A Design Framework for Social Virtual Reality Experiences: Exploring Social and Cultural Dimensions for Meaningful and Impactful VR

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Abstract. Virtual Reality has often been described as providing a means to "walk a mile in another's shoes" offering powerful interventions for experiential learning. Such experiences can, for example, provide a safe and controlled means of engaging with often difficult, unsafe or emotionally charged situations. Crucial to this experience is the sense of presence, informed by place and plausibility, of the simulation design. However, past studies often create such experiences through the lens of the developer, and they may therefore lack the authenticity and social nuance of the situations they are attempting to model. Health care students, for example, will often face difficult conversations with seriously ill patients during their placement time when in study. Currently, there is an under-preparedness associated with placement shock when students' previous assumptions and the reality of patient care do not match. VR would seem well suited to preparing students for this reality but only if the simulations capture the complexity and social nuance. As currently there is little consideration of the social and cultural dimensions for developing social VR experiences, this paper proposes a framework for designing such socially oriented VR applications. We case study the framework by designing a social VR application for health care students to prepare for placement.
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1 Introduction

Virtual Reality (VR) provides a powerful medium within which to create complex learning environments and contexts. VR can result in the illusion of presence, where a participant believes they are in a virtual place and the events occurring are really happening to their virtual self (Slater, 2017). Through body ownership, where the participant takes cognitive control of their virtual body (Slater *et al.*, 2009), implicit learning in VR can lead to changes in perception, attitudes, cognition, and behaviour. Throughout the design process, developers will seek to explore how they can maximise the feeling of presence an application provides with the goal that a strong sense of presence will lead to a believable and potentially impactful experience.

Central to achieving presence are the related concepts of place, which describes the environment or setting, and the sense of plausibility, which describes the believability

of the actions that take place in the virtual world (Slater, 2007). What is unclear, from a development perspective, is how to maximise the quality of these factors when seeking to create social VR applications; particularly, where the applications model real world experiences for others to share in. Such experiences are likely to be complex and nuanced, the subtleties of which a developer alone may not be able to capture.

Health care education provides a case study for the challenging task described. Effective conversational interactions are key for providing patients with compassionate, respectful care safely (Pollard *et al.*, 2019), yet it is a challenging area for healthcare student's learning and development. In England, the 'Reducing Pre-registration Attribution and Improving Retention' (RePAIR) report highlighted a major contributing factor to first-year healthcare students (adult, child, learning disabilities and mental health nursing, midwifery and therapeutic radiography) discontinuing their course is a perceived lack of preparedness to deal with seriously ill patients (Health Education England, 2018). As part of a higher education healthcare programme, students complete clinical practice placements where they are faced with seriously ill patients (*e.g.* cancer patients), for many, often for the first time. This under-preparedness is associated with "placement-shock" (Society and College of Radiographers, 2013) as they deal with emotional patient interactions that may not match students' previous assumptions regarding their placement (Leducq, 2019). A challenge for educators and students is that these encounters are situational, dynamic, and difficult to prepare for without first-hand experience from which to reflect and learn from.

This would therefore appear to be an ideal area of application for VR to provide pre-exposure and reduce placement shock. However, capturing the dynamic, nuanced and social complex situations they may find themselves in is a challenge. This paper seeks to extend the concepts of presence, place and plausibility and present a design methodology that captures the social nuance of lived experiences through a user-centred design approach. Using radiotherapy education as a case study, we outline the design of a VR application the intends to prepare students for some of the encounters they may face in their placement. The remainder of the paper is structured as follows: a literature review of related applications, a presentation of the theoretical framework to be utilized, an outline of the methodology and data collection activities, findings from user interviews and a proposed VR application design. It is intended that this paper provide initial steps towards a methodology for capturing social nuance in VR development.

2 Review of relevant literature

2.1 User-centred design to generate meaningful social VR content for professional learning

There is past work demonstrating VR has a history in experiential learning (see Bailenson, 2018). As suggested by Gillies and Pan (2018), the experiential learning environment provided by a VR application can assist learning and teaching of social skills and decision making in situ that cannon be gaining from books, taught sessions or two-dimensional multimedia (*e.g.* video). The potential power of using VR in experiential

learning of complex social activities in professional education such as medi-cal/healthcare education has been widely acknowledge by scholars and practitioners (see Bracq *et al.*, 2019 for summary) and in recent years, studies have tested the VR environment, interaction and the hardware to optimise its effectiveness (*e.g.* O'Connor *et al.*, 2021).

