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Bridging the Gap: Technological Mediation and the Development of Humanistic Skills in Medical Simulation: Lessons from Covid-19 and the Impact of Immersive Media and Minimal Viable Simulation (MVS)

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Bridging the Gap: Technological Mediation and the Development of Humanistic Skills in Medical Simulation: Lessons from Covid-19 and the Impact of Immersive Media and Minimal Viable Simulation (MVS)

by

Nicholas Peres

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Author's Declaration

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Doctoral College Quality Sub-Committee.

Work submitted for this research degree at the University of Plymouth has not formed part of any other degree either at the University of Plymouth or at another establishment.

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Abstract

Bridging the Gap: Technological Mediation and the Development of Humanistic Skills in Medical Simulation:
Lessons from Covid-19 and the Impact of Immersive Media and Minimal Viable Simulation (MVS).

Nicholas Peres

This thesis provides a chronological account of the integration of innovation and technology within medical simulation and training from 2014 to 2023 at Torbay and South Devon NHS Foundation Trust (TSDFT). Responding to the backdrop of a constantly changing technological and clinical (epidemiological) landscape, it seeks to develop a methodology for assessing the role of technology in improving medical simulation and training. The research critically challenges the current trend towards high-fidelity simulations, driven by manufacturers' technology-centric marketing strategies that frequently impose cost constraints and limit perceived educational outcomes.

Motivated by the Francis Report's (2013) findings, this practice-based study explores the potential of immersive media, such as 360-degree video and virtual reality, to supplement medical simulation activities, with a particular emphasis on enhancing empathy and compassion in healthcare education. Central to this research was the development of two innovative practical outputs: PatientVR, an immersive patient perspective experience aimed at fostering empathy and understanding, and the concept of minimal viable simulation (MVS), which offers a more sustainable and humanistic approach to simulation-based education. The study draws upon diverse theoretical frameworks, including film theory, narrative medicine, and sociometrical perspectives, to interrogate the complex interplay between technology, education, and the human experience.

The research employs a multidisciplinary approach, combining practice-based research, ethnographic observation, discourse analysis, and a technological and materials-based approach

to the construct of simulations. The findings demonstrate the potential for immersive media and MVS to enhance empathy, compassion, and human connection in medical simulation. The study also highlights the importance of interdisciplinary collaboration and the value of bridging the divide between the arts, humanities, and healthcare in the context of simulation-based education. The thesis concludes that the current terminology used to describe 'soft' or 'non-technical' skills in healthcare education is insufficient and advocates for the incorporation of humanities-based concepts and language, terming these qualities as 'humanistic skills'. It does this through presenting novel approaches to recording simulations for reflective learning, emphasising the importance of film theory in the application of camera work, particularly through the innovative use of patient perspective films. This underscores the need for medical education to include film theory and visual interpretation skills in its curriculum.

The research's most significant contribution is the introduction of MVS, which represents a major step forward in medical simulation optimisation, emphasising the importance of aligning clinical and interpersonal experiences more closely with educational objectives rather than technological capabilities. By reframing the conversation around technology and humanism in medical simulation, this research invites educators, researchers, and practitioners to imagine new possibilities for fostering empathy, compassion, and human connection in the face of an ever-evolving technological landscape.

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Glossary of Terms and Definitions

This glossary provides an overview of the key terms and concepts used throughout the research, with a focus on the original contributions made in developing the Minimal Viable Simulation (MVS) approach and introducing the term "Humanistic Skills." The definitions are grounded in both the specific findings of this research and the wider academic literature, offering a reference tool for understanding the complex landscape of simulation-based learning and humanistic healthcare practice.

360-degree video: An immersive video format that captures a complete spherical view of a scene, allowing the viewer to control the viewing direction during playback. In the context of this research, 360-degree videos were used to create immersive patient perspective experiences for medical simulation training, enabling learners to explore and interact with the simulated environment, promoting a deeper understanding of the patient experience (Peres, 2015).

Cardboard VR: A low-cost, accessible virtual reality platform developed by Google that uses a simple cardboard viewer and a smartphone to provide an immersive experience. In this research, Cardboard VR was used to deliver patient perspective videos and 360-degree simulations, making immersive learning experiences more widely available and cost-effective for healthcare education.

