A Survey On Measuring Presence in Mixed Reality

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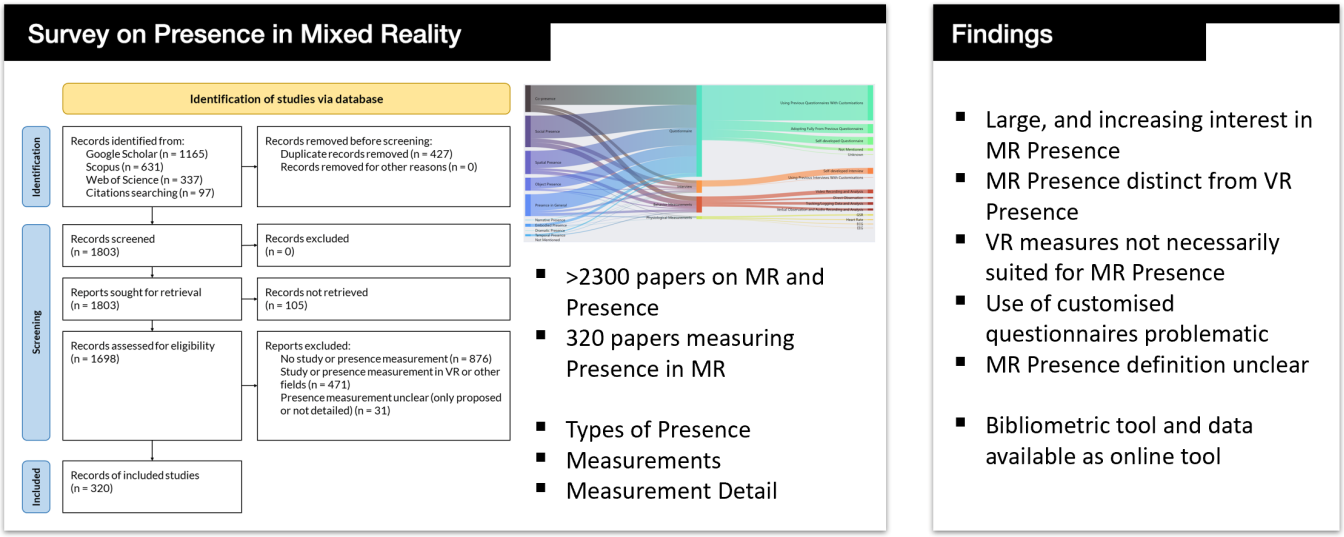

Figure 1: A visual abstract summarising our survey on presence measurements in MR and its key findings using the adapted Mixed-Reality definition by Skarbez et al. [80], incl. PRISMA flow diagram illustrating the aggregation procedure and numbers for the main review.

ABSTRACT

Presence is a defining element of virtual reality (VR), but it is also increasingly used when assessing mixed reality (MR) experiences. The increased interest in measuring presence in MR and recent works underpinning the specific nature of presence in MR raise the question of the current state and practice of assessing presence in MR. To address this question, we present an analysis of more than 320 studies that report on presence measurements in MR. Our analysis showed that questionnaires are the dominant measurement but also identify problematic trends that stem from the lack of a generally agreed-upon concept or measurement for presence in MR. More specifically, we show that using measurements that are not validated in MR or custom questionnaires limiting the comparability of results is commonplace and could contribute to a looming replication crisis in an increasingly relevant field.

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CCS CONCEPTS

• **Human-centered computing** → *Human computer interaction (HCI)*; Ubiquitous and mobile computing; **Mixed / augmented reality**.

KEYWORDS

Virtual Reality, Augmented Reality, Mixed Reality, Extended Reality, Sense of Presence, Spatial Presence

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1 INTRODUCTION AND BACKGROUND

Mixed Reality (MR) has become increasingly relevant with a growing research community in academia and industry that spans computer graphics, computer vision, and human-computer interaction. MR is also brought to the attention of developers and practitioners, mainly through the developed MR headsets by, for example, Microsoft, Meta, and Apple. With the increased interest in MR and its applications, we also see an increase in studies and empirical evaluations [21].

When looking at —*Virtual Reality* (VR), we see that one of the essential measurements to assess the quality of a VR experience is the feeling of *Presence*, which is often described as the sense of "being there" [86]. Over the years, multiple approaches to assess the feeling of presence in VR have been developed, also targeting specific aspects of presence, such as spatial presence, co-presence, and social presence, with questionnaires being the most commonly used instrument [57, 77, 78, 89]. While presence is a research area with a long history in VR, presence measures are recently also increasingly used to assess MR experiences [101]. While there are differing definitions in industry and academia on VR, Augmented Reality (AR), Extended Reality (XR), and related concepts, we are following a relatively conservative set of definitions which would put all computer-generated, 3D, interactive environments combining real and virtual elements under the umbrella term MR; placing it in-between, but excluding, real and entirely virtual reality [66, 80]. However, taking this commonly used definition raises the question of what forms the feeling of presence in an MR environment and what are the constituting elements [101]? Skarbez et al. [78] surveyed the literature intending to develop a unified model for presence, including MR presence. They distinguish between place, plausibility, and social presence illusions as the founding concepts for presence. They also provide a "presence equation" taking into account immersion, coherence, user company and individual characteristics. Latoschik and Wienrich [58] responded to this (and other prominent theories and concepts) by offering a model for XR experiences and effects, which would also include MR, based on congruence (coherence) and plausibility only, rejecting the notion of presence and also questioning the term "illusion". Both of those important works approach (MR) experiences from a conceptual point of view and offer fundamental groundwork for practical application and study while also pointing out the specific nature of presence in MR. In this work, we complement their research with an investigation into the current practice of MR presence measurements by looking at how researchers and practitioners approach the current uncertainty of widely agreed-on presence measurements. Hence, our work has an empirical rather than a theoretical focus.

The number of studies in MR is still relatively small, but it has already reached hundreds and is rapidly growing, making it a timely issue to review our current practice and connected issues. We approach this issue by reviewing how presence has been evaluated in the context of MR and its relationship to the effectiveness of MR applications in different scenarios, from learning and training environments to collaborative contexts. Our results indicate that an increasing number of studies do not reliably capture presence in MR and, with this, potentially prevent successful replication and external validity [24]. We further show that MR presence research is distinct from VR and increasingly important; prior work by Latoschik et al. [58] and the fact that many researchers had to adapt presence measurements for usage in MR highlight that MR presence is different from presence with VR and in particular the relation of plausibility and presence might be a key factor but requires further research. Besides the survey and findings, our core contributions, we also share our bibliographic analysis tool and data for future research and replication. Overall, this work has relevance not only to the field of Human-Computer Interaction as our findings support further research in presence and its roles in MR while also allowing practitioners in MR/AR to better understand the current state of MR presence measurements down to individual studies.

In summary, this paper presents our comprehensive survey on MR presence. Our review revealed that definitions for presence in MR remain unclear, and commonly used VR measures may not be suitable for assessing MR presence. Consequently, we have formulated guidelines for future studies. The guidelines advocate avoiding ad-hoc and VR-centric questionnaires and emphasize the importance of utilising both existing and newly developed tools with rigorous validation. As an outcome of the review and aid with the guidelines, we also introduce our developed tool as a reference point and advocate for increased data transparency.

2 SURVEYING PRESENCE IN MIXED REALITY

We conducted a survey to provide a first analysis of how presence has been assessed and evaluated in MR. This includes what forms or definitions of presence have been adopted and how the feeling of presence is measured.

2.1 Search Strategy

One of the immediate issues we faced was the wide range of keywords and titles used: One of the consequences of MR's increasing popularity is that terminologies are often unclear and the introduction of recent new terms (XR and its multiple readings, the Metaverse) have created extra ambiguity. As such, for this work we had to consider works on Augmented Reality, Mixed Reality, Extended Reality / X Reality, and Metaverse while also considering that many works do not explicitly mention presence in the title. We approached this problem in multiple steps: First, we ran a "pilot search" to establish our search strategy in which we retrieved articles by searching keywords in two popular academic search engines: Google Scholar[1] and Microsoft Academic[2]. For this "pilot search", we only considered the first 100 articles for each query. Besides manually checking all articles for relevance to the general topic (are they actually covering presence measures in MR or AR?) and removing duplicates, we also applied citation search based on known articles covering presence in MR. Overall, we identified 97 unique publications containing one or several studies measuring presence in MR or related technologies. However, it became apparent that our initial search and used keywords ("presence" and "mixed reality", "presence" and "augmented reality", and "presence" and "augmented virtuality") did not capture key publications that one would expect to be captured because of their relevance. As initially indicated, that is mainly because the term presence is not always mentioned and when mentioned, the authors sometimes refer not explicitly to MR or AR.

As such, for our main review, we revised our search strategy, keywords, and the number of queried articles. First, we tested multiple revised keywords and their combinations and searched them on Google Scholar using the Publish or Perish tool[3] but also searched

[1] https://scholar.google.com/
[2] https://academic.microsoft.com/. Note: No longer available after December 31, 2021.
[3] https://harzing.com/resources/publish-or-perish

Scopus[4] and Web of Science (WoS)[5]. We trialled 18 distinct keywords and their combinations (see Appendix A in the Appendices). To benchmark the keyword searches, we compared the keyword search results with roughly 150 papers that we were already aware of (97 articles aggregated from the first pilot review and articles citing MR presence questionnaires that we have been aware of [27, 28, 71]). The final keywords were those finding all those 150 papers and as such are known to produce more results rather than excluding/filtering existing works. The final keyword search for Google Scholar was: *("augmented reality" OR "mixed reality" OR "augmented virtuality") ("sense of presence" OR "being there" OR "sense of non-mediation" OR "spatial presence" OR "social presence" OR "co-presence" OR "copresence" OR "object presence" OR "selfpresence" OR "self-presence" OR "embodied presence") (study OR experiment) (evaluation OR measurement OR evaluate OR measure)*. We also retrieved publications from Scopus and WOS using identical keywords but made minor changes to match with distinct configurations for each database search engine (see Appendix B in the Appendices).

In total, we identified 1,165 articles from the Google Scholar queries, 631 publications from Scopus and 337 publications from WoS. We also added the 97 unique publications from our initial pilot search. In total, we had 2230 publications to consider but removed 427 as they were duplicates (see Figure 1). That left us with 1803 records for initial screening.

2.2 Analysis

From the search results, we accessed the records one by one to perform the review. The access to the records is through their published website addresses that were retrieved through the searches. In case the addresses were no longer available, we performed additional manual searches using the records' names on both Google and Google Scholar to look for alternative sources. A record is considered inaccessible if its published address for the record is not longer valid at the time of access or if search results from Google and Google Scholar do not yield a corresponding alternative address to access the record. Therefore, we identified and excluded 105 publications that could not be verified as they could either not be accessed or were written in languages other than English, leaving us with 1698 records that have been fully screened and further checked for eligibility.

We applied different criteria to select the final records for review, focusing on aspects of presence and how it was measured and reported. First, we skimmed the content of each record to identify the conducted study report. This assessment involved examining information about participants, demographics, experimental environments and setups, study procedures, and study reports and discussions. If an empirical study was reported in the record, we further investigated whether presence was measured during the study. Although presence is often mentioned in the records, it may not always be explicitly evaluated; sometimes, it is discussed as a related concept within the context of the record. Second, we prioritized records that reported studies conducted in MR environments rather than other mediated environments, such as VR. Besides articles that clearly describe VR systems, we further examined articles that claim to have studied MR or AR. We meticulously investigated the environment setups used in these studies and reviewed their definitions in the field to decide whether the studies are within the context of MR. For example, publications that utilised recorded 360-degree (panoramic) videos or monoscopic VR on desktop monitors were not considered in our review. In addition, systems that employed projection techniques without depth information from cameras for situated projections are also discarded. CAVE systems, to some degree, can be considered as MR systems since users can see their real bodies in the systems. But when tracing back their history and that of the CAVE systems, they are associated with and commonly considered as VR systems [18]. For that reason, we also excluded articles using these systems. As a result of applying the aforementioned criteria, we excluded 876 articles that either did not conduct any user studies or did not measure presence. Among the remaining records, 471 articles reporting measurements of presence in VR but not for MR. In addition, we removed 31 articles that only proposed the measurement of presence in future studies (see Figure 1).

In total, we included 320 publications containing MR presence studies (see our online tool or see Table 4 in the Appendices for the complete list) with the number of papers per year increasing yearly and a massive jump in papers since 2018 when the number of published studies doubled to over 40. We also saw a small drop in 2020 and 2021 (from 60 to around 50), but it is likely attributed to the COVID-19 pandemic affecting studies with human participants. We should point out that there is a small number of recent papers that have not been indexed at the time the survey started (e.g. most prominently probably the work by Westermeier et al. [101]. Each article in this list underwent a two-way single review process, where each article was reviewed twice by the same reviewer at different times. We carefully examined each article to extract the concepts of presence studied and measured in these reports. The classification of the concepts was conducted based on their definitions presented in the articles in relation to the definitions of presence found in literature [79]. The data curation was primarily performed by one person, while the data reviews were shared among all three reviewers. Meetings between the reviewers were conducted to finalise both exclusions and the classification for reports that did not explicitly state their experimental environment and/or the concept of presence for which they were evaluated.

2.3 Results

In the following, we present our findings and results when analysing the identified studies. Figure 2 provides an overview of some of the high-level findings, in particular on the identified presence concepts and the applied measurements.

Presence concepts in Mixed Reality. Since the beginning of presence research in VR, several directions of presence research and their corresponding measurements have evolved. When looking into our results on presence in MR, social presence as the sense of "being together with another" was the most commonly studied according to our analysis (136 out of 320 articles, 42.5%). This was followed by co-presence as the sense of "being there together", likely from the common use of collaboration-type MR systems [25].

[4]https://www.scopus.com/
[5]https://mjl.clarivate.com/home

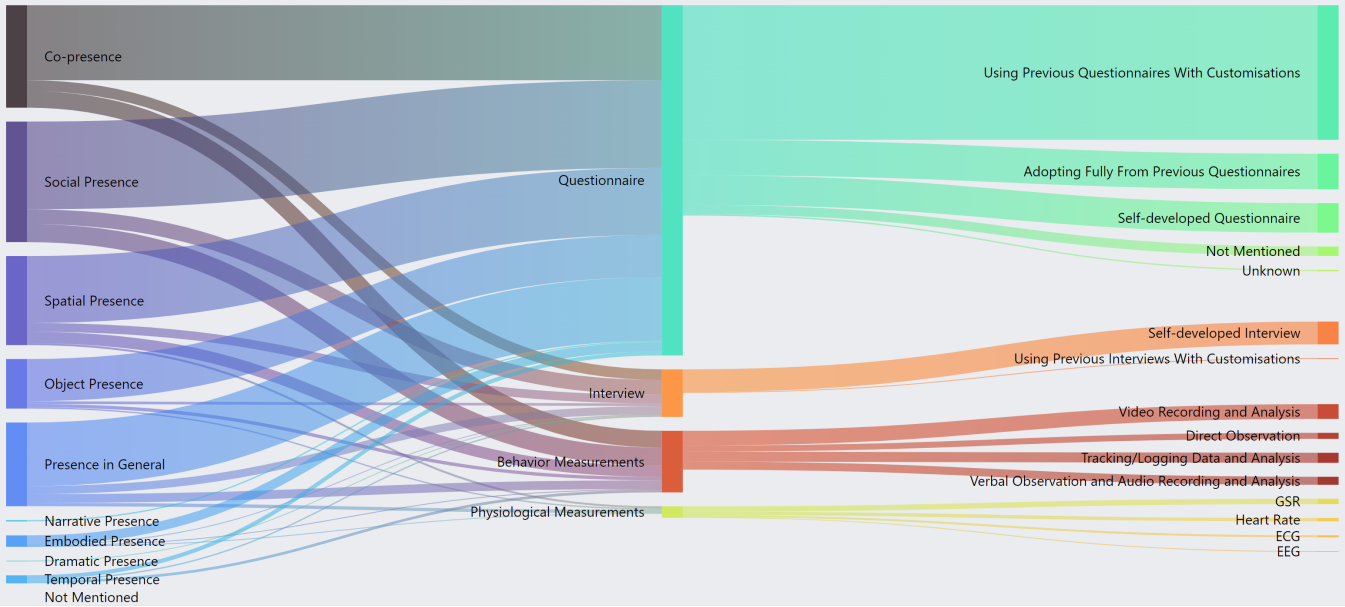

Figure 2: An illustration summarising our key findings on exploring presence concepts and their measurements as used in 320 Mixed Reality studies

Spatial presence as the sense of "being there" was the third common presence concept and is often considered as the sense of presence in general. However, we observed that amid the articles, there are authors measuring presence without clearly stating what type of presence they were measuring or using questions which only mentioned the feeling of presence without stating the feeling of being in a place or being with another. As such we treated that group separately but we think that in many cases, the studies not explicitly mentioning the type of presence (or details on the measurement) can also be attributed to spatial presence which would make it the most popular type of presence.