In the context of health and medical care education, VR has been widely used for skills-based training and learning (see Slater and Sanchez-Vives, 2016 for summaries). Studies (*e.g.* Samosorn *et al.*, 2020; Rajeswaran *et al.*, 2018; Gunn *et al.*, 2018) have highlighted the effectiveness of using VR in health care skills learning and training where trainees could undertake complex procedures in a safe place. As highlighted by Samosorn *et al* (2020), the main strengths of a well-designed VR for training healthcare professionals include allowing for computational offloading thus trainees can concen-trate on learning material rather than imagining details of the scenario and allowing skills and content to be repeated through deliberate practice. A number of VR applica-tions focus on developing social skills: Mpathic VR, for example, is an application aims to teach 'effective, empathic communication skills' to medical students that uses virtual human patients for difficult conversations. Many of these applications on using VR for effective communication in healthcare/medical care education focus on teaching – what skills/attributes should be taught and how they should be taught to learners. These ap-plications use previous research and/or professional knowledge by practitioners on what effective communication should be like and how it could be development in healthcare students. In the limited publications which share how the content is designed and developed, patient-centred perspective tends to be the lens through which the con-tent is generated (*e.g.* Hannans, 2019). The healthcare students' perspective and their experiences of difficult conversations they had are often not considered when designing the content of these new learning tools.

Capturing such perspectives and generalising them in a VR application to be relevant experiential learning experiences for new audiences is a challenge. Such lived experi-ences are often nuanced and situated based on the social and cultural contexts of persons involved. As such, understanding of this nuance and situated-ness is required during content creation and application development, something which developers are likely to lack without the input from users. User-centred design of such VR applications pro-vides a meaningful and relevant solution whereby unique insights can be obtained from users directly by placing them at the core of the design process (Chayutsahakil and Poggenpohl, 2002). Specifically, including users in the process of co-creation by cap-turing their narratives and iteratively developing with them through consultation not only ensures the authenticity of the final designs but also empowers users by giving them the opportunity to influence interventions (Dietrich *et al.*, 2021).

2.2 Theoretical framework

Like all VR applications, immersion, presence and interactivity are the core character-istics (Radianti *et al.*, 2019) for social interaction VR. The impact of an experience on an individual can be considered from two perspectives: the level of immersion offered by the VR platform and the feeling of presence within the generated 3D worlds. Slater

(2009) suggests that presence is a cognitive perception based on the place and plausibility of simulations. However, work is needed to show how these concepts be utilised when creating complex and nuanced social simulations so that they accurately and authentically represent the subject matter. As pointed out by Riva and Mantovani (2000), experiences in VR is subjective to the individual. They (2000) argued that VR could be seen as an advanced communication tool in which the social and cultural dimensions of user's experiences are as important as the quality of sensory experiences such as visual and sound in the VR. Viewing VR from this perspective opens up inquiries over the importance of considering social and cultural factors in the design, development and evaluation of VR scenarios that involve or are for social interactions. This is central to the methodological design and development of this study.

In this study, works from microsociology on social interactions (Hochschild, 1979; Blumer, 1969; Berger and Luckmann, 1966; Goffman, 1959) are used to create a framework for identifying detailed social and cultural components of social interactions. These works are underpinned by the philosophical view that social interactions are socially and culturally constructed and subjective to the individual. Moreover, social interactions such as conversations are situated which means the social and cultural circumstances of the interaction are key to such experience (Haugh, 2012). During a social interaction, the *social environment*, the *social and cultural context*, *communication* and the *social and cultural situation* are fundamental to the actions, reactions and feelings of participants of this social interaction. In the proposed framework for social VR, the virtual social interactions are intended to capture the authenticity of real-world social interactions. There is an expectation that if these interactions are meaningful to their participants, they would have powerful immediate and possible long-term impact on these participants.