Cinéma Vérité: A style of documentary filmmaking that emphasises capturing reality as it unfolds, with minimal intervention from the filmmaker. This approach influenced the patient perspective videos created in the research, aiming to provide an authentic, unfiltered representation of the patient experience, allowing learners to immerse themselves in the patient's journey and develop a deeper understanding of their perspective (Wiseman, 1967).

Compassion: "A feeling of deep sympathy and sorrow for another who is stricken by misfortune, accompanied by a strong desire to alleviate the suffering" (Goetz et al., 2010, p. 351). In healthcare, compassion involves not only understanding and empathising with a patient's suffering but also taking action to provide comfort, support, and appropriate care. Cultivating compassion is essential for building trust, improving patient outcomes, and fostering a humanistic approach to healthcare (Sinclair et al., 2016).

Debriefing: A crucial component of simulation-based learning, where participants engage in a facilitated discussion to reflect on their performance, receive feedback, and explore the implications of their actions. Effective debriefing promotes the development of both technical and non-technical skills, encourages self-awareness, and facilitates the transfer of learning to real-world clinical practice. Debriefing sessions often involve analysing video recordings of the simulation, allowing participants to observe and critique their own performance and identify areas for improvement (Fanning & Gaba, 2007; Rudolph et al., 2007).

Direct Cinema: A documentary film movement that prioritises capturing events as they occur, without the use of staged scenes or interviews. This approach influenced the patient perspective videos in the research, aiming to provide an unfiltered, authentic view of the patient experience, enabling learners to witness the genuine emotions, challenges, and triumphs of patients as they navigate the healthcare system (Pennebaker & Leacock, 1960s).

Empathy: "The ability to understand and share the feelings of another" (Oxford English Dictionary, n.d.). In healthcare, empathy involves the capacity to recognise, understand, and respond to the emotional states and experiences of patients, their families, and colleagues.

Empathy is a vital component of effective communication, building trust, and providing compassionate, patient-centred care (Hojat et al., 2009; Riess, 2017).

Fidelity: The degree to which a simulation accurately represents the real-world scenario it is intended to replicate. In medical simulation, fidelity can refer to the technological sophistication of the equipment, the realism of the scenario itself, or the authenticity of the learners' cognitive, emotional, and behavioural responses. While high fidelity is often pursued in simulation design, it is important to consider the appropriate level of fidelity required to achieve the desired learning outcomes, balancing realism with feasibility, cost, and educational effectiveness (Hamstra et al., 2014; Issenberg et al., 2005).

Human Factors: The study of how human behaviour, capabilities, and limitations interact with the design of systems, tools, and environments. In healthcare, human factors consider issues such as teamwork, communication, decision-making, workload, and situational awareness, aiming to optimise performance, minimise errors, and improve patient safety. Integrating human factors principles into medical simulation design can enhance the realism and educational value of simulated scenarios, promoting the development of non-technical skills and fostering a culture of safety (Catchpole, 2013; Scanlon et al., 2017).

Humanistic Skills: A term proposed in this research to encompass the essential non-technical skills in healthcare, such as empathy, compassion, effective communication, and the understanding of the human experience. These skills are crucial for providing patient-centred care, building strong relationships with patients and colleagues, and promoting a holistic approach to healthcare. The term "humanistic skills" aims to elevate the importance of these competencies, recognising them as integral to professional practice rather than merely supplementary to technical expertise (Peres, 2024).

Immersive Media: Technologies that create a sense of presence or immersion for the user, such as virtual reality, augmented reality, and 360-degree video. In the context of this research, immersive media were used to create patient perspective experiences for medical simulation training, enabling learners to 'virtually' step into the shoes of patients and gain an understanding of their experiences, emotions, and challenges. Immersive media have the potential to enhance empathy, situational awareness, and decision-making skills in healthcare education (Kononowicz et al., 2019; Peres, 2015; Slater & Wilbur, 1997).

In-situ Simulation: Simulation training conducted in the actual clinical environment, rather than a dedicated simulation centre. In-situ simulations offer several advantages, including increased realism, the opportunity to identify latent safety threats, and the ability to engage multidisciplinary teams in their normal working environment. By bringing simulation to the point of care, in-situ training can enhance the relevance and transferability of learning, promote teamwork and communication, and foster a culture of continuous quality improvement (Rosen et al., 2012; Sørensen et al., 2017).