Object presence, or the "subjective experience that a particular object exists in a user's environment" was roughly observed in one in five aggregated publications. While initially inspired by specific items on VR presence questionnaires, object presence as a concept has since been more connected to AR and MR research where virtual objects are placed in real environments [92].

While social presence, co-presence, spatial presence, and object presence attracted much interest from authors in MR, there are not many articles reporting on measuring embodied presence. Most studies evaluating this type of presence investigated body/avatar ownership or embodiment. Interestingly, we found other types of presence mentioned within the aggregated articles. This includes temporal presence, narrative presence, and dramatic presence. Temporal presence was defined as "the sensation of being in the time of the perceived content" by von der Pütten et al. [97, p. 318], or could be referred to as "whether the users felt present at various times" by Chen et al. [16, p. 698]. Narrative presence was defined as "the sensation of being present in a narrative world due to comprehension processes and perspective taking" by Busselle et al. [14, p. 325]. The definition for this type of presence was inspired by the transportation process from departure from the real world to arrival in an alternative world by Kim et al. [54] or "entering and returning from an alternative world is central to narrative engagement" [14, p. 341]. The last identified type of presence is dramatic presence defined as the sense of "being in a dramatic situation" that unfolds a flow of major sequential events [23, 51]. Table 1 shows statistics on the number of publications involved in two of our reviews reporting presence in MR.

Table 1: Number of Publications Measuring Presence and Its Aspects in 320 Retrieved Articles

Presence	Number of articles
Presence in general	99
Spatial presence	103
Co-presence	119
Social presence	136
Object presence	64
Embodied presence	15
Temporal presence	6
Narrative presence	2
Dramatic presence	1

In general, we see a wide spread of MR applications that have been investigated and where presence measurements are used, including collaboration tasks (e.g. Yoon et al. [109], education studies [16, 37], perception studies [46, 47, 59], and games and entertainment [39, 49, 56].

Table 2: Presence Measurements in Mixed Reality From 320 Retrieved Articles and Their Studies

Measurement	Method	Number of articles
Questionnaire	Self-development	44
	Adopting fully from previous questionnaires	53
	Using previous questionnaires with customisations	201
	Not mentioned	17
Interview	Self-development	34
	Using previous interviews with customisations	2
Behaviour Observation	Direction observation	9
	Video recording and analysis	22
	Verbal observation and audio recording and analysis	12
	Tracking/logging data and analysis	15
Physiological + Neuroimaging	Electroencephalogram (EEG)	1
	Galvanic skin response (GSR)	8
	Heart rate	5
	Electrocardiogram (ECG)	3

Presence Measurements in Mixed Reality. When looking into the specific measurements for assessing presence in MR, it is apparent that most studies used questionnaires. This is generally not surprising as presence questionnaires are equally popular in VR research (e.g. for spatial presence [77]).

However, when looking at the specific questionnaires, we were surprised to see that although there are several questionnaires available in the literature to investigate presence in MR [27, 28, 71, 72], they had only rarely been used. In fact, among the 320 articles, only about 7% of the articles use these dedicated questionnaires to measure presence in MR. The number of publications reporting on the use of the questionnaires of Regenbrecht et al. [71], Gandy et al. [27], Georgiou et al. [28], and Regenbrecht et al. [72] are 11, 6, 4, and 3, respectively. Instead, it is a common practice to adapt popular presence questionnaires from VR to measure presence in MR. This finding is not surprising, as researchers are commonly active in VR and MR and thus have prior experience in the application of questionnaires from VR. Furthermore, identified questionnaires from other fields generally see a large application outside of MR and consequently have been widely studied and evaluated in previous studies. In fact, among the better examples for using questionnaires are validated presence questionnaires, albeit validated in VR, that have been considered by researchers to measure presence in MR.

There are several examples of works in our survey who intentionally create their own questionnaires to measure presence for their MR studies. They either create completely new questions with the aim of capturing the sense of presence, or they selectively choose one or several questions from existing questionnaires reported on in the literature but again commonly used for measuring presence in VR. The issue with these custom questionnaires is that they lack any validation. Only few self-developed presence questionnaires were actually passed through validation processes performing validity and reliability analyses, e.g. Cronbach's alpha, Kaiser-Meyer-Olkin tests, and factor analyses [90, 95]. One has to assume that most custom questionnaires to measure presence have not been validated.

Besides questionnaires, interviews are also applied to assess presence in MR studies. Researchers generally develop their own questions. It is rare that the authors reused or adapted questions for their interviews from previous studies also because the actual interview questions and other details are not always reported, and with this limiting replication opportunities [24].

In addition, some authors measured presence by observing the behaviours of their participants directly. Some articles report the employment of video recordings and techniques to analyse the videos after their experiments. Tracking and recording of experimental data, such as the walking path, travel distance, and head position, were also used to measure or judge the level of presence in MR. Another method is to record participants' verbal conversations and feedback during their engagement in experimental studies and we have seen examples of using these methods in aggregated articles.

We saw limitations in applying physiological and neuroimaging measurements for presence. There are only eight articles in the collection of 320 articles reporting on using these types of measurement to assess presence in MR. Among physiological and neuroimaging methods, the most popular measurement conducted is galvanic skin response (GSR) related measurements, such as electrodermal activity (EDA) and skin conductance response (SCR), which are followed by measuring participants' heart rate. There was only one article reporting on the use of electroencephalogram (EEG) to measure and correlate the method's data with presence in MR. However, we did not discover any work using functional magnetic resonance imaging (fMRI), which had been used to measure presence in VR. An overview of the presence measurement instruments used in MR with the number of articles reporting about them from our review is presented in Table 2.

While most works relied on individual measurements, some authors have used more than one measurement in their studies. For example, Zuniga Gonzalez et al. [110] combined the use of questionnaires and heart rate to measure presence in an AV environment to study stress in students. Furthermore, Joachimczak et al. [45]

employed three different methods using interviews, questionnaires, and physiological devices (ECG) to evaluate the sense of presence in the context of telecommunication in relationship with stress. Gandy et al. [27] did not only use a questionnaire and behaviour observation, but also physiological measurements with GSR and heart rate, and interviews.

3 DISCUSSION AND OUTLOOK

In the following, we provide a brief discussion of the key findings and the relevance for Human-Computer Interaction and the field of MR/AR. In particular, we are looking into common patterns around the use of different measures, predominantly questionnaires, attempts to conceptualise what it means to "be there" in MR, and the importance of plausibility and involvement. By doing so we also integrate our proposition for moving forward with the discussion and development of MR concepts and measures calling for a future open data approach to address the identified looming replication crisis with respect to presence [24].

3.1 Mixed Reality Presence Measures

As part of our investigation, we found that using questionnaires is by far the most popular measurement for presence in MR. While the use of different measurements (e.g. questionnaires, observations, physiological measurements) is debated in the VR presence community, we are focusing our discussion mainly on the selection and use of specific measurements and not the wider discussion about which style of measurement is the right one.

Using Presence Questionnaires from Virtual Reality. The common practice to measure presence in MR is to use available questionnaires from other fields, mainly those that have originated in VR and Telepresence research. Initially, this might be seen as a good choice and is commonly used but there are issues.

First, MR is different to VR and other media. There are similarities in the environments presented by VR and MR: both of the technologies have the capability to present virtual elements that are unavailable in the physical world. However, differences appear in both the characteristics of the environments and their purposes. On the one hand, VR is developed to provide a virtual environment by targeting and transferring users' senses to the simulated environment, which is different from the physical environment. On the other hand, MR is created by combining both virtual and real environments; users can still experience their real physical environment. While VR tries to encapsulate and disengage users from the real environment, MR delivers a blended environment where the physical world is a part of it. Therefore, the definitions, concepts, and models of presence for VR cannot be applied to MR unconditionally. In fact, those differences in VR and MR have been the reasons why dedicated presence questionnaires for MR have been researched [27, 28, 71].

Second, questionnaires are developed based on their respective definitions and theories (e.g. perceiving virtual environments). Currently, there is no commonly agreed-upon definition and theory for presence in MR in the literature, and exploring presence in MR is still in its infancy when compared to presence research in VR. Commonly used presence questionnaires were evaluated and validated specifically in the environments they were targeting for. Therefore, a valid and reliable questionnaire to measure presence in VR is unlikely to provide the same level of validity and reliability when applied to other fields. For example, Villani et al. [96] found that the level of presence in a virtual reality simulation was higher than its counterpart in the real world.

Use of Custom Questionnaires. To overcome the limitations of using VR questionnaires, researchers compiled and developed their own questionnaires. As a workaround, this approach, to some degree, can help with measuring what researchers want to measure—a transitional measure until the field has matured. The main question remains: Do those instruments actually measure what they are supposed to measure? We would argue that all the development of a questionnaire should go through rigorous validation. This validation not only assesses the reliability of the items in the questionnaire but also presents their validity in measuring the target it measures. The current practice of using custom questionnaires can be used as an exploratory approach to identify items for developing questionnaires or constructs for the sense of presence in MR. However, once a customised questionnaire is used to measure presence in MR, we request publishing its details that include the items of the questionnaire and rating scores for each item from each respondent to be able to replicate, compare and scholarly discuss.

Objective Measures. So-called objective measurements, such as behavioural, physiological, and neuroimaging measurements, are sometimes considered perfect alternatives to measure presence more reliably than subjective measurements. This is doubtful since (1) first and foremost, the sense of presence is an emotion and with this inherently subjective [76], (2) there is still no solid evidence on the changes in signals of the measurements as a result of presence [31], and (3) they can be applied to very specific situations and/or very controlled environments [41]. This raises the question of what we are actually measuring here? For instance, are measures of strong arousal or stress necessarily indicators of presence?

3.2 Data Transparency and Online Reference Tool

As part of this work we have created a reference tool that lists research articles measuring presence in MR aggregated from our survey and gives an overview of the different types of presence and how they were measured in previous studies. (Figure 2). The tool serves multiple purposes and is available and free to access: https://hci.otago.ac.nz/mrpresence/: First, it provides access to the data and articles surveyed in this study (data transparency). Second, it can be used if reference data for presence measurements are needed, e.g. when designing or study or comparing data against the literature. Interested individuals can filter existing surveyed works by clicking on the types of presence (left side) or by the type of measurements used (right side) which will immediately show the papers and their bibliographic data in our database that either measure the selected presence type or the selected measurement (combinations are also possible). Similarly, we aggregated all presence measurements that were used (tab "Used Questionnaires) and allow for quick access to the original papers. Overall, our reference

tool makes all data from this survey accessible and allows for interactively finding articles studying different aspects of presence and their measurements.

3.3 Being There in Mixed Reality

In VR, there are only the relationships between the self, virtual objects, virtual agents, and virtual environments. MR adds one or more real objects, real agents, and real environments to the combined environment.

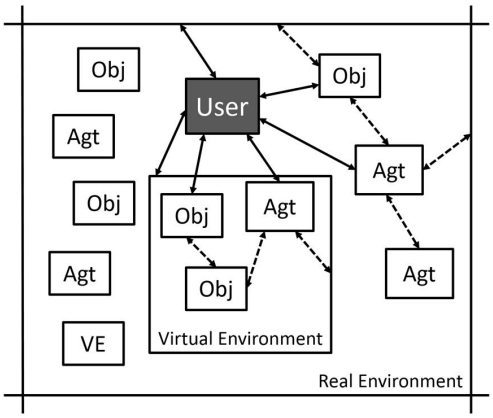

Figure 3: An exemplary illustration of the relationship between a user and object (Obj), agents: other users or other autonomous objects (Agt), the real environment and other virtual environments (VE). [72]

Based on our survey and following the approach presented in [72] this leads to a network of relationships between real and virtual entities that have to be considered when building a conceptual model for the sense of presence in MR, including the construction of instruments to measure presence in such a mixed environment.

When considering the overall picture of conceptualisations and instruments used by the research surveyed here, the sense of presence can be defined as the sense of being in a place visually presented by the MR environment. However, the short notion of presence as "being there" is apparently not entirely reasonable in the context of MR. A place in MR can "be here" in the real environment with some enhanced virtual objects or "be there" in the place illustrated by the virtual environment with augmented real agents. As a result, one can be "here", "there", or "anywhere". Following Waterworth et al.'s [100] notion of "the feeling of being located in a perceptible external world around the self", we argue to define presence in an active way instead of using the passive form. Therefore, the sense of presence in MR is the feeling of being and engaging in the world around oneself, generated by MR technologies.

3.4 Plausibility and Involvement as Mixed Reality Presence

Based on concepts found in the literature, we see the emergence of two factors: involvement and plausibility. Involvement mainly stems from the perceived relationships between the self (the MR user) and the environments (virtual and real), and other agents (virtual and real). Plausibility mainly stems from the perceived interaction between the different entities within the environment and one's interactive probing. In VR, for instance, virtual objects should behave believably within the virtual environment. In MR, all relationships between objects, the environments, and the inhabiting agents must look and behave believably, spatially and temporarily coherent. The self (user) might interact with parts of this mixed environment to test believability.

3.5 Limitations

This work comes with a few limitations. Foremost, we did not review the actual quality of the surveyed studies except that we focused on publications from the main research databases. As such, we cannot rule out a bias in our data which is caused by the quality of the studies (e.g. over-representation of works from less experienced researchers). As also pointed out there are a number of studies that needed to be removed as details were unclear while there is also a chance that we missed some studies as they did not match our keywords (as it is always the case for a systematic search). Finally, this work does not solve the actual problem of uncertainty on what defines MR presence. However, this was also not the goal. Instead, our goal was to better understand how current research is dealing with this uncertainty and in particular how research assesses MR presence despite no commonly agreed on measurement. To that end, this work also tries to not take a position on what constitutes the right measurement for presence in MR, but instead focuses on the problematic trends that arise from the gap in standard measurements, such as issues in replication and comparison among studies.

4 CONCLUSION

In conclusion, recent studies have shown an increase in the number of measurements of the sense of presence in Mixed Reality (MR), making it timely to ask how we assess presence in MR. This survey shows that there are problematic trends. The main one is the application of measurements that are not validated. Either because they are validated for VR but not for MR, or because the authors customise questionnaires by only considering a subset of questions. Both approaches are problematic because they raise the question of what we actually measure and how comparable and replicable the reported findings are. We acknowledge that many of these issues stem from the current state of uncertainty with respect to MR presence and its definitions. There seems to be a large agreement that the concept of presence in MR is very different from the concept of presence in VR. Current research seems to suggest that MR presence requires spatial and temporal coherence for plausibility and involvement and considers all relationships between the self (user) and the combined world of real and virtual objects, agents, and environments. However, a conceptual model of MR presence still needs to be developed and validated. Furthermore, despite of all their shortcomings, existing and to-be-developed questionnaires are the first step in that direction but we need to be careful with interpreting them.

The variety and range of MR presence measurement methodologies and instruments found in our survey suggests that we cannot

find conclusive empirical answers to the conceptual models proposed by e.g. Skarbez et al. [78] or Latoschik et al. [58] yet. What the theoretical and empirical findings have in common is the notion of *plausibility* as the illusion of "what is apparently happening is really happening (even though you know for sure that it is not)." [81, p. 3553]. Hence, we would argue that it is worthwhile to investigate the relationship between plausibility and presence in MR environments in future studies.