Table 1. social and cultural dimensions of the design framework for social VR

Dimension	Description
Social Environment	Where the interaction takes place and who are there
Social and Cultural Context	The relationship between persons involved and the wider social and cultural context of such relationship
Communication	Verbal and non verbal languages, facial expressions and tones of verbal communication
Social and Cultural Situation	The identities of the persons involved and how they are perceived by each other

3   Methodology and methods

A user-centred design approach necessitates the identification and involvement of user representatives throughout the design and development process deployed by this project. This section describes the methodology and methods the project used to ascertain placement experiences and learning from therapeutic radiography students which were then turned into the scenarios in the VR application.

An interpretive phenomenological approach (IPA) (Larkin *et al.*, 2009) to capture students' lived experiences and emotions when encountering challenging conversations with patients is utilised. IPA is used as it is the methodology for understanding lived experiences and exploring how individuals make sense of their personal experiences in the social world. The foundation of IPA is the phenomenological philosophical understanding of human experiences in the way in which things are perceived as they appear to consciousness (Langdridge, 2007). In this study, student therapeutic radiographers' memories and reflections of their encountered challenging conversations with patients form the basis for the content of the VR application. The underpinning philosophy of IPA regarding the subjectivity of human making sense of lived experiences aligns with Riva and Mantovani's argument about the subjectivity of VR experiences (2000) and the pedagogical view of reflective learning that learning experiences is subjective to individual learners.

To ensure the content can engage users in meaningful experiences, the use of IPA allows the researchers to gather and analyse data to understand the meanings individual students attach to their experience. Participants are encouraged to tell their own story in their own words which means the data collection and analysis provide an outline of themes for creating the VR content that is not too rigidly scheduled and structured. By focusing on interviewees telling their own experiences, the data collection and analysis design allows the project team to capture the authentic situated accounts and nuanced details (Larkin *et al.*, 2009) of the challenging conversations interviewees had with patients.

These interpretive phenomenological interviews focused on students recalling and reflecting on challenging conversations they had with patients during their first year clinical placement. The interview schedule is underpinned by Gibbs' reflective model (1988) in order to capture what students experienced, how they felt about their experiences and what they learnt from it. Students were given the interview questions prior to the interview in preparation for recalling the experiences. The interview questions involved:

- **Descriptive recall** of these challenging encounters – a detailed sketch of the event, the environment where it took place, the people involved and the interactions (verbal and non-verbal) took place – to capture the environment (social and physical) and the social and cultural situation of the scenarios;
- Reflection by student on how they **felt** at the time during the interaction and immediately afterwards to capture the perceived social and cultural context; and
- Reflection on what the student **learnt** from these experiences about themselves as a student healthcare professional and how these experiences connect with their learning and development in clinical settings and at university.

Telling the experiences through their own words, these students offered authentic understandings of '*What conversations do students find challenging? And Why?*' '*Where and when did the conversation take place?*' '*Who was at the scene and what was their involvement?*' '*How did they feel during and after these encounters with patients?*' '*How did they go about managing and negotiating during these conversa-*

tions?' and *'How did they manage their emotions during and after these conversations?'* which are essential to the creation and development a VR experiential learning tool that is meaningful for medical/healthcare learners in similar context.

For the interviews to ascertain student placement experiences and learning, a total of six participants were recruited through convenience sampling. Recruitment emails were sent to all second-year students from course leaders inviting their participation. All six participants were female and from a range of age, race and nationality groups with some being mature students who had previous professional experience (not in healthcare) prior to their course and some young students who came straight to higher education from school/college. The range of social and cultural backgrounds represented by interview participants is essential in collecting scenarios that are relevant and meaningful to the target user group in similar social and cultural contexts. One limitation of this study is the lack of male student participation in the interview.

Interviews were recorded and transcribed verbatim. Data analysis followed the approach designed by Larkin *et al.* (2009). Two researchers first read transcripts independently and took notes on the initial themes which include characteristics of difficult/challenging conversations, the environment where the conversation took place (physical and social), the social and cultural context and situation of the conversation. Coding of social and cultural aspects (Table 1) of the interactions was produced in the notes. Notes from each researcher then collected and formed a table of themes and findings. This was refined by one of the researchers to create a final table of themes and findings.