Interdisciplinary Collaboration: The process of healthcare professionals from different disciplines working together towards a common goal, leveraging their unique expertise and perspectives to improve patient care, research, and education. In the context of this research, interdisciplinary collaboration involves bringing together clinicians, educators, researchers, and experts from fields such as the arts, humanities, and technology to develop innovative approaches to medical simulation and enhance the development of humanistic skills. Effective interdisciplinary collaboration requires open communication, mutual respect, shared decision-making, and a commitment to continuous learning and improvement (Green & Johnson, 2015; Nancarrow et al., 2013).

Minimal Viable Simulation (MVS): An approach to simulation design that was developed and informed by the experiences within this research and driven by the simulation community's response to the challenges posed by the Covid-19 pandemic. MVS prioritises the essential components required to achieve the desired learning outcomes, rather than focusing on technological complexity or high fidelity. It aims to create effective, engaging, and accessible simulations while minimising costs and resource requirements. By identifying and integrating the core elements necessary for learning, MVS enables the development of targeted, efficient simulations that can be implemented and scaled, making simulation-based education more feasible and sustainable in resource-limited settings (Peres, 2024).

Narrative Medicine: An approach to medical practice that recognises the value of patient stories and experiences in understanding illness, providing care, and fostering empathy. Narrative medicine emphasises the importance of listening to, interpreting, and reflecting upon patient narratives, as well as the narratives of healthcare professionals themselves. By engaging with these stories, healthcare providers can gain insights into the personal, social, and cultural contexts that shape health and illness, leading to more personalised, compassionate, and effective care. Narrative medicine also promotes self-awareness, reflective practice, and resilience among healthcare professionals (Charon, 2001; Greenhalgh & Hurwitz, 1999).

Non-technical Skills: The cognitive, social, and personal resource skills that complement technical expertise in healthcare. Non-technical skills include situational awareness, decision-making, communication, teamwork, leadership, and stress management. These skills are essential for safe, effective, and efficient healthcare delivery, particularly in complex, dynamic, or high-stakes situations. Non-technical skills training is increasingly recognised as a critical component of medical education, with simulation-based learning playing a key role in their development and assessment (Flin et al., 2008; Gordon et al., 2012).

Patient Perspective: The unique viewpoint and lived experience of an individual receiving healthcare. Understanding the patient perspective is vital for providing patient-centred care, which prioritises the needs, values, and preferences of patients and their families. In this research, patient perspective videos were created to immerse healthcare professionals in the patient's journey, fostering empathy, compassion, and a deeper appreciation of the challenges and emotions patients face as they navigate the healthcare system. By engaging with the patient perspective, healthcare providers can develop more effective communication skills, build stronger therapeutic relationships, and deliver care that is tailored to the individual needs of each patient (Peres, 2015; Hojat et al., 2009).

Plastic Shell Syndrome: A term used in this research to describe the limitations of medical simulation manikins in conveying genuine facial expressions, emotional cues, and the subtleties of human interaction. The plastic shell syndrome refers to the artificial appearance and feel of manikins, which can hinder the development of empathy, compassion, and effective communication skills among trainees. This disconnect between the manikin and the learner can lead to a focus on technical skills at the expense of humanistic skills, potentially compromising the overall effectiveness of the simulation experience (Peres, 2024).

Presence: The subjective feeling of being physically and psychologically immersed in a virtual or simulated environment. Presence is a key factor in the effectiveness of immersive learning experiences, such as those created using virtual reality, augmented reality, or 360-degree video. A strong sense of presence can enhance learner engagement, motivation, and the transfer of learning to real-world settings. Factors that influence presence include the fidelity of the simulation, the level of interactivity, and the learner's individual characteristics and prior experiences (Diemer et al., 2015; Slater, 2009).

Psychological Safety: The belief that one can express oneself openly, take risks, and make mistakes without fear of negative consequences, such as embarrassment, rejection, or punishment. In the context of simulation-based learning, psychological safety is essential for creating a supportive learning environment that encourages active participation, experimentation, and reflective practice. When learners feel psychologically safe, they are more likely to engage fully in the simulation, ask questions, share ideas, and learn from their experiences. Facilitators play a crucial role in fostering psychological safety by establishing a non-judgmental, inclusive, and respectful learning climate (Edmondson, 1999; Rudolph et al., 2014).