In summary, based on our survey of a large number of studies addressing MR presence in one way or another, we would argue that (a) there is a large and increasing interest in MR presence as a central experience construct, (b) that MR presence is sharing some commonalities with VR presence, but appears to be fundamentally different, (c) that therefore VR presence measurement instruments are not necessarily well suited for MR presence, (d) that the use of customised questionnaires (based on VR or not) is problematic, and (e) that there seems to be no generally agreed upon definition on the concept of MR presence yet. Our findings are paving the way to the development of standardised methods for conceptualising and assessing presence in MR. To support future research into MR presence we are providing our developed online bibliometric tool in an open and transparent way with the hope to address issues identified in our survey, to allow for a more systematic approach to investigate MR presence in an empirical and practical way, and to avoid problems with the replication of studies in our field. Based on our findings, we propose some guiding principles on how to shape future research on MR conceptualization and measurement:

First, the importance of *utilising established resources*. Researchers can leverage existing presence knowledge and concepts, specifically those defined and discussed within the context of MR. In addition, employing validated measurements for presence in MR can significantly enhance research quality. Striking a balance between innovation in research methods and reliance on proven resources can also elevate the overall quality of research.

Second, we encourage researchers to thoroughly report and *publish their work*. It is essential to define the concept of presence used in the research and to specify the investigated aspect of presence within the study. In addition, presenting thoroughly how presence is measured and reporting its results are crucial steps. This includes specifying which instrument or devices are used to measure, the applied measurement setup and configuration, the timing of measurements within the empirical study, and the measurement process. Further analyses and discussions relating presence measurements with available related concepts' measurements in the same study can provide valuable insights into their relationship. Finally, to "dare" to *think outside the box*. While presence in MR can benefit from presence in VR and other fields, it is important to recognize that presence in MR is distinctive. Embracing creativity and unconventional perspectives of presence in MR can shed more light on the concept. For example, Wienrich et al. [102] contribute insights into interpreting the perception of spatial presence in MR. Regarding presence measurements in MR, questionnaires are the predominant and often opportunistic measurement method, but researchers should explore alternative approaches like physiological measurements [82]. By leveraging on multiple measurement approaches, researchers can complement results obtained from different methods.

AUTHOR CONTRIBUTIONS

Tanh Tran performed writing - original draft, conceptualisation, investigation and data curation, Tobias Langlotz performed writing - review & editing, conceptualisation, and supervision, Holger Regenbrecht performed writing - review & editing, conceptualisation, and supervision.

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APPENDICES

A TESTED KEYWORDS FOR THE MAIN REVIEW

List of considered keywords for the second review:

- **Keyword 1** "augmented reality" "presence" (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- **Keyword 2** "mixed reality" "presence" (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- **Keyword 3** "augmented virtuality" "presence" (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- **Keyword 4** ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("sense of presence" OR "being there" OR "sense of non-mediation" OR "feeling of presence" OR "spatial presence" OR "social presence" OR "co-presence" OR "copresence" OR "object presence" OR "selfpresence" OR "self-presence" OR "embodied presence") (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- **Keyword 5** ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("sense of presence" OR "being there" OR "sense of non-mediation" OR "spatial presence" OR "social presence" OR "co-presence" OR "copresence" OR "object presence" OR "selfpresence" OR "self-presence" OR "embodied presence") (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- **Keyword 6** ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("sense of presence" OR "being there" OR "spatial presence" OR "social presence" OR "co-presence" OR "copresence" OR "object presence" OR "selfpresence" OR "self-presence" OR "embodied presence") (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- **Keyword 7** ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("sense of presence" OR "spatial presence" OR "social presence" OR "co-presence" OR "copresence" OR "object presence" OR "selfpresence" OR "self-presence" OR "embodied presence") (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- **Keyword 8** ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("being there" OR "spatial presence" OR "social presence" OR "co-presence" OR "copresence" OR "object presence" OR "selfpresence" OR "self-presence" OR "embodied presence") (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- **Keyword 9** ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("sense of non-mediation" OR "spatial presence" OR "social presence" OR "co-presence" OR "copresence" OR "object presence" OR "selfpresence" OR "self-presence" OR "embodied presence") (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- **Keyword 10** ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("feeling of presence" OR "spatial presence" OR "social presence" OR "co-presence" OR "copresence" OR "object presence" OR "selfpresence" OR "self-presence" OR "embodied presence") (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- **Keyword 11** ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("sense of presence") (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- **Keyword 12** ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("being there") (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- **Keyword 13** ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("sense of non-mediation") (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- **Keyword 14** ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("feeling of presence") (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- **Keyword 15** ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("sense of presence")

- **Keyword 16** ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("being there")
- **Keyword 17** ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("sense of non-mediation")
- **Keyword 18** ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("feeling of presence")

B KEYWORDS USED TO AGGREGATE PUBLICATIONS FOR THE MAIN REVIEW

B.1 Keywords for Retrieving Publications From Google Scholar

- *Keyword 1*: ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("sense of presence" OR "being there" OR "sense of non-mediation" OR "spatial presence" OR "social presence" OR "co-presence" OR "copresence" OR "object presence" OR "selfpresence" OR "self-presence" OR "embodied presence") (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- *Keyword 2*: ("augmented reality" OR "mixed reality" OR "augmented virtuality") ("sense of presence" OR "being there" OR "spatial presence" OR "social presence" OR "co-presence" OR "copresence" OR "object presence" OR "selfpresence" OR "self-presence" OR "embodied presence") (study OR experiment) (evaluation OR measurement OR evaluate OR measure)

B.2 Keywords for Retrieving Publications From Scopus

- *Keyword 1*: (augmented reality OR mixed reality OR augmented virtuality) (sense of presence OR being there OR sense of non-mediation OR spatial presence OR social presence OR co-presence OR copresence OR object presence OR selfpresence OR self-presence OR embodied presence) (study OR experiment) (evaluation OR measurement OR evaluate OR measure) AND (LIMIT-TO (EXACTKEYWORD, "Augmented Reality") OR LIMIT-TO (EXACTKEYWORD, "Mixed Reality") OR LIMIT-TO (EXACTKEYWORD, "Augmented Virtuality") OR LIMIT-TO (EXACTKEYWORD, "AR") OR LIMIT-TO (EXACTKEYWORD, "MR") OR LIMIT-TO (EXACTKEYWORD, "AV"))
- *Keyword 2*: (augmented reality OR mixed reality OR augmented virtuality) (sense of presence OR being there OR spatial presence OR social presence OR co-presence OR copresencez OR object presence OR selfpresence OR self-presence OR embodied presence) (study OR experiment) (evaluation OR measurement OR evaluate OR measure) AND (LIMIT-TO (EXACTKEYWORD, "Augmented Reality") OR LIMIT-TO (EXACTKEYWORD, "Mixed Reality") OR LIMIT-TO (EXACTKEYWORD, "Augmented Virtuality") OR LIMIT-TO (EXACTKEYWORD, "AR") OR LIMIT-TO (EXACTKEYWORD , "MR") OR LIMIT-TO (EXACTKEYWORD , "AV"))

B.3 Keywords for Retrieving Publications From Web of Science

- *Keyword 1*: (augmented reality OR mixed reality OR augmented virtuality) (sense of presence OR being there OR sense of non-mediation OR spatial presence OR social presence OR co-presence OR copresence OR object presence OR selfpresence OR self-presence OR embodied presence) (study OR experiment) (evaluation OR measurement OR evaluate OR measure)
- *Keyword 2*: (augmented reality OR mixed reality OR augmented virtuality) (sense of presence OR being there OR spatial presence OR social presence OR co-presence OR copresence OR object presence OR selfpresence OR self-presence OR embodied presence) (study OR experiment) (evaluation OR measurement OR evaluate OR measure)

C QUESTIONNAIRES USED TO MEASURE PRESENCE IN MIXED REALITY

Table 3: A List of (adopted and adapted) Questionnaires to Measure Presence in Mixed Reality (NR: Information Not Reported in Original Article)

Questionnaire	Number of items	Construct	Analysis
Ahn et al., 2013 [2]	5		NR
Ahn et al., 2016 [1]	5	spatial presence	Cronbach's alpha
Algharabat et al., 2011 [3]	18	perceived control, animated colours, 3D authenticity, 3D telepresence, behavioural intention	structural equation model
Antunes et al., 2014	54	collaboration awareness, location awareness, context awareness, social awareness, workspace awareness, situation awareness	NR
Aymerich-Franch et al., 2014 [4]	15	self-presence, social presence, and spatial presence	reliability test with reported alpha values
Bailenson et al., 2001, 2003 [6, 7]	5	social presence	Cronbach's alpha
Bailenson et al., 2004 [5]	12	social presence [7], likeability, status, interest	NR
Bailenson et al., 2005 [8]	10	co-presence, embarrassment, likability	NR (reported alpha values)
Banos et al., 2000 [10]	18	reality judgement, internal/external correspondence, attention/absorption	factor analysis
Basdogan et al., 2000 [9]	8	co-presence	NR
Bevacqua et al., 2017 [11]	30	believability, co-presence, game experience and engagement	NR
Botvinick et al., 1998	9	(rubber hand illusion)	NR
Bouchard et al., 2004 [12]	1		ANOVA
Brockmyer et al., 2009 [13]	19	absorption, presence, immersion, and flow	Cronbach's alpha and Rasch validation
Busselle et al., 2009 [14]	12	narrative presence, narrative understanding, attentional focus, and emotional engagement	exploratory and confirmatory factor analysis
Casanueva et al., 2001 [15]	NR	co-presence, collaboration	NR (ANOVA)
Coyle et al., 2001 [17]	18	attitude, behavioral intention, telepresence	factor analysis
D'Angelo et al., 2017 [19]	13	[task performance]	NR
De Kort et al., 2007 [20]	21	psychological involvement – empathy, psychological involvement – negative feelings, and behavioural involvement	exploratory factor analysis
Dinh et al., 1999 [22]	23	presence, other presence, spatial layout, and object location	ANOVA
Fox et al., 2009 [26]	10	presence in general	Cronbach's alpha
Gandy et al., 2010 [27]	21	presence in general	NR
Georgiou et al., 2017 [28]	21	interest, time investment, usability, emotional attachment, focus of attention, presence, flow	exploratory factor analysis, confirmatory factor analysis, and Cronbach's alpha
Gerhard et al., 2001 [29]	24	immersion, communication, involvement, and awareness, and qualitative (5 questions)	NR
Goldiez et al., 2004 [30]	26		NR
Gratch et al., 2007 [32]	20	emotional rapport, cognitive rapport, behavioural or interactional rapport, helpfulness, distraction, agent naturalness, performance (unknown number of items), trustworthiness (unknown number of items), likableness (unknown number of items)	NR (reported Cronbach's alpha)
Gupta et al., 2016 [33]	11	co-presence, enjoyment, focus, and self-confidence	NR (reported Cronbach's alpha)
Gutwin et al., 2002 [34]	NR	presence, identity, authorship, action, intention, artifact, location, gaze, view, reach	NR

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Questionnaire	Number of items	Construct	Analysis
Harms et al., 2004 [35]	36	co-presence, attentional allocation, perceived message understanding, perceived emotional understanding, perceived behavioural interdependence, perceived emotion interdependence	confirmatory factor analysis, Cronbach's alpha
Hartmann et al., 2016 [36]	8	self-location, possible actions	principal component analysis, confirmatory factor analysis, corrected item-total correlation, Cronbach's alpha
Heerink et al., 2010 [38]	41	anxiety, attitude towards technology, facilitating conditions, intention to use, perceived adaptiveness, perceived enjoyment, perceived ease of use, perceived sociability, perceived usefulness, social influence, social presence, trust, use	regression analysis, path analysis, Cronbach's alpha
Heerink et al., 2010 [38]	41	anxiety, attitude towards technology, facilitating conditions, intention to use, perceived adaptiveness, perceived enjoyment, perceived ease of use, perceived sociability, perceived usefulness, social influence, social presence, trust, use	NR (reported Cronbach's alpha)
Hilken et al., 2017 [40]	62	hedonic value, utilitarian value, functionality, spatial presence [98], psychological ownership, style-of-processing, word-of-mouth intentions, purchase intentions, involvement, decision comfort, awareness of privacy practices	internal consistency with reporting alpha values
Ijsselsteijn et al., 2007 [42]	81	core, social presence, and post-game	NR
Jin et al., 2011 [43]	42	challenge, involvement, focused attention, physical presence, flow, perceived skill, spatial presence, behavioural intention, empathy, self-presence	structural equation modelling
Jin et al., 2009 [44]	7	self-presence, closeness of parasocial interaction	NR (reported Cronbach's alpha)
Jung et al., 2017 [48]	6	presence, virtual body ownership illusion, body continuity, agency	NR (reported Cronbach's alpha)
Kalckert et al., 2012 [50]	16	ownership, agency, ownership control, and agency control	NR
Kim and Biocca 1997 [54]	8	arrival, departure	exploratory factor analysis, path analysis
Kim et al, 2014 [53]	6		NR
Kim et al., 2020 [52]	21	distraction, visual inconsistency, AR implausibility, spatial presence, and animalism	NR
Klein 2003 [55]	7	telepresence	factor analysis, Cronbach's alpha
Lee et al., 2006 [60]	21	personality, social presence, intelligence, and social attraction, and enjoyment of interaction	NR (reported alpha values)
Lessiter et al., 2001 [61]	44	sense of physical space, engagement, ecological validity, negative effects	principal axis factoring analysis, Cronbach's alpha
Lim et al., 2018 [62]	18	standardization of specification, sensory descriptiveness, interactivity, feedback quality, telepresence, off-line knowledge	partial least squares structural equation modelling, Cronbach's Alpha
Lombard et al., 2009 [63]	42	spatial presence, social presence-actor, passive social presence, active social presence, presence as engagement, presence as social richness, presence as social realism, presence as perceptual realism	confirmatory factor analyses, Cronbach's alpha
Longo et al., 2008 [64]	27	ownership, location, agency, and communalities	principal components analysis
Mason 1994 (cannot access)			
Makransky et al., 2017 [65]	15	self-presence, social presence, and physical presence	confirmatory factor analysis
Miller et al., 2019 [67]	16	interpersonal attraction, social presence	NR
Nowak et al., 2003 [68]	29	co-presence, telepresence, social presence	confirmatory factor analysis

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Questionnaire	Number of items	Construct	Analysis
Poeschl et al., 2015 [69]	15	Presenter's Reaction to Virtual Agents, Perceived Virtual Agents' Reaction, Impression of Interaction Possibilities, (Co-)Presence of other people	item- and principal axis factor analysis
Ratan et al., 2013 [70]	7	proto self-presence, core self-presence, extended self-presence	NR
Regenbrecht et al., 2002 [71]	7	realness, spatial presence, perceptual stress	factor analysis
Regenbrecht et al., 2013, 2017 [72]	33		NR
Romano et al., 2013 [73]	6	ownership, illusion of movement, motor awareness, nonspecific aspects of confusion, and unexpected effects	ANOVA
Ryan et al., 2006 [74]	71	in-game competence and autonomy, in-game relatedness, intuitive controls, game enjoyment, game play behaviour, post-play mood, presence, motivation components measure	NR (reported alpha values)
Schubert et al., 2001 [75]	13	general presence, spatial presence, involvement, experienced realism	exploratory and confirmatory factor analyses
Slater et al., 1994 [85]	3/5	presence in general	regression analysis
Slater et al., 1998 [84]	6	presence in general	regression analysis
Slater et al., 2000 [83]	5		regression analysis
Steed et al., 1999 [91]	24	presence, co-presence, accord, leadership, personality	NR
Smith et al., 2018 [87]	33	clarity of communication, satisfaction with results, social awareness, conversation management, ease and efficiency of task completion, disconnection to partner	factor analysis
Song et al., 2007 [88]	19	telepresence, fantasy, shopping enjoyment, willingness to purchase, and willingness to patronize	NR (reported Cronbach's alpha)
Tang et al., 2004 [93]	44	spatial presence, engagement, naturalness, negative effect	NR (ANOVA)
Towell et al., 1997[94]	2	presence in general	NR
Verhagen et al., 2014 [95]	21	local presence, product likability, physical tangibility, mental tangibility, specificity, purchase intention	Cronbach's alpha, composite reliability, average variance extracted
von der Pütten et al., 2012 [97]	25	willing suspension of disbelief, involvement, perceived interactivity, spatial presence, social presence of virtual characters, social presence of team partner, temporal presence	Cronbach's alpha
Vorderer et al., 2004 [98]	64	attention allocation, spatial situation model, spatial presence - self location, spatial presence - possible actions, higher cognitive involvement, suspension of disbelief, domain specific interest, visual spatial imagery	Cronbach's alpha
Wang et al., 2018 [99]	6		NR
Witmer et al., 1994 [104]	32	sensory exploration, involvement, interface awareness, control responsiveness, reality/fidelity, adjustment/adaptation	cluster analysis
Witmer et al., 1998 [105] (ITQ)	16	involvement, focus, games	cluster analysis, Cronbach's alpha
Witmer et al., 1998 [105] (PQ)	32	control, sensory, distraction, realism	cluster analysis
Witmer et al., 2005 [103]	29	involvement, sensory fidelity, adaptation/immersion, interface quality	factor analysis
Won et al., 2018 [106]	20	social distance	NR (reported alpha values)
Yim et al., 2012 [108]	18	presence, enjoyment, perceived product knowledge, advertising attitude	confirmatory factor analysis, average variance extracted, the squared correlation