Findings from these themes formed the scenario vignettes representing the range of experiences encountered by participants. Scenario vignettes were presented back to participants to confirm they broadly represented a key experience. From the interview data, scripts were also developed that would form the potential character interactions. Scripts were drawn in collaboration with the participants for to ensure representation of their experience.

The work was fully ethically approved by the university's research ethics committee and it followed the research ethics guidelines provided by the British Education Research Associated (BERA, 2018). Three particular potential research ethical issues regarding participant anonymity, participant in distress and reporting poor practice or risk of harm were dealt with caution. As the interview aimed to find out as much detail as possible about these specific incidents, there was a potential of revealing the identities of those individuals involved and the clinical practice. In order to protect their anonymity, the scenarios created are not based on any one particular student's experience but an amalgamation of different incidents. The validity of the content is underpinned by the shared characteristics from the thematic analysis of each incident. The amalgamated scenarios were presented back to interview participants to confirm they broadly represented their experience. As participants were asked to reflect on difficult situations they encountered, the protocol allowed them to stop at any time and further support service provided if required. The interview was not aimed at discovering poor practice or risk of harm/s that took place during student placements. Participants were asked to not disclose any issues that might be considered as poor practice or risk of harm/s as the

interview is not the appropriate forum. Should participant start to disclose such information, the researcher would stop the recording and ask the participant to stop and advise the participant to report the issue to an appropriate authority. Because therapeutic radiography is governed by a set of professional standards, the researcher made it clear to participants that if there were possible disclosure of poor practice or risk of harm, the research team would inform the programme leader of the course participating students belonged to.

4 Interview findings

Between six participants, thirteen scenarios of difficult conversations with patients were reported. Analysis of the thirteen reported scenarios enabled the research team to generate a number of potential scenarios for the VR application.

Findings from the interviews identified five broad characteristics of difficult conversations (Image 1). In all these situations, at least two of these characteristics were involved, *e.g.* being in an unexpected and overwhelming situation as such a patient having a cardiac rest. In addition, a number of these examples also involved situations where students were performing technical/medical tasks while carrying out social interactions. Findings from these interviews clearly indicate these students experienced complex situations that required quick professional decision making and communication with patients under pressure.
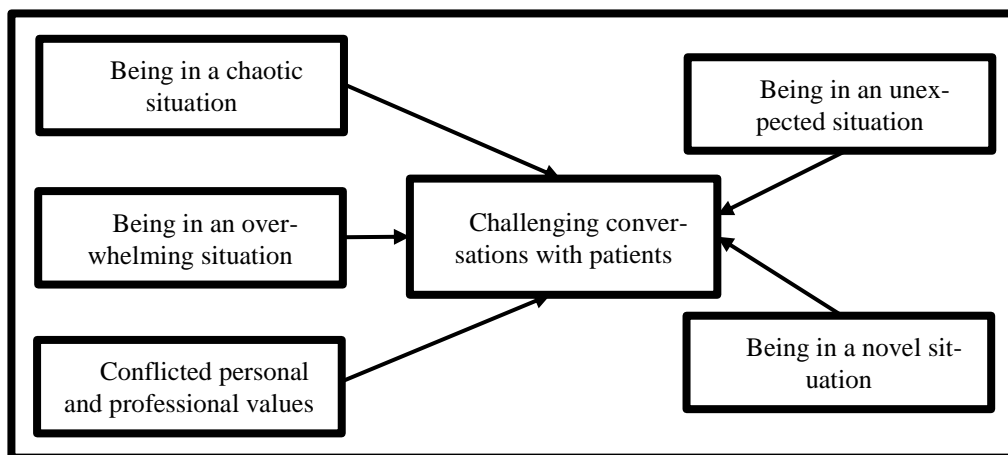
Image 1. Key characteristics of challenging conversations with patients based on student experiences

Analysis using the framework on the social environment, the social and cultural context, communication and the social and cultural situation (Table 1) across the thirteen scenarios revealed a number of key findings that are essential to students' perceptions of their interactions with patients.

The presence of persons involved is an important aspect of the social environment. In this study, students reported that who else were present and their involvement matter significantly to how they acted and perceived the situation. When there were others present, such as another staff member or the patient's family, all students felt they had to consider how the others might judge their actions. While some students preferred having a senior colleague with them to ask for guidance, reassurance and/or support, some students felt that having the opportunity to deal with challenging conversations by themselves helped them grow and establish their professional identity.