Reflection: The process of critically analysing one's experiences, actions, and thought processes to gain insights, learn from successes and failures, and improve future performance. Reflection is a core component of experiential learning and professional development, enabling individuals to make sense of their experiences, identify areas for growth, and develop new perspectives and strategies. In simulation-based learning, reflection is often facilitated through structured debriefing sessions, where participants are encouraged to explore their thoughts, feelings, and decision-making processes in a supportive, collaborative environment (Kolb, 1984; Schön, 1983).

Simulation: An experiential learning technique that immerses learners in realistic, guided scenarios designed to evoke authentic cognitive, emotional, and behavioural responses. These immersive experiences are followed by structured debriefing sessions that facilitate reflection, feedback, and the integration of theoretical knowledge with practical skills, ultimately enhancing clinical competence, decision-making, and patient-centred care (Gaba, 2004; Peres, 2024).

Simulation-based Learning: An experiential learning approach that utilises simulated scenarios to provide learners with opportunities to practice skills, apply knowledge, and receive feedback in a safe, controlled environment. Simulation-based learning can take many forms, from low-fidelity task trainers to high-fidelity manikins, standardised patients, and virtual reality environments. By engaging in realistic, structured simulations, learners can develop technical and non-technical skills, enhance their clinical reasoning and decision-making abilities, and prepare for real-world clinical practice. Simulation-based learning is increasingly recognised as a valuable complement to traditional didactic and clinical education in healthcare (Issenberg et al., 2005; McGaghie et al., 2010).

Thresholds: In the context of this research, thresholds refer to the critical transitions and transformative learning experiences that occur within medical simulation and healthcare education. These thresholds can be physical, such as the transition from a classroom setting to an immersive simulation environment, or cognitive and emotional, such as the shift in perspective and understanding that occurs when learners engage with patient narratives or experience a simulation from a first-person viewpoint. Crossing these thresholds can lead to changes in knowledge, skills, and attitudes, ultimately enhancing clinical competence and patient-centred care (Meyer & Land, 2003; Peres, 2024).

Uncanny Valley: A concept that describes the unsettling or eerie feeling that people experience when encountering an artificial representation that closely resembles, but does not quite achieve, the appearance and behaviour of a real human. In the context of medical simulation, the uncanny valley can occur when high-fidelity manikins, virtual patients, or other simulated entities fall short of accurately replicating human appearance, movement, or expression. This discrepancy can lead to feelings of discomfort, distraction, or disengagement among learners, potentially undermining the effectiveness of the simulation. Strategies to mitigate the uncanny valley effect include focusing on functional fidelity rather than physical realism, enhancing the interactivity and responsiveness of simulated entities, and providing learners with adequate preparation and context (Mori et al., 2012;).

Visual Literacy: The ability to interpret, analyse, and create meaning from visual information, such as images, videos, and animations, specifically within the context of medical simulation. Visual literacy is important for both learners and educators to effectively engage with and learn from visual media, such as patient perspective videos, 360-degree simulations, and virtual reality environments. By developing visual literacy skills, individuals can better understand the humanistic aspects of patient care, recognise non-verbal cues and emotional expressions, and use visual communication to enhance empathy, compassion, and clinical decision-making. Incorporating visual literacy training into medical simulation curricula can help bridge the gap between theoretical knowledge and practical application, ultimately improving patient care and outcomes (Bristor & Drake, 1994; Peres, 2024)

Preface

This research started from a fundamental question that emerged during my time as a simulation technician within Torbay and South Devon NHS Foundation Trust: Is the increasing emphasis on technological veracity in high-fidelity simulation inadvertently obscuring the essential details that elicit compassionate and humanistic behaviour? Rooted in my background as a filmmaker, this question acted as the impetus for an eight-year in-depth investigation providing a rich timeframe to capture the changing nature of technology within simulation as well as a unique time during the Covid-19 epidemic where some of the ideas of the research practice were applied in an educational and training response. Regular access to simulation and clinical teams as a simulation technician, and later as head of simulation at TSDFT gave me a unique viewpoint on the rising tendency towards great degrees of authenticity using new technologies. Manikins were getting ever more advanced, with features that remarkably precisely reflected human physiology. But among this search for technological realism, I started to wonder whether the emphasis on exacting physical details was obscuring equally vital elements of empathy, compassion, and human connection. Over this eight-year path, I participated in a number of noteworthy events that helped to guide the direction of the research. Early on, I concentrated on making simulated patient story films, meant to humanise the manikin's contextual backstory and provide students a more realistic and emotionally interesting experience. As the study went on, I investigated how virtual reality and 360-degree video might capture the patient perspective more fully, which resulted in the creation of PatientVR, a creative practical output that put students in the patient's shoes. The start of the Covid-19 epidemic brought fresh potential and problems, which led to the creation of the idea of "minimal viable simulation" (MVS) in response to the demand for easily available, flexible, humanistic simulation-based teaching in environments limited in resources. Turning to the theoretical frameworks of film theory and certain fundamental ideas regarding representation and mediation in the humanities, I sought to probe the central problem of this research. Using concepts such as the "uncanny valley" (Mori, 1970) and the "imperfect cinema" (Espinosa, 1969), I sought to understand how the aesthetic and emotional qualities of simulation could impact learners' engagement and emotional response.