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Questionnaire	Number of items	Construct	Analysis
Yim et al., 2017 [107]	37	interactivity, vividness, previous media experience, media usefulness, media enjoyment, immersion, media novelty, attitudes toward medium, purchase intention	Cronbach's alpha, composite reliability, average variance extracted

D AGGREGATED PUBLICATIONS

Table 4: A List of Aggregated Publications Measuring and Reporting Presence in Mixed Reality. (n=320)

Author	Title	Year	Source
Abbey, Alexandre and Porssut, Thibault and Herbelin, Bruno and Boulic, Ronan	Assessing the Impact of Mixed Reality Immersion on Presence and Embodiment	2021	Proceedings of the 14th ACM SIGGRAPH Conference on Motion, Interaction and Games
Abels, Eva A.M. and Toet, Alexander and Stokking, Hans and Klunder, Tessa and M.C. van Berlo, Zeph and Smeets, Bram and Niamut, Omar	Augmented Reality-based Remote Family Visits in Nursing Homes	2021	Proceedings of the 2021 ACM International Conference on Interactive Media Experiences
Abigail R. Wooldridge, Widya A. Ramadhani, Keith Hanson, Elsa Vazquez-Melendez, Harleena Kendhari, Nadia Shaikh, Teresa Riech, Matthew Mischler, Sara Krzyzaniak, Ginger Barton, Kyle T. Formella, Zachary R. Abbott, John N. Farmer, Rebecca Ebert-Allen and Trina Croland	Walking the Line: Balancing Performance Barriers and Facilitators in an Augmented Reality Mobile Application for Paediatric Code Cart Training	2022	Ergonomics
Akers, John and Zimmermann, Joelle and Trutoiu, Laura and Schowengerdt, Brian and Kemelmacher-Shlizerman, Ira	Mixed Reality Spatial Computing in a Remote Learning Classroom	2020	Proceedings of the 2020 ACM Symposium on Spatial User Interaction
Alma Leopardi and Silvia Ceccacci and Maura Mengoni and Simona Naspetti and Danilo Gambelli and Emel Ozturk and Raffaele Zanoli	X-reality Technologies for Museums: a Comparative Evaluation Based on Presence and Visitors Experience Through User Studies	2021	Journal of Cultural Heritage
Almeida, Igor de Souza and Oikawa, Marina Atsumi and Carres, Jordi Polo and Miyazaki, Jun and Kato, Hirokazu and Billinghurst, Mark	AR-based Video-mediated Communication: a Social Presence Enhancing Experience	2012	2012 14th Symposium on Virtual and Augmented Reality
Anne R. Smink and Eva A. van Reijmersdal and Guda van Noort and Peter C. Neijens	Shopping in Augmented Reality: the Effects of Spatial Presence, Personalization and Intrusiveness on App and Brand Responses	2020	Journal of Business Research
Ao, Yanjiao and Kanbara, Masayuki and Fujimoto, Yuichiro and Kato, Hirokazu	MR System to Promote Social Participation of People Who Have Difficulty Going Out	2021	Human Aspects of IT for the Aged Population. Supporting Everyday Life Activities
Arino, Juan-J and Juan, M-Carmen and González-Gancedo, Santiago and Seguí, Ignacio and Vivó, Roberto	Augmented Reality With Autostereoscopic Visualization	2012	Proceedings of the International Conference on Computer Graphics Theory and Applications (GRAPP-2012), pages 419-425
Arroyo-Palacios, Jorge and Azmandian, Mahdi and Osman, Steven	Bringing Video Game Characters Into the Real World on a Holographic Light Field Display	2019	Proceedings of the 19th ACM International Conference on Intelligent Virtual Agents
Asai, Kikuo and Takase, Norio	Learning Molecular Structures in a Tangible Augmented Reality Environment	2013	Technologies, Innovation, and Change in Personal and Virtual Learning Environments
Aschenbrenner, Doris and Li, Meng and Dukalski, Radoslaw and Verlinden, Jouke and Lukosch, Stephan and others	Exploration of Different Augmented Reality Visualizations for Enhancing Situation Awareness for Remote Factory Planning Assistance	2018	IEEE VR
Azmandian, Mahdi and Hancock, Mark and Benko, Hrvoje and Ofek, Eyal and Wilson, Andrew D.	Haptic Retargeting: Dynamic Repurposing of Passive Haptics for Enhanced Virtual Reality Experiences	2016	Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems

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Author	Title	Year	Source
Bai, Huidong and Sasikumar, Prasanth and Yang, Jing and Billinghurst, Mark	A User Study on Mixed Reality Remote Collaboration With Eye Gaze and Hand Gesture Sharing	2020	Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems
Baldwin, Alex and Serafin, Stefania and Erkut, Cumhur	Towards the Design and Evaluation of Delay-based Modeling of Acoustic Scenes in Mobile Augmented Reality	2018	2018 IEEE 4th VR Workshop on Sonic Interactions for Virtual Environments (SIVE)
Barresi, Giacinto and Marinelli, Andrea and Caserta, Giulia and de Zambotti, Massimiliano and Tessadori, Jacopo and Angioletti, Laura and Boccardo, Nicolò and Freddolini, Marco and Mazzanti, Dario and Deshpande, Nikhil and Frigo, Carlo Albino and Balconi, Michela and Gruppioni, Emanuele and Laffranchi, Matteo and De Michieli, Lorenzo	Exploring the Embodiment of a Virtual Hand in a Spatially Augmented Respiratory Biofeedback Setting	2021	Frontiers in Neurorobotics
Bastos, Arthur Silva and Gomes, Renata Faria and dos Santos, Clemilson Costa and Rodrigues Maia, José Gilvan	Assessing the Experience of Immersion in Electronic Games	2017	2017 19th Symposium on Virtual and Augmented Reality (SVR)
Baytar, Fatma and Chung, Telin and Shin, Eonyou	Evaluating Garments in Augmented Reality When Shopping Online	2020	Journal of Fashion Marketing and Management: An International Journal
Bengtsson, Daniel and Jursenaite, Giedre	A User Study to Analyse the Experience of Augmented Reality Board Games	2019	Bachelor's Thesis
Benko, Hrvoje and Wilson, Andrew D. and Zannier, Federico	Dyadic Projected Spatial Augmented Reality	2014	Proceedings of the 27th Annual ACM Symposium on User Interface Software and Technology
Bennett, E. and Stevens, B.	The Effect That Touching a Projection Augmented Model Has on Object-presence	2005	Ninth International Conference on Information Visualisation (IV'05)
Bennett, Emily and Stevens, Brett	A Comparison of the Effect That the Visual and Haptic Problems Associated With Touching a Projection Augmented Model Have on Object-presence	2005	Presence: Teleoperators and Virtual Environments
Bennett, Emily and Stevens, Brett	The Effect That the Visual and Haptic Problems Associated With Touching a Projection Augmented Model Have on Object-presence	2006	Presence: Teleoperators and Virtual Environments
Bishop, Carl and Esteves, Augusto and McGregor, Iain	Head-mounted Displays as Opera Glasses: Using Mixed-reality to Deliver an Egalitarian User Experience During Live Events	2017	Proceedings of the 19th ACM International Conference on Multimodal Interaction
Blum, Lisa and Wetzel, Richard and McCall, Rod and Oppermann, Leif and Broll, Wolfgang	The Final Timewarp: Using Form and Content to Support Player Experience and Presence When Designing Location-aware Mobile Augmented Reality Games	2012	Proceedings of the Designing Interactive Systems Conference
Bokyung, Kye	Investigation on the Relationships Among Media Characteristics, Presence, Flow, and Learning Effects in Augmented Reality Based Learning	2009	Multimedia and E-Content Trends: Implications for Academia
Bönsch, Andrea and Kies, Alexander and Jörling, Moritz and Paluch, Stefanie and Kuhlen, Torsten W.	An Empirical Lab Study Investigating if Higher Levels of Immersion Increase the Willingness to Donate	2019	2019 IEEE Virtual Humans and Crowds for Immersive Environments (VHCIE)
Botella, C.M. and Juan, M.C. and Baños, R.M. and Alcañiz, M. and Guillén, V. and Rey, B.	Mixing Realities? An Application of Augmented Reality for the Treatment of Cockroach Phobia	2005	CyberPsychology & Behavior

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Author	Title	Year	Source
Bozgeyikli, Evren and Bozgeyikli, Lal Lila	Evaluating Object Manipulation Interaction Techniques in Mixed Reality: Tangible User Interfaces and Gesture	2021	2021 IEEE Virtual Reality and 3D User Interfaces (VR)
Bretón-López, Juani and Quero, Soledad and Botella, Cristina and García-Palacios, Azucena and Baños, Rosa Maria and Alcañiz, Mariano	An Augmented Reality System Validation for the Treatment of Cockroach Phobia	2010	Cyberpsychology, Behavior, and Social Networking
Brondi, Raffaello and Alem, Leila and Avveduto, Giovanni and Faita, Claudia and Carrozzino, Marcello and Tecchia, Franco and Bergamasco, Massimo	Evaluating the Impact of Highly Immersive Technologies and Natural Interaction on Player Engagement and Flow Experience in Games	2015	Entertainment Computing - ICEC 2015
Brown, Gordon and Prilla, Michael	The Effects of Consultant Avatar Size and Dynamics on Customer Trust in Online Consultations	2020	Proceedings of Mensch Und Computer 2020
Bruder, Gerd and Steinicke, Frank and Rothaus, Kai and Hinrichs, Klaus	Enhancing Presence in Head-mounted Display Environments by Visual Body Feedback Using Head-mounted Cameras	2009	2009 International Conference on CyberWorlds
Bruno Patrão and Paulo Menezes and Nuno Gonçalves	Augmented Shared Spaces: an Application for Exposure Psychotherapy	2020	International Journal of Online and Biomedical Engineering (iJOE)
Cai, Minghao and Tanaka, Jiro	Go Together: Providing Nonverbal Awareness Cues to Enhance Co-located Sensation in Remote Communication	2019	Human-centric Computing and Information Sciences
Cai, Minghao and Tanaka, Jiro	Mixed-reality Communication System Providing Shoulder-to-shoulder Collaboration	2019	International Journal on Advances in Software Volume 12, Number 3 & 4, 2019
Cao, Yuanzhi and Qian, Xun and Wang, Tianyi and Lee, Rachel and Huo, Ke and Ramani, Karthik	An Exploratory Study of Augmented Reality Presence for Tutoring Machine Tasks	2020	Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems
Carlos Orús and Sergio Ibáñez-Sánchez and Carlos Flavián	Enhancing the Customer Experience With Virtual and Augmented Reality: the Impact of Content and Device Type	2021	International Journal of Hospitality Management
Champney, Roberto and Lackey, Stephanie J. and Stanney, Kay and Quinn, Stephanie	Augmented Reality Training of Military Tasks: Reactions From Subject Matter Experts	2015	Virtual, Augmented and Mixed Reality
Chen, Lei and Liu, Yilin and Li, Yue and Yu, Lingyun and Gao, BoYu and Caon, Maurizio and Yue, Yong and Liang, Hai-Ning	Effect of Visual Cues on Pointing Tasks in Co-located Augmented Reality Collaboration	2021	Proceedings of the 2021 ACM Symposium on Spatial User Interaction
Chen, Ni	A Case Study on the Effect of Narrative in Augmented Reality Experiences in Museums	2018	Masters Thesis
Chen, Yu-Chien and Wang, Sheng-Jo and Chiang, Ya-Ling	Exploring the Effect of Presence in an AR-based Learning Environment	2009	13th Global Chinese Conference on Computers in Education, Taipei
Cheng, Kun-Hung	Surveying Students' Conceptions of Learning Science by Augmented Reality and Their Scientific Epistemic Beliefs	2018	Eurasia Journal of Mathematics, Science and Technology Education
Chicchi Giglioli, Irene Alice and Chirico, Alice and Cipresso, Pietro and Serino, Silvia and Pedroli, Elisa and Pallavicini, Federica and Riva, Giuseppe	Feeling Ghost Food as Real One: Psychometric Assessment of Presence Engagement Exposing to Food in Augmented Reality	2016	Pervasive Computing Paradigms for Mental Health

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Author	Title	Year	Source
Chicchi Giglioli, Irene Alice and Bermejo Vidal, Cristina and Alcañiz Raya, Mariano	A Virtual Versus an Augmented Reality Cooking Task Based-tools: a Behavioral and Physiological Study on the Assessment of Executive Functions	2019	Frontiers in Psychology
Choi, Hyoenah and Kim, Youngwon Ryan and Kim, Gerard J.	Presence, Immersion and Usability of Mobile Augmented Reality	2019	Virtual, Augmented and Mixed Reality. Multimodal Interaction
Christian Jerome and Bob Witmer	The Perception and Estimation of Egocentric Distance in Real and Augmented Reality Environments	2005	Proceedings of the Human Factors and Ergonomics Society Annual Meeting
Chuah, Joon Hao	Identifying and Exploring Factors Affecting Embodied Conversational Agent Social Presence for Interpersonal Skills Training	2013	PhD Thesis
Chuah, Joon Hao and Lok, Benjamin and Black, Erik	Applying Mixed Reality to Simulate Vulnerable Populations for Practicing Clinical Communication Skills	2013	IEEE Transactions on Visualization and Computer Graphics
Chuah, Joon Hao and Robb, Andrew and White, Casey and Wendling, Adam and Lampotang, Samsun and Kopper, Regis and Lok, Benjamin	Exploring Agent Physicality and Social Presence for Medical Team Training	2013	Presence: Teleoperators and Virtual Environments
Chuah, Joon Hao and Robb, Andrew and White, Casey and Wendling, Adam and Lampotang, Samsun and Kopper, Regis and Lok, Benjamin	Increasing Agent Physicality to Raise Social Presence and Elicit Realistic Behavior	2012	2012 IEEE Virtual Reality Workshops (VRW)
Cidota, Marina A. and Clifford, Rory M.S. and Lukosch, Stephan G. and Billinghurst, Mark	Using Visual Effects to Facilitate Depth Perception for Spatial Tasks in Virtual and Augmented Reality	2016	2016 IEEE International Symposium on Mixed and Augmented Reality (ISMAR-Adjunct)
Cidota, Marina and Lukosch, Stephan and Datcu, Dragos and Lukosch, Heide	Workspace Awareness in Collaborative AR Using Hmds: a User Study Comparing Audio and Visual Notifications	2016	Proceedings of the 7th Augmented Human International Conference 2016
Cordar, Andrew and Wendling, Adam and White, Casey and Lampotang, Samsun and Lok, Benjamin	Repeat After Me: Using Mixed Reality Humans to Influence Best Communication Practices	2017	2017 IEEE Virtual Reality (VR)
Damian, Ionut and Bühling, René and Obaid, Mohammad and Buhling, Rene and Billinghurst, Mark and André, Elisabeth	Motion Capturing Empowered Interaction With a Virtual Agent in an Augmented Reality Environment	2013	2013 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)
Datcu, Dragos and Lukosch, Stephan and Lukosch, Heide	Comparing Presence, Workload and Situational Awareness in a Collaborative Real World and Augmented Reality Scenario	2013	Proceedings of IEEE ISMAR workshop on Collaboration in Merging Realities (CiMeR)
Datcu, Dragos and Lukosch, Stephan G. and Lukosch, Heide K.	A Collaborative Game to Study the Perception of Presence During Virtual Co-location	2014	Proceedings of the Companion Publication of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing
David F. Arppe and Loutfouz Zaman and Richard W. Pazzi and Khalil El-Khatib	Uninet: a Mixed Reality Driving Simulator	2020	Graphics Interface 2020
de Melo, Celso M. and Kim, Kangsoo and Norouzi, Nahal and Bruder, Gerd and Welch, Gregory	Reducing Cognitive Load and Improving Warfighter Problem Solving With Intelligent Virtual Assistants	2020	Frontiers in Psychology
De Pace, Francesco and Manuri, Federico and Sanna, Andrea and Zappia, Davide	A Comparison Between Two Different Approaches for a Collaborative Mixed-virtual Environment in Industrial Maintenance	2019	Frontiers in Robotics and AI