The perceived relationships and professional identities between persons involved play a part in students' feelings towards the interaction as one participant revealed 'you know you can have a laugh with some senior colleagues about an embarrassing situation but it's not being professional to some other colleagues'. However, the relationships between persons involved impact on the interactions as a longitudinal quality. A characteristic of therapeutic radiographer's work is working with patients during the course of their treatment thus having the opportunity and time to know them and their families. Such kind of relationship development led some students to grow a deep empath with their patients which meant having conversations about their treatment became challenging. This is a challenging area for short, episodic VR scenarios to convey. As such, this project did not incorporate this finding into its design. Nevertheless, it is an important social and cultural aspect for social VR applications to be mindful of.

The identities of persons involved (such as their age and gender) matter to how participant perceives the situation and how they act during the interaction. In this study, students' empathy led them to make personal connections with people in the personal lives with similar age and gender. For example, one student reported a challenging conversation with a female patient who reminded her of her sister due to their age similarity; several students also reported that older patients made them thinking about their own grandparents. Some students reported encounters with male patients that were either awkward or made them feeling slightly intimidated due to the voice or the physical size and presence of a male.

Age and maturity of the students were important factors to their perceptions of these challenging conversations they had. This is where the situated-ness and subjectivity of social interactions matter to consider participants' experiences. Students who were more mature with previous experiences of working in other professions reported challenging conversations that shared similar characteristics as their younger peers. The nature of a therapeutic radiographer's work with cancer patients meant conversing with empathy and compassion for students is an emotional experience. Sometimes, the situation requires the student to act counterintuitively to how they would acted in other social situations. Nevertheless, mature students revealed more effective recovery strategies after a challenging encounter with a patient where younger students required more support from their peers or more experienced colleagues. This is a key area for student to have experiential learning using the VR application to carry out reflections and professional discussions safely with their peers and/or tutors.

The other environmental factor that played an important part in student's perception of the situation is the physical materials they were working with while conversing with the patients. As these were student's initial placement experiences, familiarising and

operating the equipment, technologies and/or materials for technical tasks were high on their training priority. Even a task like reading the patient's report, which experienced therapeutic radiographer can skillfully perform routinely, added complexity to the situation. In some cases, students were anxious about having to do this while talking to the patient when often the conversation is emotionally charged. While the physical environment and materials can be seen as outside the scope of social and cultural factors, clearly it is an integral part of radiographer's work and should be considered with the other factors. Therefore, having an interactive technical task for the participant to do during the VR experience is also incorporated in our design.

5   Scenario design and development

Based on the time scale, resource and skillset of the project team, after consultation with the therapeutic radiography programme team, this pilot project decided to develop three scenarios for the VR application: an introduction scenario that introduce participant to the VR environment, interaction and equipment, a scenario with an upsetting patient and a scenario with an angry patient. Each scenario combined at least two of five difficult conversation characteristics illustrated in Image 1 and incorporated the social, cultural and physical factors identified from interview data. Vignettes were developed to detail the setting, personals involved, the interaction (including scripts of verbal and non-verbal communication) and how each scenario starts, develops and ends. This was the starting point of how the amalgamation of different incidents from interviews was created. Table 2 is the vignette of scenario two - the angry patient which is presented here as an illustrative example.

5.1   Scenario 1: Introduction and Training

The student (*i.e.* the user) is placed in a consultancy room with a senior radiographer and asked to read the patients treatment sheet (Image 2). This scenario is for student to:
- test the hardware and settings of the VR
- familiarise themselves with wearing the VR headset and using the controllers
- experience the virtual environment
- carry out virtual interaction with a senior radiographer
- perform a technical skill of reading patient's treatment sheet

Image 2. Introduction and training

This scenario is for student and researcher to ensure the student does not experience any discomfort during the simulation. The student can interact with a clipboard containing the patient information. This has been modelled on real treatment sheets so students can familiarise themselves with it. This had the aim of grounding them quickly into the simulation.