I also considered the principles of narrative medicine (Charon, 2001) and how storytelling may help to build empathy and understanding. Contextualist approaches to film theory, which stress the need of considering the social, cultural, and historical settings in which films are produced and received, further enhanced these theoretical roots (Stam, 2000). By means of cross-disciplinary translation and application of these points of view to the domain of medical simulation, I sought to acquire a more sophisticated knowledge of the intricate interaction of technology, education, and the human experience. It is important to note that while there has been brilliant and insightful work in medical simulation coming from the medical humanities, the application of humanities insights into representation and mediation, particularly in what is most pertinent to this research - film theory, seems to have been missing. Along with other contributions, this research aims to start to close this gap by bridging the divide between film theory and medical simulation, offering new perspectives on the role of aesthetic and emotional qualities in both the film material captured and shaping the learning experience.

Methodologically, this study embraced a multidisciplinary approach combining relevant elements of practice-based research, ethnographic observation, discourse analysis, and a technological and materials-based approach to the construct of simulations. It sat as it does between the sciences and the arts. As a practitioner-researcher, I actively engaged with the simulation community at TSDFT, co-creating solutions that addressed the identified challenges while remaining grounded in the realities of healthcare education. With each influencing and guiding the other throughout the study process, this comprehensive approach let for a vibrant conversation between theory and practice. Through ethnographic observation and a specific aspect of discourse analysis (active listening), I was able to examine the language, patterns, and interactions that emerged within simulation scenarios and the reactions captured within patient perspective films. In the framework of medical simulation, this qualitative material shed important light on the interactions among technology, narrative, and human variables. The materials-based approach to the construct of simulations allowed for a separation of technology from practice and performance, enabling a more nuanced analysis of the role of technology in shaping the learning experience. New research questions developed as the project progressed and my professional role changed from simulation technician to head of digital education and development and finally director of digital innovation, drawing on the initial inquiry and probing further into the complexity of combining technology and humanism in medical simulation. Examined in detail over the chapters of this thesis, these questions included:

How might virtual reality and 360-degree video among other immersive media tools be used to improve empathy and compassion in medical simulation?

How can the concept of "minimal viable simulation" (MVS), informed by the challenges during the Covid-19 pandemic, provide a sustainable approach to simulation practice going forward, where accessibility, equitability, realism, and authenticity need to be featured?

In what ways can the integration of arts and humanities perspectives enrich the design and delivery of medical simulation?

Each one of these questions reflects a different aspect of the main research goal, which aimed to redefine the interaction between technology and humanism in medical simulation. Through a critical analysis of the presumptions and methods behind modern simulation, this study aimed to create an alternate path that values technical innovation while simultaneously giving growth of empathy, compassion, and human connection priority. Central to this research was the development of two innovative practical outputs: PatientVR and the concept of "minimal viable simulation" (MVS). PatientVR, an immersive patient perspective experience, aimed to foster empathy and understanding by placing learners in the shoes of the patient. By leveraging the power of virtual reality and 360-degree video, PatientVR offered a unique approach to humanising healthcare education and training. The ethnographic and observational research approach to the use of VR and filmic material within the education and debriefing setting provided valuable insights into the impact of immersive media on learners' engagement and emotional response. The development of PatientVR involved close collaboration with healthcare professionals and educators at TSDFT, ensuring that the content was authentic, relevant, and aligned with the learning objectives of the simulation curriculum. MVS, on the other hand, emerged as a response to the challenges posed by the Covid-19 pandemic. This paradigm shifts in simulation design prioritised accessibility, adaptability, and a focus on core learning objectives over technological complexity. By distilling simulation down to its essential elements, MVS offered a more sustainable and humanistic approach to simulation-based education.