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Author	Title	Year	Source
de Souza Almeida, Igor and Oikawa, Marina Atsumi and Polo, Jordi Carres and Miyazaki, Jun and Billinghurst, Mark and Kato, Hirokazu	Poster: AR-based Social Presence Enhancement in Videochat Communication	2012	2012 IEEE Symposium on 3D User Interfaces (3DUI)
Desai, Shital and Fels, Deborah and Astell, Arlene	Designing for Experiences in Blended Reality Environments for People With Dementia	2020	HCI International 2020 – Late Breaking Papers: Universal Access and Inclusive Design
Devon Allcoat and Tim Hatchard and Freeha Azmat and Kim Stansfield and Derrick Watson and Adrian von Mühlenen	Education in the Digital Age: Learning Experience in Virtual and Mixed Realities	2021	Journal of Educational Computing Research
Di Mascio, Tania and Tarantino, Laura and De Gasperis, Giovanni and Pino, Chiara	Immersive Virtual Environments: a Comparison of Mixed Reality and Virtual Reality Headsets for Asd Treatment	2020	Methodologies and Intelligent Systems for Technology Enhanced Learning, 9th International Conference
Dijkstra-Soudarissanane, Sylvie and Klunder, Tessa and Brandt, Aschwin and Niamut, Omar	Towards Xr Communication for Visiting Elderly at Nursing Homes	2021	Proceedings of the 2021 ACM International Conference on Interactive Media Experiences
Doh, Hyunji	Augmented Reality and Presence in Health Communication and Their Influence on the Empathy of Healthcare Professionals	2021	PhD Thesis
Dow, Steven and Mehta, Manish and Harmon, Ellie and MacIntyre, Blair and Mateas, Michael	Presence and Engagement in an Interactive Drama	2007	Proceedings of the SIGCHI Conference on Human Factors in Computing Systems
Dragos Datcu and Stephan Lukosch and Heide Lukosch	A Collaborative Game to Study Presence and Situational Awareness in a Physical and an Augmented Reality Environment	2016	JUCS - Journal of Universal Computer Science
Duenser, Andreas and Abramovici, Daniel and Obaid, Mohammad and Lochner, Martin	Towards Reactive Augmented Reality Exposure Treatment	2014	Proceedings of the 8th International Conference on Pervasive Computing Technologies for Healthcare
Eckhoff, Daniel and Cassinelli, Alvaro and Liu, Tuo and Sandor, Christian	Psychophysical Effects of Experiencing Burning Hands in Augmented Reality	2020	Virtual Reality and Augmented Reality
Fatharany, Fiandra and Yuniarti, Anny and Hariadi, Ridho Rahman	Design and Implementation of Markerless Augmented Reality Application for Cockroach Phobia Therapy Using Adaptive Threshold	2016	Jurnal Teknik ITS
Feng, Qi and Shum, Hubert P. H. and Morishima, Shigeo	Resolving Hand-object Occlusion for Mixed Reality With Joint Deep Learning and Model Optimization	2020	Computer Animation and Virtual Worlds
Firnkes, Joschka C. and Zerres, Christopher and Israel, Kai	Enhanced Product Presentation With Augmented Reality: the Role of Affective Reactions and Authenticity	2021	HCI in Business, Government and Organizations
Francisco Javier Sandoval-Henríquez and María Graciela Badilla-Quintana	Measuring Stimulation and Cognitive Reactions in Middle Schoolers After Using Immersive Technology: Design and Validation of the Tinmer Questionnaire	2021	Computers & Education
Frey, Jérémy	Leveraging Human-computer Interactions and Social Presence With Physiological Computing	2015	PhD Thesis
Gandy, Maribeth and Catrambone, Richard and MacIntyre, Blair and Alvarez, Chris and Eiriksdottir, Elsa and Hilimire, Matthew and Davidson, Brian and McLaughlin, Anne Collins	Experiences With an AR Evaluation Test Bed: Presence, Performance, and Physiological Measurement	2010	2010 IEEE International Symposium on Mixed and Augmented Reality
Gao, Lei	Using Mixed Reality for Asymmetric Remote Collaboration in a Room-scale Workspace	2020	PhD Thesis

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Author	Title	Year	Source
Gao, Lei and Bai, Huidong and Billinghurst, Mark and Lindeman, Robert W.	User Behaviour Analysis of Mixed Reality Remote Collaboration With a Hybrid View Interface	2021	Proceedings of the 32nd Australian Conference on Human-Computer Interaction
Gao, Lei and Bai, Huidong and Lindeman, Rob and Billinghurst, Mark	Static Local Environment Capturing and Sharing for MR Remote Collaboration	2017	SIGGRAPH Asia 2017 Mobile Graphics & Interactive Applications
Garcia, A. and Andre, N. and Bell Boucher, D. and Roberts-South, A. and Jog, M. and Katchabaw, M.	Immersive Augmented Reality for Parkinson Disease Rehabilitation	2014	Virtual, Augmented Reality and Serious Games for Healthcare 1
Garcia, Andres Ayala	Interactive Augmented Reality as a Support Tool for Parkinson's Disease Rehabilitation Programs	2012	Masters Thesis
Georgiou, Yiannis and Kyza, Eleni A	Investigating the Coupling of Narrative and Locality in Augmented Reality Educational Activities: Effects on Students' Immersion and Learning Gains	2018	ICLS 2018 Proceedings
Gironacci, Irene M and Mc Call, Roderick and Tamisier, Thomas	Mixed Reality Collaborative Storytelling	2018	Proceedings of the 32nd International BCS Human Computer Interaction Conference (HCI)
Goldiez, Brian F and Saptoka, Nabin and Aedunuthula, Prashanth	Human Performance Assessments When Using Augmented Reality for Navigation	2006	University of Central Florida Orlando Inst for Simulation and Training, Tech. Rep.
Gong, Ziyi and Wang, Geping and Wu, Qiong	Grey Island: Immersive Tangible Interaction Through Augmented Reality	2019	2019 IEEE Fourth International Conference on Data Science in Cyberspace (DSC)
Grandi, Jerônimo G and Debarba, Henrique G and Bemdt, Iago and Nedel, Luciana and Maciel, Anderson	Design and Assessment of a Collaborative 3D Interaction Technique for Handheld Augmented Reality	2018	2018 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)
Grandi, Jerônimo Gustavo and Debarba, Henrique Galvan and Maciel, Anderson	Characterizing Asymmetric Collaborative Interactions in Virtual and Augmented Realities	2019	2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)
Groechel, Thomas and Shi, Zhonghao and Pakkar, Roxanna and Matarić, Maja J	Using Socially Expressive Mixed Reality Arms for Enhancing Low-expressivity Robots	2019	2019 28th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)
Höhler, Chiara and Rasamoel, Nils David and Rohrbach, Nina and Hansen, John Paulin and Jahn, Klaus and Hermsdörfer, Joachim and Krewer, Carmen	The Impact of Visuospatial Perception on Distance Judgment and Depth Perception in an Augmented Reality Environment in Patients After Stroke: an Exploratory Study	2021	Journal of NeuroEngineering and Rehabilitation
Hamilton, Jared and Phung, Thao and Tran, Nhan and Williams, Tom	What's the Point? Tradeoffs Between Effectiveness and Social Perception When Using Mixed Reality to Enhance Gesturally Limited Robots	2021	Proceedings of the 2021 ACM/IEEE International Conference on Human-Robot Interaction
Hamilton, Jared and Tran, Nhan and Williams, Tom	Tradeoffs Between Effectiveness and Social Perception When Using Mixed Reality to Supplement Gesturally Limited Robots		International Workshop on Virtual, Augmented, and Mixed Reality for Human-Robot Interaction
Hammady, Ramy and Ma, Minhua and Strathern, Carl and Mohamad, Mostafa	Design and Development of a Spatial Mixed Reality Touring Guide to the Egyptian Museum	2020	Multimedia Tools and Applications
Han, Bin and Kim, Gerard Jounghyun	AudienceMR: Extending the Local Space for Large-scale Audience With Mixed Reality for Enhanced Remote Lecturer Experience	2021	Applied Sciences
Harrington, Maria C. R.	Observation of Presence in an Ecologically Valid Ethnographic Study Using an Immersive Augmented Reality Virtual Diorama Application	2020	2020 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)

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Harrington, Maria C. R.	Connecting User Experience to Learning in an Evaluation of an Immersive, Interactive, Multimodal Augmented Reality Virtual Diorama in a Natural History Museum & the Importance of Story	2020	2020 6th International Conference of the Immersive Learning Research Network (iLRN)
Henson, Anna	We're in This Together: Embodied Interaction, Affect, and Design Methods in Asymmetric, Co-located, Co-present Mixed Reality	2019	Masters Thesis
Herbst, Iris and Braun, Anne-Kathrin and McCall, Rod and Broll, Wolfgang	Timewarp: Interactive Time Travel With a Mobile Mixed Reality Game	2008	Proceedings of the 10th International Conference on Human Computer Interaction with Mobile Devices and Services
Hilken, Tim	Seeing is Believing: Enhancing the Customer Experience With Augmented Reality	2018	PhD Thesis
Hilken, Tim and de Ruyter, Ko and Chylinski, Mathew and Mahr, Dominik and Keeling, Debbie I.	Augmenting the Eye of the Beholder: Exploring the Strategic Potential of Augmented Reality to Enhance Online Service Experiences	2017	Journal of the Academy of Marketing Science
Holger Regenbrecht and Thomas Schubert	Measuring Presence in Augmented Reality Environments: Design and a First Test of a Questionnaire	2002	Proceedings of the Fifth Annual International Workshop Presence; arxiv.org/ftp/arxiv/papers/2103/2103.02831.pdf
Hsieh, Yi-Ta and Orso, Valeria and Andolina, Salvatore and Canaveras, Manuela and Cabral, Diogo and Spagnolli, Anna and Gamberini, Luciano and Jacucci, Giulio	Interweaving Visual and Audio-haptic Augmented Reality for Urban Exploration	2018	Proceedings of the 2018 Designing Interactive Systems Conference
Hu, Yupeng and He, Weiping and Zhang, Li and Li, Silian	Enhancing Realism and Presence With Active Physical Reactions in Augmented Reality	2021	Proceedings of the 32nd Australian Conference on Human-Computer Interaction
Huang, Kuo-Ting and Ball, Christopher and Francis, Jessica and Ratan, Rabindra and Boumis, Josephine and Fordham, Joseph	Augmented Versus Virtual Reality in Education: an Exploratory Study Examining Science Knowledge Retention When Using Augmented Reality/virtual Reality Mobile Applications	2019	Cyberpsychology, Behavior, and Social Networking
Huang, Tseng-Lung and Liao, Shu-Ling	Creating E-shopping Multisensory Flow Experience Through Augmented-reality Interactive Technology	2017	Internet Research
Huang, Tseng-Lung and Liao, Shuling	A Model of Acceptance of Augmented-reality Interactive Technology: the Moderating Role of Cognitive Innovativeness	2015	Electronic Commerce Research
Huang, Tseng-Lung and Mathews, Shane and Chou, Cindy Yunhsin	Enhancing Online Rapport Experience via Augmented Reality	2019	Journal of Services Marketing
Huang, Weidong and Alem, Leila and Tecchia, Franco	HandsIn3D: Supporting Remote Guidance With Immersive Virtual Environments	2013	Human-Computer Interaction – INTERACT 2013
Huang, Weidong and Alem, Leila and Tecchia, Franco and Duh, Henry Been-Lirn	Augmented 3D Hands: a Gesture-based Mixed Reality System for Distributed Collaboration	2018	Journal on Multimodal User Interfaces
Huertas, Assumpci'o and Gonzalo, Jan	The Role of Augmented Reality in Destination Branding	2020	Tourism and hospitality management
Hyeon-Cheol Kim and Martin Yongho Hyun	Predicting the Use of Smartphone-based Augmented Reality (AR): Does Telepresence Really Help?	2016	Computers in Human Behavior

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Author	Title	Year	Source
IJsselsteijn, Wijnand A and de Kort, Yvonne A. W and Haans, Antal	Is This My Hand I See Before Me? The Rubber Hand Illusion in Reality, Virtual Reality, and Mixed Reality	2006	Presence: Teleoperators and Virtual Environments
Irlitti, Andrew and Piumsomboon, Thammathip and Jackson, Daniel and Thomas, Bruce H.	Conveying Spatial Awareness Cues in Xr Collaborations	2019	IEEE Transactions on Visualization and Computer Graphics
Isabelle Verhulst and Andy Woods and Laryssa Whittaker and James Bennett and Polly Dalton	Do VR and AR Versions of an Immersive Cultural Experience Engender Different User Experiences?	2021	Computers in Human Behavior
Jing, Allison and May, Kieran William and Naeem, Mahnoor and Lee, Gun and Billinghurst, Mark	Eyemr-vis: Using Bi-directional Gaze Behavioural Cues to Improve Mixed Reality Remote Collaboration	2021	Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems
Jiyoung Lee, Soyoung Jung, Ji Won Kim and Frank Biocca	Applying Spatial Augmented Reality to Anti-smoking Message: Focusing on Spatial Presence, Negative Emotions, and Threat Appraisal	2019	International Journal of Human–Computer Interaction
Jo, Dongsik and Kim, Ki-Hong and Kim, Gerard Jounghyun	Effects of Avatar and Background Types on Users' Co-presence and Trust for Mixed Reality-based Teleconference Systems	2017	Proceedings the 30th Conference on Computer Animation and Social Agents
Joachimczak, Michał and Liu, Juan and Ando, Hiroshi	Effects of the Size of Mixed-reality Person Representations on Stress and Presence in Telecommunication	2019	International Journal of Semantic Computing
Joachimczak, Michal and Liu, Juan and Ando, Hiroshi	Downsizing: the Effect of Mixed-reality Person Representations on Stress and Presence in Telecommunication	2018	2018 IEEE International Conference on Artificial Intelligence and Virtual Reality (AIVR)
Jones, Brennan and Zhang, Yaying and Wong, Priscilla N. Y. and Rintel, Sean	Belonging There: VROOM-ing Into the Uncanny Valley of XR Telepresence	2021	Proceedings of the ACM on Human-Computer Interaction
Juan, Carmen M. and Llop, Edith and Abad, Francisco and Lluch, Javier	Learning Words Using Augmented Reality	2010	2010 10th IEEE International Conference on Advanced Learning Technologies
Juan, M.-Carmen and Carrizo, Marta and Abad, Francisco and Giménez, Miguelón and estiu, Instituto	Using an Augmented Reality Game to Find Matching Pairs	2011	WSCG 2011 Communication Paper
Juan, M.-Carmen and García-García, Inmaculada and Mollá, Ramón and López, Richard	Users' Perceptions Using Low-end and High-end Mobile-rendered Hmds: a Comparative Study	2018	Computers
Juan, M.-Carmen and Loachamín-Valencia, Mauricio and Garcia-Garcia, Inmaculada and Melchor, José Manuel and Benedito, Josep	ARCoins. An Augmented Reality App for Learning About Numismatics	2017	2017 IEEE 17th International Conference on Advanced Learning Technologies (ICALT)
Juan, M.C. and Alcaniz, M. and Monserrat, C. and Botella, C. and Banos, R.M. and Guerrero, B.	Using Augmented Reality to Treat Phobias	2005	IEEE Computer Graphics and Applications
Jung, Soyoung	The Message Effect of Augmented Health Messages on Body	2018	Virtual, Augmented and Mixed Reality: Applications in Health, Cultural Heritage, and Industry
Jung, Soyoung and Biocca, Frank and Lee, Daeun	Effect of 3D Projection Mapping Art: Digital Surrealism	2015	Virtual, Augmented and Mixed Reality
Jung, Soyoung and Lee, Jiyoung and Biocca, Frank and Kim, Ji Won	Augmented Reality in the Health Domain: Projecting Spatial Augmented Reality Visualizations on a Perceiver's Body for Health Communication Effects	2019	Cyberpsychology, Behavior, and Social Networking
Jung, Timothy and tom Dieck, M. Claudia and Lee, Hyunae and Chung, Namho	Effects of Virtual Reality and Augmented Reality on Visitor Experiences in Museum	2016	Information and Communication Technologies in Tourism 2016