5.2   Scenario 2: Upset Patient

Scenario 2 covers an upset patient vignette. Here, the user is placed in the same consultancy room as in the training scenario. This scenario involves the student radiographer (*i.e.* the user), an approximately 60 year old female patient with breast cancer and a senior radiographer. The decision on the profile of the patient was made based on students found talking to patients who remind them about their own elderly relatives while remaining professional can be really challenging. This is an important social situation from interview findings.

The treatment sheet reveals to the student the cancer has metastasised to the patient's bones and it was a hip that was being treated. The patient had her CT scan and this was the first appointment to discuss her scan and treatment. While the senior radiographer was talking about the scan result, the patient suddenly looked at the student anxiously and start asking '*Will I be cured?*' '*How long will it take for me to die?*' then starting to cry. As mentioned earlier, these statements were designed during scripting using the interview data and they are generic enough to be repeatable.

The virtual agent will focus on the user during this portion of the scenario, with their head amination tracking the users HMD position. Similarly, during the emotive exchange, the senior member of staff will also look at the user. This was a design decision based on interview findings as the participants highlighted that the scrutiny of senior members of staff was often just as disconcerting as the pressure of the situation they found themselves in. Furthermore, this is an example of a social dimension informed by the framework; specifically, the social environment and social situation where the individuals involved, and their role impact the emotion of an encounter.

Image 3. Upset patient

5.3   Scenario 3: Angry Patient

The final scenario for the proof-of-concept prototype was based on an angry patient vignette (Table 2). The premise is a patient who has been waiting for his appointment for over 20 minutes with a full bladder (a requirement for the particular scan).

This scenario involves the student radiographer and two male patients (Mr. Allen and Mr. Bridge) with prostate cancer. The student is at the waiting area to collect one patient (Mr. Allen) for his appointment, while the other patient (Mr. Bridge) barged in front of the student and started asking '*When will I being seen?*' '*I have been here for ages, before this gentlemen, how is it not my turn?*' Suddenly, Mr Bridge starts to swear loudly and moving close to the student. This scenario design used interview data of some students finding dealing with male patients can be challenging in particular when they raise their voices. The design of the character's look and body language is intended to make students feel unconformable or even a little intimidated. Unlike the first two scenarios, there is no senior staff present but another patient. Again, it addresses the findings of the social environment, the communication and the social and cultural context of these challenging conversations.

Image 4. Angry patient

These three scenarios provided the initial proof-of-concept prototype for a VR application that has been co-designed with key stakeholders. This was necessary in order to ensure the authenticity of the scenarios such that the experiences they are based on can be provided to new students in a safe and controlled environment. However, prior to testing with new students to assess if these experiences have the desired impact, it was necessary to close the co-creation loop and ascertain if these simulations are close approximations of the vignettes defined by participants.

Table 2. Scenario two, the angry patient, vignette

Scenario and setting	Script	Notes for developer
A patient in pain and anger at the waiting area: This scenario involves the student radiographer and two over male patients (Mr. Allen and Mr. Bridge) with prostate cancer. The student is at the waiting area to collect one patient (Mr. Allen) for his appointment, while the other patient (Mr. Bridge) barged in front of the student and started asking 'When will I being seen?' 'I have been here for ages, before this gentleman, how is it not my turn?' It transpires the patient have been waiting with a full bladder as required for his treatment for over 20 minutes as the previous treatments were over run. **Note, this is not a reception but a waiting area specifically for these patients – more privacy than a reception area that would be found in a hospital.** **Student position and body:** Participant will be standing as will the patients. No	In waiting area, two males sitting across the area, the one sitting nearer to the consultation room across the corridor is Mr Bridge, and the one sitting across at the far end of the waiting area is Mr Allen (who the student radiographer is coming to collect). Mr Bridge is the "Angry Patient" who will ultimately cause a scene. Student radiographer standing close by Mr Bridge, holding Mr Allen's report, the student calls for the patient. <mark>Student radiographer "…"</mark> Mr Allen standing up, walking towards the student radiographer. Mr Bridge suddenly standing up, very close to the student, (Tall – 6 foot +, big built), looking contempt "I've been here for ages!" <mark>Student radiographer "…"</mark>	As per scenario 1, these scripted elements are not concerned with high fidelity implementations on the interactions but serve to set the scene. The student will need to call for Mr Alan in this first part which starts the simulation. A UI widget should make this clear to the participant as per training scenario. When the response has been made, **the simulation progresses through a button press triggered by the director.**