The experiences and insights gained during the research process as well as the pressing need to modify simulation-based education to fit the restrictions of the epidemic shaped MVS development. The concept of MVS was tested and refined through a series of workshops and pilot studies conducted at TSDFT, demonstrating its potential to enhance the accessibility and effectiveness of simulation-based education in resource-constrained settings. Throughout this journey, I have drawn selectively upon a diverse range of theoretical frameworks, from the philosophical insights of Heidegger's "The Question Concerning Technology" (1954) to the technological imaginary developed by Punt (2000) and the sociomaterial perspectives of Fenwick et al. (2011). These diverse theoretical lenses have provided a robust foundation for interrogating the complex interplay between technology, education, and the human experience. By adopting a contextualist approach to film theory and a materials-based approach to the construct of simulations, I aimed to separate the technology from the practice and performance, allowing for a more nuanced analysis of the role of technology in medical simulation. Ultimately, this research is a narrative of exploration, collaboration, and transformation. It is a record of interdisciplinary thinking and the value of bridging the divide between the arts, humanities, and healthcare. By reframing the conversation around technology and humanism in medical simulation, this work invites educators, researchers, and practitioners to imagine new possibilities for fostering empathy, compassion, and human connection in the face of an ever-evolving technological landscape. From my first job as a simulation technician to my current post as director of digital innovation, the eight-year path at TSDFT has produced insightful analysis, creative practical outputs, and a fresh respect of the need of including humanistic viewpoints in healthcare education and practice. As the field of medical simulation continues to evolve, the lessons learned, and the approaches developed throughout this research I hope support the grounding of the fundamental values of empathy, compassion, and human connection.

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Introduction

Introduction to the audience

This thesis is framed towards healthcare staff as the primary audience for several crucial reasons. By focusing on healthcare professionals, the intention is to provide a resource that effectively communicates the value and impact of integrating arts, humanities, and research into the health sector. This approach is essential for fostering interdisciplinary collaboration and enhancing the overall effectiveness of medical simulation training.

Firstly, healthcare staff are at the forefront of patient care and are directly involved in the application of simulation training. By providing a document tailored to their needs and understanding, it becomes a practical and useful tool that can be easily incorporated into their daily practices. This ensures that the insights and knowledge shared throughout it have the potential to make a tangible difference in the work of healthcare professionals and ultimately lead to improved patient care. Secondly, the language used in arts, humanities, and research can often be unfamiliar or inaccessible to healthcare professionals, creating a barrier to effective communication and knowledge sharing. By framing this thesis towards healthcare staff, I aim to bridge this gap and translate the language of arts and humanities into a more accessible form that can be readily understood and appreciated by those working in the health sector.

Lastly, by focusing on healthcare staff as the primary audience, it aims to inspire further interdisciplinary collaboration within the health sector. By demonstrating the value and impact of incorporating arts, humanities, and research into medical simulation training, healthcare professionals may be more inclined to seek out and engage with other disciplines, ultimately leading to innovative solutions and improvements in patient care.

The decision to frame the research narrative towards healthcare staff is driven by the desire to make the content accessible, practical, and impactful. By translating the language of arts, humanities, and research into a form that resonates with healthcare professionals, this thesis aims to foster interdisciplinary collaboration and drive the ongoing evolution of medical simulation training and patient care.

In this thesis, the term 'we' is frequently employed to denote various activities, thought processes, practical simulation sessions, directional shifts, and responses to the training needs of our NHS Trust. This usage reflects my deep appreciation for the exceptional simulation and digital team at Torbay and South Devon NHS Foundation Trust. The team's forward-thinking, innovative spirit, and unwavering support have been instrumental in the development and execution of this research. Torbay has been recognised as a centre of excellence in simulation delivery long before my tenure, and it is essential to acknowledge the profound impact that working within this team has had on both my professional growth and the insights contributed to the research.

ii. Context of the current situation

As the NHS embraces interdisciplinary collaboration in its future planning, this thesis is crafted with clinical and healthcare professionals as its primary audience. By illuminating the integration of film and arts concepts into healthcare, the aim is to promote knowledge sharing and bolster interdisciplinary communication towards supporting incorporating diverse influences and languages into the health sector.