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Kán, Peter	High-quality Real-time Global Illumination in Augmented Reality	2014	PhD Thesis
Kán, Peter and Dünser, Andreas and Billinghurst, Mark and Schönauer, Christian and Kaufmann, Hannes	The Effects of Direct and Global Illumination on Presence in Augmented Reality	2014	Proc. ISPR. Vienna: Facultas Verlags-und Buchhandels AG
Kangsoo Kim and Ryan Schubert and Jason Hochreiter and Gerd Bruder and Gregory Welch	Blowing in the Wind: Increasing Social Presence With a Virtual Human via Environmental Airflow Interaction in Mixed Reality	2019	Computers & Graphics
Kase, Sue and Su, Simon and Perry, Vincent and Roy, Heather and Gamble, Katherine	An Augmented Reality Shared Mission Planning Scenario: Observations on Shared Experience	2019	Virtual, Augmented and Mixed Reality. Applications and Case Studies
Keighrey, Conor and Flynn, Ronan and Murray, Siobhan and Murray, Niall	A Physiology-based QOE Comparison of Interactive Augmented Reality, Virtual Reality and Tablet-based Applications	2021	IEEE Transactions on Multimedia
Keighrey, Conor and Flynn, Ronan and Murray, Siobhan and Murray, Niall	A QOE Evaluation of Immersive Augmented and Virtual Reality Speech & Language Assessment Applications	2017	2017 Ninth International Conference on Quality of Multimedia Experience (QoMEX)
Khenak, Nawel and Vézien, Jeanne and Théry, David and Bourdot, Patrick	Spatial Presence in Real and Remote Immersive Environments and the Effect of Multisensory Stimulation	2020	Presence
Kim, Hanseob and Ali, Ghazanfar and Pastor, Andréas and Lee, Myungho and Kim, Gerard J. and Hwang, Jae-In	Silhouettes From Real Objects Enable Realistic Interactions With a Virtual Human in Mobile Augmented Reality	2021	Applied Sciences
Kim, Hanseob and Kim, Taehyung and Lee, Myungho and Kim, Gerard Jounghyun and Hwang, Jae-In	CIRO: the Effects of Visually Diminished Real Objects on Human Perception in Handheld Augmented Reality	2021	Electronics
Kim, Hanseob and Kim, TaeHyung and Lee, Myungho and Kim, Gerard Jounghyun and Hwang, Jae-In	Don't Bother Me: How to Handle Content-irrelevant Objects in Handheld Augmented Reality	2020	Proceedings of the 26th ACM Symposium on Virtual Reality Software and Technology
Kim, Hanseob and Lee, Myungho and Kim, Gerard J. and Hwang, Jae-In	The Impacts of Visual Effects on User Perception With a Virtual Human in Augmented Reality Conflict Situations	2021	IEEE Access
Kim, Jea In and Ha, Taejin and Woo, Woontack and Shi, Chung-Kon	Enhancing Social Presence in Augmented Reality-based Telecommunication System	2013	Virtual Augmented and Mixed Reality. Designing and Developing Augmented and Virtual Environments
Kim, Kangsoo	Improving Social Presence With a Virtual Human via Multimodal Physical - Virtual Interactivity in AR	2018	Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems
Kim, Kangsoo	Environmental Physical-virtual Interaction to Improve Social Presence With a Virtual Human in Mixed Reality	2018	PhD Thesis
Kim, Kangsoo and Boelling, Luke and Haesler, Steffen and Bailenson, Jeremy and Bruder, Gerd and Welch, Greg F.	Does a Digital Assistant Need a Body? The Influence of Visual Embodiment and Social Behavior on the Perception of Intelligent Virtual Agents in AR	2018	2018 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)
Kim, Kangsoo and Bruder, Gerd and Maloney, Divine and Welch, Greg	The Influence of Real Human Personality on Social Presence With a Virtual Human in Augmented Reality	2016	ICAT-EGVE 2016 - International Conference on Artificial Reality and Telexistence and Eurographics Symposium on Virtual Environments
Kim, Kangsoo and Bruder, Gerd and Welch, Greg	Exploring the Effects of Observed Physicality Conflicts on Real-virtual Human Interaction in Augmented Reality	2017	Proceedings of the 23rd ACM Symposium on Virtual Reality Software and Technology

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Kim, Kangsoo and de Melo, Celso M. and Norouzi, Nahal and Bruder, Gerd and Welch, Gregory F.	Reducing Task Load With an Embodied Intelligent Virtual Assistant for Improved Performance in Collaborative Decision Making	2020	2020 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)
Kim, Kangsoo and Maloney, Divine and Bruder, Gerd and Bailenson, Jeremy N. and Welch, Gregory F.	The Effects of Virtual Human's Spatial and Behavioral Coherence With Physical Objects on Social Presence in AR	2017	Computer Animation and Virtual Worlds
Kim, Kangsoo and Norouzi, Nahal and Losekamp, Tiffany and Bruder, Gerd and Anderson, Mindi and Welch, Gregory	Effects of Patient Care Assistant Embodiment and Computer Mediation on User Experience	2019	2019 IEEE International Conference on Artificial Intelligence and Virtual Reality (AIVR)
Kim, Seungwon and Billinghurst, Mark and Lee, Gun	The Effect of Collaboration Styles and View Independence on Video-mediated Remote Collaboration	2018	Computer Supported Cooperative Work (CSCW)
Kim, Seungwon and Jing, Allison and Park, Hanhoon and Lee, Gun A. and Huang, Weidong and Billinghurst, Mark	Hand-in-air (Hia) and Hand-on-target (Hot) Style Gesture Cues for Mixed Reality Collaboration	2020	IEEE Access
Kim, Seungwon and Lee, Gun and Billinghurst, Mark and Huang, Weidong	The Combination of Visual Communication Cues in Mixed Reality Remote Collaboration	2020	Journal on Multimodal User Interfaces
Kim, Seungwon and Lee, Gun and Huang, Weidong and Kim, Hayun and Woo, Woontack and Billinghurst, Mark	Evaluating the Combination of Visual Communication Cues for Hmd-based Mixed Reality Remote Collaboration	2019	Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems
Kim, Seungwon and Lee, Gun and Sakata, Nobuchika and Billinghurst, Mark	Improving Co-presence With Augmented Visual Communication Cues for Sharing Experience Through Video Conference	2014	2014 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)
Kim, Terry Haekyung and Choo, Ho Jung	Augmented Reality as a Product Presentation Tool: Focusing on the Role of Product Information and Presence in AR	2021	Fashion and Textiles
Klatt, J. and Ten Broeke, S. and von der Putten, A. and Schuetz, A. C. and Vervoort, J. and McCall, Roderick and Kraemer, N. C. and Wetzel, R. and Blum, L. and Oppermann, L.	Let's Do the Time Warp Again – Subjective and Behavioral Presence Measurement in the Augmented Reality Game Timewarp	2011	Proceedings of the 13th International Workshop on Presence
Kockord, René and Bodensiek, Oliver	Cognitive Load During First Contact With Mixed Reality Learning Environments	2021	Proceedings of Mensch Und Computer 2021
Kolkmeier, Jan and Harmsen, Emiel and Giesselink, Sander and Reidsma, Dennis and Theune, Mariët and Heylen, Dirk	With a Little Help From a Holographic Friend: the Openimpress Mixed Reality Telepresence Toolkit for Remote Collaboration Systems	2018	Proceedings of the 24th ACM Symposium on Virtual Reality Software and Technology
Korsgaard, Dannie and Bjørner, Thomas and Sørensen, Pernille Krog and Bruun-Pedersen, Jon Ram	Older Adults Eating Together in a Virtual Living Room: Opportunities and Limitations of Eating in Augmented Virtuality	2019	Proceedings of the 31st European Conference on Cognitive Ergonomics
Korsgaard, Dannie and Bjørner, Thomas and Bruun-Pedersen, Jon R. and Sørensen, Pernille K. and Perez-Cueto, Federico J. A.	Eating Together While Being Apart: a Pilot Study on the Effects of Mixed-reality Conversations and Virtual Environments on Older Eaters' Solitary Meal Experience and Food Intake	2020	2020 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)
Korsgaard, Dannie and Nilsson, Niels Christian and Bjørner, Thomas	Immersive Eating: Evaluating the Use of Head-mounted Displays for Mixed Reality Meal Sessions	2017	2017 IEEE 3rd Workshop on Everyday Virtual Reality (WEVR)

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Author	Title	Year	Source
Koskela, Timo and Mazouzi, Mounib and Alavesa, Paula and Pakanen, Minna and Minyaev, Ilya and Paavola, Eero and Tuliniemi, Jere	Avatarex: Telexistence System Based on Virtual Avatars	2018	Proceedings of the 9th Augmented Human International Conference
Lallart, Elise and Lallart, Xavier and Jouvent, Roland	Agency, the Sense of Presence, and Schizophrenia	2009	CyberPsychology & Behavior
Lawrence, Louise and Dey, Arindam and Billinghurst, Mark	The Effect of Video Placement in AR Conferencing Applications	2018	Proceedings of the 30th Australian Conference on Computer-Human Interaction
Lee, Cha	Mixed Reality Simulation	2013	PhD Thesis
Lee, Cha and Rincon, Gustavo A. and Meyer, Greg and Höllerer, Tobias and Bowman, Doug A.	The Effects of Visual Realism on Search Tasks in Mixed Reality Simulation	2013	IEEE Transactions on Visualization and Computer Graphics
Lee, Gun A. and Teo, Theophilus and Kim, Seungwon and Billinghurst, Mark	A User Study on MR Remote Collaboration Using Live 360 Video	2018	2018 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)
Lee, Myungho and Bruder, Gerd and Höllerer, Tobias and Welch, Greg	Effects of Unaugmented Periphery and Vibrotactile Feedback on Proxemics With Virtual Humans in AR	2018	IEEE Transactions on Visualization and Computer Graphics
Lee, Myungho and Norouzi, Nahal and Bruder, Gerd and Wisniewski, Pamela J. and Welch, Gregory F.	The Physical-virtual Table: Exploring the Effects of a Virtual Human's Physical Influence on Social Interaction	2018	Proceedings of the 24th ACM Symposium on Virtual Reality Software and Technology
Lee, Myungho and Norouzi, Nahal and Bruder, Gerd and Wisniewski, Pamela J. and Welch, Gregory F.	Mixed Reality Tabletop Gameplay: Social Interaction With a Virtual Human Capable of Physical Influence	2021	IEEE Transactions on Visualization and Computer Graphics
Lee, Sangyoon and Hua, Hong	Effects of Viewing Conditions and Rotation Methods in a Collaborative Tabletop AR Environment	2010	2010 IEEE Virtual Reality Conference (VR)
Li, Chengjie and Androulakaki, Theofronia and Gao, Alex Yuan and Yang, Fangkai and Saikia, Himangshu and Peters, Christopher and Skantze, Gabriel	Effects of Posture and Embodiment on Social Distance in Human-agent Interaction in Mixed Reality	2018	Proceedings of the 18th International Conference on Intelligent Virtual Agents
Li, Ruobing and Zhang, Bo and Sundar, S. Shyam and Duh, Henry Been-Lirn	Interacting With Augmented Reality: How Does Location-based AR Enhance Learning?	2013	Human-Computer Interaction – INTERACT 2013
Lorenz, Mario and Busch, Marc and Rentzos, Loukas and Tscheligi, Manfred and Klimant, Philipp and Fröhlich, Peter	I'm There! The Influence of Virtual Reality and Mixed Reality Environments Combined With Two Different Navigation Methods on Presence	2015	2015 IEEE Virtual Reality (VR)
Louis, Thibault and Troccaz, Jocelyne and Rochet-Capellan, Amélie and Bérard, François	Is It Real? Measuring the Effect of Resolution, Latency, Frame Rate and Jitter on the Presence of Virtual Entities	2019	Proceedings of the 2019 ACM International Conference on Interactive Surfaces and Spaces
Lu, Yangzhicheng and Ishida, Tomoyuki	Implementation and Evaluation of a High-presence Interior Layout Simulation System Using Mixed Reality	2020	J. Journal of Internet Services and Information Security (JISIS)
M. Bordegoni and G. Caruso	Mixed Reality Distributed Platform for Collaborative Design Review of Automotive Interiors	2012	Virtual and Physical Prototyping
M. Carmen Juan and David Pérez	Using Augmented and Virtual Reality for the Development of Acrophobic Scenarios. Comparison of the Levels of Presence and Anxiety	2010	Computers & Graphics

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Author	Title	Year	Source
M. Carmen Juan and Dennis Joele	A Comparative Study of the Sense of Presence and Anxiety in an Invisible Marker Versus a Marker Augmented Reality System for the Treatment of Phobia Towards Small Animals	2011	International Journal of Human-Computer Studies
M. Carmen Juan and Jérôme Calatrava	An Augmented Reality System for the Treatment of Phobia to Small Animals Viewed via an Optical See-through Hmd: Comparison With a Similar System Viewed via a Video See-through Hmd	2011	International Journal of Human–Computer Interaction
M. Carmen Juan Lizandra	Augmented Reality and Tangible Interfaces for Learning	2009	Advanced Learning
Mésároová, Alena and Hernandez, Manuel Ferrer	Art Behind the Mind: Exploring New Art Forms by Implementation of the Electroencephalography	2015	2015 International Conference on Cyberworlds (CW)
Müller, Jens and Rädle, Roman and Reiterer, Harald	Remote Collaboration With Mixed Reality Displays: How Shared Virtual Landmarks Facilitate Spatial Referencing	2017	Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems
Müller, Jens and Zagermann, Johannes and Wieland, Jonathan and Pfeil, Ulrike and Reiterer, Harald	A Qualitative Comparison Between Augmented and Virtual Reality Collaboration With Handheld Devices	2019	Proceedings of Mensch Und Computer 2019
Mahmood, Tahir and Fulmer, Willis and Mungoli, Neelesh and Huang, Jian and Lu, Aidong	Improving Information Sharing and Collaborative Analysis for Remote Geospatial Visualization Using Mixed Reality	2019	2019 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)
Marto, Anabela and Melo, Miguel and Gonçalves, Alexandrino and Bessa, Maximino	Multisensory Augmented Reality in Cultural Heritage: Impact of Different Stimuli on Presence, Enjoyment, Knowledge and Value of the Experience	2020	IEEE Access
McCall, Rod and Wetzel, Richard and Löschner, Johannes and Braun, Anne-Kathrin	Using Presence to Evaluate an Augmented Reality Location Aware Game	2011	Personal and Ubiquitous Computing
McCall, Roderick and Braun, Anne-Kathrine	Experiences of Evaluating Presence in Augmented Realities	2008	PsychNology Journal
McGill, Mark and Boland, Daniel and Murray-Smith, Roderick and Brewster, Stephen	A Dose of Reality: Overcoming Usability Challenges in VR Head-mounted Displays	2015	Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems
McKee, Cameron	The Role of Media Naturalness on Dyadic Collaboration Effectiveness in Mixed Reality and Virtual Reality	2019	Masters Thesis
Mehmet Kosa and Ahmet Uysal	Effects of Presence and Physical Activity on Player Well-being in Augmented Reality Games: a Diary Study	2022	International Journal of Human–Computer Interaction
Mikropoulos, Tassos A. and Delimitros, Michael and Gaintatzis, Pavlos and Iatraki, Georgia and Stergiouli, Aikaterini and Tsiara, Angeliki and Kalyvioti, Katerina	Acceptance and User Experience of an Augmented Reality System for the Simulation of Sensory Overload in Children With Autism	2020	2020 6th International Conference of the Immersive Learning Research Network (iLRN)
Milad Dehghani and Seung Hwan (Mark) Lee and Atefeh Mashatan	Touching Holograms With Windows Mixed Reality: Renovating the Consumer Retailing Services	2020	Technology in Society
Miller, Mark Roman and Bailenson, Jeremy N.	Social Presence Outside the Augmented Reality Field of View	2021	Frontiers in Virtual Reality
Miller, Mark Roman and Jun, Hanseul and Herrera, Fernanda and Yu Villa, Jacob and Welch, Greg and Bailenson, Jeremy N.	Social Interaction in Augmented Reality	2019	PLoS ONE