full body avatar is necessary for the participant character, but should have visible hands.	Mr Bridge: "I can't wait! I am bursting" <mark>Student radiographer "…"</mark> Mr Allen standing next to the two, watches the proceedings, waiting patiently but focussed on the drama. Mr Bridge: "Are you not hearing me! I was here first." He snaps… "It's MY turn NOW!" "I am bursting" "I can't bloody wait!" <mark>Student radiographer "…"</mark> Mr Bridge: "For fucks sake". Then he storms off.	The goal here is to set-up what ultimately will be an intimidating simulation. A UI widget should make this clear to the participant as per training scenario. When the response has been made, **the simulation progresses through a button press triggered by the director.**

6 Initial user feedback

After the VR application was developed, the six students and a member of staff from the programme were invited back to review it. Two students and the staff were able to take part in this review evaluation. Participants received the narrated video captions of the VR scenarios a week before the interview. The narration explained the differences between the video captions and the VR experience, walked the participants through the VR application, and highlighted key features to participants. The participants were asked to note down their thoughts on their initial impression about the VR scenarios and application and to what extent do they feel they represent the students' real world experiences. The group interview used these questions as prompts to co-evaluate the application and its potential pedagogical use. It took place on Microsoft Teams and it was recorded and transcribed for analysis.

The two students and one staff member though the scenarios are very realistic. They captured the environment well. Details such as the filled in treatment sheet which users can interact with provided users with the sense of realism, as well as a purpose for student to experience what they do on a radiotherapy ward.

Users also commented on the authenticity of the interactions which reflect real world experiences of student radiographers. The user can learn from the conversations taking place in the scenarios between the senior radiographer and the patients, modelled on real conversations, thus developing their professional knowledge and skills. Most importantly, the challenging conversational interactions between the patients and the user felt very emotionally charged and put the student radiographers on the spot to react quickly and professionally. The changing tones of their voices, their eye contact, their physical appearances and their language (verbal and non-verbal) all play an important part in making the interaction feel realistic. For instance, the users commented on how the angry patient's body language, his stare and the use of swear words brought the situation to life and made them feel they were challenged by this person.

The students commented on the appearances of the characters in the scenarios are similar to what they encountered during their placements. The upset patient in particular reminded students someone they saw or cared for during placements. Students also commented on the presence of others (the senior radiographer in scenario 1 and 2 and another patient in scenario 3) as an important factor of these experiences. They believed these characters would impact on how users react in these situations. Again, they felt the inclusion of these characters was authentic.

7 Conclusion

Based on user feedback, for future development of VR applications for and with social interactions, the nuanced details of the social and physical environment, the characters (their age, gender, ethnicity and appearances), their expressions, languages (verbal and non-verbal) and their movements are key to ensure the realism of the scenarios. While creators and developers of the application can pay close attention to such details during

the design and development process, this project shows working closely with users to capture the details from their experiences and including their input into the design of these details is essential to ensure the authentic nuances are faithfully captured and included in the application.

Ultimately, in order for a socially oriented VR scenario to be believable to participants, there is a need to extend the concepts of place, plausibility and presence based on the social and cultural considerations outlined in this paper. What this study demonstrated is that social environment (where the interaction takes place and who are there) and social and cultural situation (the identities of the persons involved) are part of the concept of place. Communication and social and cultural context (the relationship between persons involved) are the essence of a conversational interaction that must be considered to create a plausible scenario. These social and cultural considerations should be rooted in the authentic experiences of those informing the design process in order for future participants to effectively "walk a mile" in another's shoes.

The next step for this project is to run the VR application with first year students to see whether it provides them with believable experiences which can influence their views and behaviours of patient care. After this initial pilot case study with the healthcare programme, future studies ought to test and refine the social and cultural dimensions outlined in this paper to see their impact on the sense of presence in VR. Furthermore, the relationship of these factors to other key design considerations requires exploration through research. For example, how these factors work with other aspects such as graphical fidelity, animation quality, voice acting *etc.* to provide a meaningful and impact experience.

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