The fusion of arts and healthcare, as exemplified by the integration of film theory and patient perspective in medical simulation, can lead to significant improvements in patient care and the overall healthcare experience. This research account provides a unique perspective on the value of interdisciplinary collaboration, demonstrating how the combined expertise of professionals from various fields can drive innovation and change within the healthcare system.

By exploring the benefits of integrating arts and humanities into healthcare practice, this research seeks to inspire healthcare professionals to consider alternative approaches and methodologies to patient care, training, and education. The inclusion of film and arts concepts can enhance empathy, communication, and teamwork, all of which are vital components of effective patient care. Ultimately, the hope is that it serves as a testament to the power of interdisciplinary collaboration in enhancing healthcare practice. By merging film and arts concepts with healthcare, it is possible to create a more holistic, patient-centred approach to care, paving the way for a more compassionate, empathetic, and efficient healthcare system.

The COVID-19 pandemic has undoubtedly reshaped the digital landscape of the NHS, as healthcare systems worldwide were forced to quickly adapt to new challenges and demands. The need for rapid adoption of innovative technologies and changes in staff workflows, communication methods, and patient care strategies have had a lasting impact on healthcare delivery. Simulation training has not been exempted from these changes, and the pandemic has driven advancements and adaptations that will be examined throughout this thesis.

One such adaptation is the increased reliance on remote and virtual simulation training. With social distancing measures and limitations on in-person gatherings, healthcare educators were compelled to find alternative ways to deliver simulation training effectively. As a result, the use of virtual and augmented reality, online platforms, and digital tools for remote collaboration has surged, providing new opportunities for healthcare professionals to engage in training activities from a distance.

Additionally, the pandemic has underscored the importance of interdisciplinary and interprofessional collaboration in healthcare. As the crisis unfolded, it became clear that effective communication and teamwork across various healthcare disciplines were critical to navigating the challenges presented by COVID-19.

The pandemic has also highlighted the significance of non-technical skills, such as empathy, compassion, and adaptability, in providing high-quality patient care under extraordinary circumstances. Simulation training has begun adapting to this new reality by placing a stronger focus on these critical soft skills, with training scenarios that address the unique emotional and psychological challenges faced by healthcare professionals and patients during the pandemic.
It will detail these changes, exploring how they have shaped the present and future of medical simulation training. Additionally, the increasing importance of digital literacy for the NHS workforce has led to the development of diagnostic toolkits and materials that support individuals' technical proficiency and innovation capacity within the NHS system. The Topol Review (2019) identified virtual and augmented reality as one of the most influential and important technologies for the NHS over the next 20 years, highlighting the necessity of integrating digital literacy initiatives with emerging technological themes.
Navigating the post-pandemic world, this research aims to provide valuable insights and lessons that can be applied to the ongoing evolution of the NHS and its digital landscape. By sharing the knowledge and experiences gained through this research, I hope to empower healthcare professionals to embrace innovative solutions and collaborative approaches, ultimately enhancing patient care and outcomes.

iii. Thesis Overview

This thesis presents a chronological research journey aimed at contributing to the field of medical simulation, particularly in the context of frequent technological changes. By adopting a personal voice, this thesis provides reflections on and practical experiences within the field, highlighting the journey's importance in understanding and innovating within medical simulation. The hope is that by providing a personal narrative throughout, the tone may support staff feeling empowered and connected to the research, which is particularly relevant where the digital transformation of the NHS is currently a major theme met with some intrepidation.

The key contributions of this research and practice are:

A) The development of a novel methodology that combines film theory with the practical application of immersive and perspective media. This methodology focuses on how camera work can strategically improve reflective learning in soft skills like compassion and empathy. It calls for rethinking traditional simulation practices, proposing the incorporation of filmic elements to supplement and enrich medical education.

B) Promoting and developing 'Minimal Viable Simulation' as a concept and methodology for designing medical simulations. This contribution challenges the market-driven emphasis on high-fidelity simulations, which frequently impose significant cost and capacity constraints, possibly limiting accessibility and perceived educational outcomes. This research advocates for a simpler, narrative-driven approach, implying a shift towards simulations that prioritise educational effectiveness over technological sophistication.