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Mohamed Daassi and Sana Debbabi	Intention to Reuse AR-based Apps: the Combined Role of the Sense of Immersion, Product Presence and Perceived Realism	2021	Information & Management
Mostajeran Gourtani, Fariba	MR Pharmacy: Development and Evaluation of Therapeutic Mixed Reality Applications	2021	PhD Thesis
Mostajeran, Fariba and Katzakis, Nikolaos and Ariza, Oscar and Freiwald, Jann Philipp and Steinicke, Frank	Welcoming a Holographic Virtual Coach for Balance Training at Home: Two Focus Groups With Older Adults	2019	2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)
Mostajeran, Fariba and Steinicke, Frank and Ariza Nunez, Oscar Javier and Gatsios, Dimitrios and Fotiadis, Dimitrios	Augmented Reality for Older Adults: Exploring Acceptability of Virtual Coaches for Home-based Balance Training in an Aging Population	2020	Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems
Munoz-Montoya, Francisco and Juan, M.-Carmen and Mendez-Lopez, Magdalena and Fidalgo, Camino	Augmented Reality Based on Slam to Assess Spatial Short-term Memory	2019	IEEE Access
Munoz-Montoya, Francisco and Juan, M.-Carmen and Mendez-Lopez, Magdalena and Molla, Ramon and Abad, Francisco and Fidalgo, Camino	Slam-based Augmented Reality for the Assessment of Short-term Spatial Memory. A Comparative Study of Visual Versus Tactile Stimuli	2021	PLoS ONE
Nørgård, C. and O'Neill, L. and Nielsen, K.G. and Juul, S.H. and Chemnitz, J.	Learning Anatomy With Augmented Reality	2018	10th International Conference on Education and New Learning Technologies
Nassani, Alaeddin and Bai, Huidong and Lee, Gun and Billinghurst, Mark and Langlotz, Tobias and Lindeman, Robert W.	Filtering Shared Social Data in AR	2018	Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems
Nassani, Alaeddin and Kim, Hyungon and Lee, Gun and Billinghurst, Mark and Langlotz, Tobias and Lindeman, Robert W.	Augmented Reality Annotation for Social Video Sharing	2016	SIGGRAPH ASIA 2016 Mobile Graphics and Interactive Applications
Nassani, Alaeddin and Lee, Gun and Billinghurst, Mark and Lindeman, Robert W.	Filtering Mechanisms of Shared Social Surrounding Environments in AR	2019	2019 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)
Niemelä, Arttu	Mobile Augmented Reality Client for Citizen Participation	2018	Masters Thesis
Nimcharoen, Chontira and Zollmann, Stefanie and Collins, Jonny and Regenbrecht, Holger	Is That Me?—embodiment and Body Perception With an Augmented Reality Mirror	2018	2018 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)
Norman, Mitchell and Lee, Gun A. and Smith, Ross T. and Billingurst, Mark	The Impact of Remote User's Role in a Mixed Reality Mixed Presence System	2019	Proceedings of the 17th International Conference on Virtual-Reality Continuum and Its Applications in Industry
Norouzi, Nahal and Kim, Kangsoo and Lee, Myungho and Schubert, Ryan and Erickson, Austin and Bailenson, Jeremy and Bruder, Gerd and Welch, Greg	Walking Your Virtual Dog: Analysis of Awareness and Proxemics With Simulated Support Animals in Augmented Reality	2019	2019 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)
Obaid, Mohammad and Niewiadomski, Radosław and Pelachaud, Catherine	Perception of Spatial Relations and of Coexistence With Virtual Agents	2011	Intelligent Virtual Agents

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Oliveira, Wesley and Tizuka, Michelle and Clua, Esteban and Trevisan, Daniela and Salgado, Luciana	Virtual and Real Body Representation in Mixed Reality: an Analysis of Self-presence and Immersive Environments	2019	Entertainment Computing and Serious Games
Oriti, Damiano and Manuri, Federico and Pace, Francesco De and Sanna, Andrea	Harmonize: a Shared Environment for Extended Immersive Entertainment	2023	Virtual Reality
Orts-Escolano, Sergio and Rhemann, Christoph and Fanello, Sean and Chang, Wayne and Kowdle, Adarsh and Degtyarev, Yury and Kim, David and Davidson, Philip L. and Khamis, Sameh and Dou, Mingsong and Tankovich, Vladimir and Loop, Charles and Cai, Qin and Chou, Philip A. and Mennicken, Sarah and Valentin, Julien and Pradeep, Vivek and Wang, Shenlong and Kang, Sing Bing and Kohli, Pushmeet and Lutchyn, Yuliya and Keskin, Cem and Izadi, Shahram	Holoportation: Virtual 3D Teleportation in Real-time	2016	Proceedings of the 29th Annual Symposium on User Interface Software and Technology
Osmers, Niklas and Prilla, Michael	Getting Out of Out of Sight: Evaluation of AR Mechanisms for Awareness and Orientation Support in Occluded Multi-room Settings	2020	Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems
Pan, Ye and Sinclair, David and Mitchell, Kenny	Empowerment and Embodiment for Collaborative Mixed Reality Systems	2018	Computer Animation and Virtual Worlds
Pejsa, Tomislav and Kantor, Julian and Benko, Hrvoje and Ofek, Eyal and Wilson, Andrew	Room2room: Enabling Life-size Telepresence in a Projected Augmented Reality Environment	2016	Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing
Pérez, Pablo and González-Sosa, Ester and Kachach, Redouane and Pereira, Francisco and Villegas, Álvaro	Ecological Validity Through Gamification: an Experiment With a Mixed Reality Escape Room	2021	2021 IEEE International Conference on Artificial Intelligence and Virtual Reality (AIVR)
Perez, Pablo and Gonzalez-Sosa, Ester and Kachach, Redouane and Ruiz, Jaime and Benito, Ignacio and Pereira, Francisco and Villegas, Alvaro	Immersive Gastronomic Experience With Distributed Reality	2019	2019 IEEE 5th Workshop on Everyday Virtual Reality (WEVR)
Phan, Huu Lam and Kim, Jong Pal and Kim, Kwangsoo and Hwang, Chang Ho and Koo, Kyo-in	Wrist Rehabilitation System Using Augmented Reality for Hemiplegic Stroke Patient Rehabilitation: a Feasibility Study	2019	Applied Sciences
Pimentel, Daniel and Vinkers, Charlotte	Copresence With Virtual Humans in Mixed Reality: the Impact of Contextual Responsiveness on Social Perceptions	2021	Frontiers in Robotics and AI
Piumsomboon, Thammathip and Dey, Arindam and Ens, Barrett and Lee, Gun and Billinghurst, Mark	The Effects of Sharing Awareness Cues in Collaborative Mixed Reality	2019	Frontiers in Robotics and AI
Piumsomboon, Thammathip and Lee, Gun A. and Hart, Jonathon D. and Ens, Barrett and Lindeman, Robert W. and Thomas, Bruce H. and Billinghurst, Mark	Mini-me: an Adaptive Avatar for Mixed Reality Remote Collaboration	2018	Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems

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Piumsomboon, Thammathip and Lee, Gun A. and Irlitti, Andrew and Ens, Barrett and Thomas, Bruce H. and Billinghurst, Mark	On the Shoulder of the Giant: a Multi-scale Mixed Reality Collaboration With 360 Video Sharing and Tangible Interaction	2019	Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems
Ramkumar, Niveta and Fereydooni, Nadia and Shaer, Orit and Kun, Andrew L.	Visual Behavior during Engagement with Tangible and Virtual Representations of Archaeological Artifacts	2019	Proceedings of the 8th ACM International Symposium on Pervasive Displays
Randhavane, Tanmay and Bera, Aniket and Kapsaskis, Kyra and Gray, Kurt and Manocha, Dinesh	Fva: Modeling Perceived Friendliness of Virtual Agents Using Movement Characteristics	2019	IEEE Transactions on Visualization and Computer Graphics
Rapp, Daniel and Müller, Jonas and Bucher, Kristina and von Mammen, Sebastian	Pathomon: a Social Augmented Reality Serious Game	2018	2018 10th International Conference on Virtual Worlds and Games for Serious Applications (VS-Games)
Ratan, Rabindra and Boumis, Josephine K. and Kuang, Sarah and Gambino, Andrew and Huang, Kuo-Ting	Reality Stems From Modality: Stereotype Threat Effects of a Stem Game in Augmented and Virtual Reality	2021	Frontiers in Virtual Reality
Redaelli, Claudia and Pellegrini, Raffaella and Mottura, Stefano and Sacco, Marco	Shoe Customers' Behaviour With New Technologies: the Magic Mirror Case	2009	2009 IEEE International Technology Management Conference (ICE)
Regenbrecht, Holger and Meng, Katrin and Reepen, Arne and Beck, Stephan and Langlotz, Tobias	Mixed Voxel Reality: Presence and Embodiment in Low Fidelity, Visually Coherent, Mixed Reality Environments	2017	2017 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)
Regenbrecht, Holger and Ott, Claudia and Park, Noel and Duncan, Stuart and Collins, Jonny	Voxelvideos for Entertainment, Education, and Training	2021	IEEE Access
Regenbrecht, Holger and Park, Jung-Woo (Noel) and Ott, Claudia and Mills, Steven and Cook, Matthew and Langlotz, Tobias	Preaching Voxels: an Alternative Approach to Mixed Reality	2019	Frontiers in ICT
Reichherzer, Carolin and Nassani, Alaeddin and Billinghurst, Mark	[Poster] Social Panoramas Using Wearable Computers	2014	2014 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)
Rhee, Taehyun and Thompson, Stephen and Medeiros, Daniel and dos Anjos, Rafael and Chalmers, Andrew	Augmented Virtual Teleportation for High-fidelity Telecollaboration	2020	IEEE Transactions on Visualization and Computer Graphics
Richards, Kendra and Mahalanobis, Nikhil and Kim, Kangsoo and Schubert, Ryan and Lee, Myungho and Daher, Salam and Norouzi, Nahal and Hochreiter, Jason and Bruder, Gerd and Welch, Greg	Analysis of Peripheral Vision and Vibrotactile Feedback During Proximal Search Tasks With Dynamic Virtual Entities in Augmented Reality	2019	Symposium on Spatial User Interaction
Robb Lindgren and Michael Tscholl and Shuai Wang and Emily Johnson	Enhancing Learning and Engagement Through Embodied Interaction Within a Mixed Reality Simulation	2016	Computers & Education
Robb, Andrew and Cordar, Andrew and Lampotang, Samsun and White, Casey and Wendling, Adam and Lok, Benjamin	Teaming Up With Virtual Humans: How Other People Change Our Perceptions of and Behavior With Virtual Teammates	2015	IEEE Transactions on Visualization and Computer Graphics
Rogers, Katja and Colley, Mark and Lehr, David and Frommel, Julian and Walch, Marcel and Nacke, Lennart E. and Weber, Michael	Kickar: Exploring Game Balancing Through Boosts and Handicaps in Augmented Reality Table Football	2018	Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems

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Rohrbach, Nina and Krewer, Carmen and Löhnert, Lisa and Thierfelder, Annika and Randerath, Jennifer and Jahn, Klaus and Hermsdörfer, Joachim	Improvement of Apraxia With Augmented Reality: Influencing Pantomime of Tool Use via Holographic Cues	2021	Frontiers in Neurology
Rosa, Nina and van Bommel, Jean-Paul and Hürst, Wolfgang and Nijboer, Tanja and Veltkamp, Remco C. and Werkhoven, Peter	Embodying an Extra Virtual Body in Augmented Reality	2019	2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)
Rosa, Nina and Veltkamp, Remco C. and Hürst, Wolfgang and Brouwer, Anne-Marie and Gijsbertse, Kaj and Cocu, Ioana and Werkhoven, Peter	Embodiment and Performance in the Supernumerary Hand Illusion in Augmented Reality	2021	Frontiers in Computer Science
Rzayev, Rufat and Karaman, Gürkan and Henze, Niels and Schwind, Valentin	Fostering Virtual Guide in Exhibitions	2019	Proceedings of the 21st International Conference on Human-Computer Interaction with Mobile Devices and Services
Saifeddin Alimamy and Samer Al-Imamy	Customer Perceived Value Through Quality Augmented Reality Experiences in Retail: the Mediating Effect of Customer Attitudes	2022	Journal of Marketing Communications
Sajjadi, Pejman and Bagher, Mahda M. and Oliver, Jan and Kopp, Stefan and Cimiano, Philipp and Klippel, Alexander	Mixed or Virtual: Does Device Type Matter in Human-eca Interactions	2020	2020 6th International Conference of the Immersive Learning Research Network (iLRN)
Salar, Riza and Arici, Faruk and Caliklar, Seyma and Yilmaz, Rabia M.	A Model for Augmented Reality Immersion Experiences of University Students Studying in Science Education	2020	Journal of Science Education and Technology
Sasikumar, Prasanth and Chittajallu, Soumith and Raj, Navindd and Bai, Huidong and Billinghurst, Mark	Spatial Perception Enhancement in Assembly Training Using Augmented Volumetric Playback	2021	Frontiers in Virtual Reality
Sasikumar, Prasanth and Gao, Lei and Bai, Huidong and Billinghurst, Mark	Wearable Remotefusion: a Mixed Reality Remote Collaboration System With Local Eye Gaze and Remote Hand Gesture Sharing	2019	2019 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)
Schüller-Reichl, David	Mapping of Realism in Rendering Onto Perception of Presence in Augmented Reality	2017	Masters Thesis (Diplomarbeit)
Seichter, Hartmut	Augmented Reality and Tangible Interfaces in Collaborative Urban Design	2007	Computer-Aided Architectural Design Futures (CAADFutures) 2007
Seichter, Hartmut	Communication in Augmented Reality Aided Architectural Design	2009	Mixed Reality In Architecture, Design And Construction
Seichter, Hartmut and Schnabel, Marc Aurel	Digital and Tangible Sensation: an Augmented Reality Urban Design Studio	2005	Tenth International Conference on Computer Aided Architectural Design Research in Asia, CAADRIA, New Delhi, India
Sekhavat, Yoones A.	Kioskar: an Augmented Reality Game as a New Business Model to Present Artworks	2016	International Journal of Computer Games Technology
Serrano Vergel, Ramiro and Morillo Tena, Pedro and Casas Yrurzum, Sergio and Cruz-Neira, Carolina	A Comparative Evaluation of a Virtual Reality Table and a Hololens-based Augmented Reality System for Anatomy Training	2020	IEEE Transactions on Human-Machine Systems

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Author	Title	Year	Source
Shin, Jae-eun and Kim, Hayun and Parker, Callum and Kim, Hyung-il and Oh, Seoyoung and Woo, Woontack	Is Any Room Really Ok? The Effect of Room Size and Furniture on Presence, Narrative Engagement, and Usability During a Space-adaptive Augmented Reality Game	2019	2019 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)
Shin, Jae-eun and Yoon, Boram and Kim, Dooyoung and Woo, Woontack	A User-oriented Approach to Space-adaptive Augmentation: the Effects of Spatial Affordance on Narrative Experience in an Augmented Reality Detective Game	2021	Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems
Siggelkow, Michael	Importance of Gaze Awareness in Augmented Reality Teleconferencing	2005	Masters Thesis (Diplomarbeit)
Spierling, Ulrike and Winzer, Peter and Massarczyk, Erik	Experiencing the Presence of Historical Stories With Location-based Augmented Reality	2017	Interactive Storytelling
Stella Sylaiou and Katerina Mania and Athanasis Karoulis and Martin White	Exploring the Relationship Between Presence and Enjoyment in a Virtual Museum	2010	International Journal of Human-Computer Studies
Steptoe, William and Julier, Simon and Steed, Anthony	Presence and Discernability in Conventional and Non-photorealistic Immersive Augmented Reality	2014	2014 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)
Stevens, Brett and Jerrams-Smith, Jennifer and Heathcote, David and Callear, David	Putting the Virtual Into Reality: Assessing Object-presence With Projection-augmented Models	2002	Presence: Teleoperators and Virtual Environments
Suárez, Gonzalo and Jung, Sungchul and Lindeman, Robert W.	Evaluating Virtual Human Role-players for the Practice and Development of Leadership Skills	2021	Frontiers in Virtual Reality
Sugano, N. and Kato, H. and Tachibana, K.	The Effects of Shadow Representation of Virtual Objects in Augmented Reality	2003	Proceedings Second IEEE and ACM International Symposium on Mixed and Augmented Reality
Susanna Aromaa and Antti Väätänen and Iina Aaltonen and Vladimir Goriachev and Kaj Helin and Jaakko Karjalainen	Awareness of the Real-world Environment When Using Augmented Reality Head-mounted Display	2020	Applied Ergonomics
Sylaiou, Stella and Killintzis, Vassilis and Paliokas, Ioannis and Mania, Katerina and Patias, Petros	Usability Evaluation of Virtual Museums' Interfaces Visualization Technologies	2014	Virtual, Augmented and Mixed Reality. Applications of Virtual and Augmented Reality
Tang, Arthur and Biocca, Frank and Lim, Lynette and others	Comparing Differences in Presence During Social Interaction in Augmented Reality Versus Virtual Reality Environments: an Exploratory Study	2004	Proceedings of PRESENCE
Tang, Wenjing	Augmented Virtuality Enhanced Visualization in an Immersive Cinematic Environment	2018	Masters Thesis
Tang, Wenjing and Lee, Gun A. and Billinghurst, Mark and Lindeman, Robert W.	User Virtual Costume Visualisation in an Augmented Virtuality Immersive Cinematic Environment	2018	Proceedings of the 30th Australian Conference on Computer-Human Interaction
Tanja Aitamurto and Laura Aymerich-Franch and Jorge Saldivar and Catherine Kircos and Yasamin Sadeghi and Sukolsak Sakshuwong	Examining Augmented Reality in Journalism: Presence, Knowledge Gain, and Perceived Visual Authenticity	2022	New Media & Society
Tarantino, Laura and De Gasperis, Giovanni and Mascio, Tania Di and Pino, Maria Chiara	Immersive Applications: What if Users Are in the Autism Spectrum?	2019	Proceedings of the 17th International Conference on Virtual-Reality Continuum and Its Applications in Industry
Teles Roxo, Mafalda and Quelhas Brito, Pedro	"I See Myself, Therefore I Purchase": Factors Influencing Consumer Attitudes Towards M-commerce AR Apps	2020	Augmented Reality and Virtual Reality: Changing Realities in a Dynamic World
Teo, Theophilus and Lawrence, Louise and Lee, Gun A. and Billinghurst, Mark and Adcock, Matt	Mixed Reality Remote Collaboration Combining 360 Video and 3D Reconstruction	2019	Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems

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Teo, Theophilus and Lee, Gun A. and Billinghurst, Mark and Adcock, Matt	Investigating the Use of Different Visual Cues to Improve Social Presence Within a 360 Mixed Reality Remote Collaboration	2019	Proceedings of the 17th International Conference on Virtual-Reality Continuum and Its Applications in Industry
Teo, Theophilus and Norman, Mitchell and Lee, Gun A. and Billinghurst, Mark and Adcock, Matt	Exploring Interaction Techniques for 360 Panoramas Inside a 3D Reconstructed Scene for Mixed Reality Remote Collaboration	2020	Journal on Multimodal User Interfaces
Thanyadit, Santawat and Punpongsanon, Parinya and Pong, Ting-Chuen	ObserVAR: Visualization System for Observing Virtual Reality Users Using Augmented Reality	2019	2019 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)
Thompson, Stephen	A High Fidelity Mixed Reality System for Remote Collaboration	2020	Masters Thesis
Tibert Verhagen and Charlotte Vonkeman and Frans Feldberg and Pløn Verhagen	Present It Like It is Here: Creating Local Presence to Improve Online Product Experiences	2014	Computers in Human Behavior
Tsai, Chai-Fen and Yeh, Shih-Ching and Huang, Yanyan and Wu, Zhengyu and Cui, Jianjun and Zheng, Lirong	The Effect of Augmented Reality and Virtual Reality on Inducing Anxiety for Exposure Therapy: a Comparison Using Heart Rate Variability	2018	Journal of Healthcare Engineering
Tseng-Lung Huang	Restorative Experiences and Online Tourists' Willingness to Pay a Price Premium in an Augmented Reality Environment	2021	Journal of Retailing and Consumer Services
Ty, Jayzon and Plopski, Alexander and Taketomi, Takafumi and Sandor, Christian and Kato, Hirokazu	A Preliminary Study on the Effects of Virtual and Augmented Reality on the Psychological Response of Users When Hurting Avatars Depicting Friends and Strangers	2018	IEICE technical report: Journal of Information Science and Technology
von der Pütten, Astrid M. and Klatt, Jennifer and Ten Broeke, Simon and McCall, Roderick and Krämer, Nicole C. and Wetzel, Richard and Blum, Lisa and Oppermann, Leif and Klatt, Johannes	Subjective and Behavioral Presence Measurement and Interactivity in the Collaborative Augmented Reality Game Timewarp	2012	Interacting with Computers
Vongurai, Rawin	Factors Influencing Experiential Value Toward Using Cosmetic AR Try-on Feature in Thailand	2021	Journal of Distribution Science
Vrellis, Ioannis and Delimitros, Michael and Chalki, Panagiota and Gaintatzis, Pavlos and Bellou, Ioanna and Mikropoulos, Tassos A.	Seeing the Unseen: User Experience and Technology Acceptance in Augmented Reality Science Literacy	2020	2020 IEEE 20th International Conference on Advanced Learning Technologies (ICALT)
Wagner, Ina and Broll, Wolfgang and Jacucci, Giulio and Kuutii, Kari and McCall, Rod and Morrison, Ann and Schmalstieg, Dieter and Terrin, Jean-Jacques	On the Role of Presence in Mixed Reality	2009	Presence: Teleoperators and Virtual Environments
Waldow, Kristoffer and Fuhrmann, Arnulph and Grünvogel, Stefan M.	Investigating the Effect of Embodied Visualization in Remote Collaborative Augmented Reality	2019	Virtual Reality and Augmented Reality
Wan-Hsiu Sunny Tsai, Shiyun Chloe Tian, Ching-Hua Chuan and Cong Li	Inspection or Play? A Study of How Augmented Reality Technology Can Be Utilized in Advertising	2020	Journal of Interactive Advertising
Wang, Bingcheng and Rau, Pei-Luen Patrick	Influence of Embodiment and Substrate of Social Robots on Users' Decision-making and Attitude	2019	International Journal of Social Robotics
Wang, Isaac and Smith, Jesse and Ruiz, Jaime	Exploring Virtual Agents for Augmented Reality	2019	Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems

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Wang, Peng and Bai, Xiaoliang and Billinghurst, Mark and Zhang, Shusheng and He, Weiping and Han, Dechuan and Wang, Yue and Min, Haitao and Lan, Weiqi and Han, Shu	Using a Head Pointer or Eye Gaze: the Effect of Gaze on Spatial AR Remote Collaboration for Physical Tasks	2020	Interacting with Computers
Wang, Peng and Bai, Xiaoliang and Billinghurst, Mark and Zhang, Shusheng and Wei, Sili and Xu, Guangyao and He, Weiping and Zhang, Xiangyu and Zhang, Jie	3DGAM: Using 3D Gesture and Cad Models for Training on Mixed Reality Remote Collaboration	2021	Multimedia Tools and Applications
Wang, Peng and Zhang, Shusheng and Bai, Xiaoliang and Billinghurst, Mark and He, Weiping and Sun, Mengmeng and Chen, Yongxing and Lv, Hao and Ji, Hongyu	2.5DHANDS: a Gesture-based MR Remote Collaborative Platform	2019	The International Journal of Advanced Manufacturing Technology
Wang, Peng and Zhang, Shusheng and Bai, Xiaoliang and Billinghurst, Mark and He, Weiping and Wang, Shuxia and Zhang, Xiaokun and Du, Jiaxiang and Chen, Yongxing	Head Pointer or Eye Gaze: Which Helps More in MR Remote Collaboration?	2019	2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)
Wang, Peng and Zhang, Shusheng and Bai, Xiaoliang and Billinghurst, Mark and He, Weiping and Zhang, Li and Du, Jiaxiang and Wang, Shuxia	Do You Know What I Mean? An MR-based Collaborative Platform	2018	2018 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)
Wang, Peng and Zhang, Shusheng and Bai, Xiaoliang and Billinghurst, Mark and Zhang, Li and Wang, Shuxia and Han, Dechuan and Lv, Hao and Yan, Yuxiang	A Gesture- and Head-based Multimodal Interaction Platform for MR Remote Collaboration	2019	The International Journal of Advanced Manufacturing Technology
Wang, Rui and Wang, Xiangyu	Experimental Investigation of Co-presence Factors in a Mixed Reality-mediated Collaborative Design System	2009	Cooperative Design, Visualization, and Engineering
Wang, Xiangyu	Implementation and Experimentation of a Mixed Reality Collaborative Design Space	2008	Computer Supported Cooperative Work in Design IV
Wang, Xiangyu and Dunston, Phillip S.	Tangible Mixed Reality for Remote Design Review: a Study Understanding User Perception and Acceptance	2013	Visualization in Engineering
Wang, Xiangyu and Kim, Mi Jeong	Exploring Presence and Performance in Mixed Reality-based Design Space	2009	Mixed Reality In Architecture, Design And Construction
Wang, Yining and Ko, Eunju and Wang, Huanzhang	Augmented Reality (AR) App Use in the Beauty Product Industry and Consumer Purchase Intention	2022	Asia Pacific Journal of Marketing and Logistics
Wang, Zenglei and Zhang, Shusheng and Bai, Xiaoliang	A Mixed Reality Platform for Assembly Assistance Based on Gaze Interaction in Industry	2021	The International Journal of Advanced Manufacturing Technology
Weir, Peter and Sandor, Christian and Swoboda, Matt and Nguyen, Thanh and Eck, Ulrich and Reitmayr, Gerhard and Day, Arindam	Burnar: Involuntary Heat Sensations in Augmented Reality	2013	2013 IEEE Virtual Reality (VR)
Wolf, Erik and Döllinger, Nina and Mal, David and Wienrich, Carolin and Botsch, Mario and Latoschik, Marc Erich	Body Weight Perception of Females Using Photorealistic Avatars in Virtual and Augmented Reality	2020	2020 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)

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Wrzesien, Maja and Alcañiz, Mariano and Botella, Cristina and Burkhardt, Jean-Marie and Bretón-López, Juana and Ortega, Mario and Brotons, Daniel Beneito	The Therapeutic Lamp: Treating Small-animal Phobias	2013	IEEE Computer Graphics and Applications
Xiangyu Wang and Phillip S. Dunston	User Perspectives on Mixed Reality Tabletop Visualization for Face-to-face Collaborative Design Review	2008	Automation in Construction
Xu, Yan	Exploring Social Play in a Shared Hybrid Space Enabled by Handheld Augmented Reality	2012	PhD Thesis
Xu, Yan and Gandy, Maribeth and Deen, Sami and Schrank, Brian and Spreen, Kim and Gorbsky, Michael and White, Timothy and Barba, Evan and Radu, Iulian and Bolter, Jay and MacIntyre, Blair	Bragfish: Exploring Physical and Social Interaction in Co-located Handheld Augmented Reality Games	2008	Proceedings of the 2008 International Conference on Advances in Computer Entertainment Technology
Yang, Jing and Sasikumar, Prasanth and Bai, Huidong and Barde, Amit and Sörös, Gábor and Billinghurst, Mark	The Effects of Spatial Auditory and Visual Cues on Mixed Reality Remote Collaboration	2020	Journal on Multimodal User Interfaces
Yeo, Dohyeon and Kim, Gwangbin and Kim, Seungjun	Toward Immersive Self-driving Simulations: Reports From a User Study Across Six Platforms	2020	Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems
Yeo, Dohyeon and Kim, Gwangbin and Kim, SeungJun	MAXIM: Mixed-reality Automotive Driving XIMulation	2019	2019 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)
Yiannis Georgiou and Eleni A. Kyza	The Development and Validation of the Ari Questionnaire: an Instrument for Measuring Immersion in Location-based Augmented Reality Settings	2017	International Journal of Human-Computer Studies
Yiannis Georgiou and Eleni A. Kyza	Bridging Narrative and Locality in Mobile-based Augmented Reality Educational Activities: Effects of Semantic Coupling on Students' Immersion and Learning Gains	2021	International Journal of Human-Computer Studies
Yilmaz, Rabia M. and Kucuk, Sevda and Goktas, Yuksel	Are Augmented Reality Picture Books Magic or Real for Preschool Children Aged Five to Six?	2017	British Journal of Educational Technology
Yoon, Boram and Kim, Hyung-il and Lee, Gun A. and Billinghurst, Mark and Woo, Woontack	The Effect of Avatar Appearance on Social Presence in an Augmented Reality Remote Collaboration	2019	2019 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)
Yoon, Boram and Kim, Hyung-il and Oh, Seo Young and Woo, Woontack	Evaluating Remote Virtual Hands Models on Social Presence in Hand-based 3D Remote Collaboration	2020	2020 IEEE International Symposium on Mixed and Augmented Reality (ISMAR)
Yoshino, Kazuma and Kawakita, Hiroyuki and Handa, Takuya and Hisatomi, Kensuke	Viewing Style of Augmented Reality/virtual Reality Broadcast Contents While Sharing a Virtual Experience	2020	Proceedings of the 26th ACM Symposium on Virtual Reality Software and Technology
Young, Jacob and Langlotz, Tobias and Cook, Matthew and Mills, Steven and Regenbrecht, Holger	Immersive Telepresence and Remote Collaboration Using Mobile and Wearable Devices	2019	IEEE Transactions on Visualization and Computer Graphics
Yu-Hsuan Chen and Chang-Hwa Wang	Learner Presence, Perception, and Learning Achievements in Augmented–reality–mediated Learning Environments	2018	Interactive Learning Environments
Yu, Kevin and Gorbachev, Gleb and Eck, Ulrich and Pankratz, Frieder and Navab, Nassir and Roth, Daniel	Avatars for Teleconsultation: Effects of Avatar Embodiment Techniques on User Perception in 3D Asymmetric Telepresence	2021	IEEE Transactions on Visualization and Computer Graphics

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Yu, Kevin and Winkler, Alexander and Pankratz, Frieder and Lazarovici, Marc and Wilhelm, Dirk and Eck, Ulrich and Roth, Daniel and Navab, Nassir	Magnoramas: Magnifying Dioramas for Precise Annotations in Asymmetric 3D Teleconsultation	2021	2021 IEEE Virtual Reality and 3D User Interfaces (VR)
Zackoff, Matthew W. and Cruse, Bradley and Sahay, Rashmi D. and Fei, Lin and Saupe, Jennifer and Schwartz, Jerome and Klein, Melissa and Geis, Gary L. and Tegtmeyer, Ken	Development and Implementation of Augmented Reality Enhanced High-fidelity Simulation for Recognition of Patient Decompensation	2021	Simulation in Healthcare
Zhou, ZhiYing and Cheok, Adrian David and Qiu, Yan and Yang, Xubo	The Role of 3-d Sound in Human Reaction and Performance in Augmented Reality Environments	2007	IEEE Transactions on Systems, Man, and Cybernetics - Part A: Systems and Humans
Zhou, Zhiying and Cheok, Adrian David and Yang, Xubo and Qiu, Yan	An Experimental Study on the Role of Software Synthesized 3D Sound in Augmented Reality Environments	2004	Interacting with Computers
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