C) A critical redefinition of language in the simulation and clinical training domains, addressing current terminology's inability to fully encompass elements such as compassion and empathy in representation. This re-evaluation proposes a more nuanced and human-centred language that goes beyond the limitations of 'soft' or 'non-technical' skills, incorporating insights and influences from the humanities to enrich the conversation in medical simulation debriefing.

D) By demonstrating new paths in the integration of film theory, visual literacy, and MVS-based simulation design, it opens the field for further research opportunities. It identifies, through testing and engaging with clinicians, both the challenges and potential breakthroughs in these innovative approaches, to create a more accessible, balanced, and reflective learning environment.

Through these contributions, the thesis seeks to enhance the pedagogical approaches within medical simulation and inspire a broader reconsideration of how technology and humanistic skills can be integrated to improve clinical training.

It is also essential to have clear definitions of emerging technologies in healthcare that are tailored to the unique context, as these technologies continue to expand and become more common in the industry. My research began at the onset of a new wave of attention towards virtual reality (VR) and other related technologies, such as augmented reality (AR) and mixed reality (MR) – circa 2014. By initiating the exploration during this period, I aimed to develop an approach that went beyond the initial allure of shiny new technology and instead focused on their practical application within healthcare.

As a healthcare professional, it is important to examine and evaluate the potential of these technologies for our specific field. Many emerging technologies, such as VR and AR, have been designed with multiple purposes and audiences in mind, often leading to descriptions and definitions that are not readily applicable or relevant to healthcare. The challenge lies in adapting these technologies and their accompanying language to suit the unique needs and requirements of the healthcare sector. The portrayal of these technologies in mass media further complicates the matter, as they are often depicted as science-fictional and complex. This can hinder our ability to understand their actual use cases and value within healthcare and make it difficult to present these technologies as approachable, accessible, and easily understood by healthcare professionals. Also, the rapid pace of technological advancements can create a sense of urgency in adopting these innovations, potentially leading to hasty decisions without a thorough understanding of their implications and utility within healthcare.

One significant need identified through the research and practical professional experience working at the Trust was to establish definitions for these emerging technologies within a healthcare context, rather than relying on industry or manufacturer-provided descriptions.

The challenge of translating these technologies into healthcare is multifaceted. Firstly, there is a lack of knowledge and experience among healthcare professionals regarding the potential applications and benefits of these technologies. This gap can be bridged through education and training, tailored to the unique needs and requirements of the healthcare sector.

Secondly, there is often a disconnect between the language used by technology developers and the terminology familiar to healthcare professionals. This disconnect can create barriers to communication and hinder the successful adoption of these technologies in clinical settings. To overcome this, it is necessary to develop a shared language and understanding, allowing for more effective communication between technology developers and healthcare professionals.

Thirdly, the portrayal of these technologies in the media as futuristic or complex can create unrealistic expectations and discourage healthcare professionals from exploring their practical applications. By demystifying these technologies and presenting them in a more accessible and relevant manner within the correct context, it can help to dispel misconceptions and misplaced hype and encourage healthcare professionals to explore the potential benefits of these tools in their practice.

Creating our own definitions of these technologies for a healthcare audience involves conducting thorough research, engaging in interdisciplinary collaboration, and seeking input from a wide range of stakeholders. This process helps to ensure that the resulting definitions are relevant, accurate, and readily understood by healthcare professionals. One prime example of the challenges faced in defining these technologies for healthcare is the way medical simulation has been defined, promoted, and marketed by simulation equipment manufacturers. Their descriptions often do not align with the needs and goals of effective education and learning outcomes within the healthcare context. By dissecting these discrepancies in greater detail in Chapter 1, I aim to demonstrate the importance of context-specific definitions in facilitating a more accurate understanding of these technologies' potential within healthcare.

My research also probes into the importance of interdisciplinary collaboration, drawing upon fields such as the arts and humanities to better understand and approach the integration of technology within healthcare. By considering the role of human behaviour and desire, along with the technical aspects of these innovations, a more holistic approach to their evaluation and adoption can be achieved. This is particularly relevant when considering the potential of these technologies to enhance non-technical skills training, such as communication, empathy, and teamwork. Also, this work examined the concept of minimal viable solutions, which advocates for the integration of technological and human actors in ways that stimulate professional empathy and compassion while delivering the essential functionality required for effective medical training and practice. By focusing on the most critical aspects of these technologies, healthcare professionals can better assess their value and potential for improving patient care and medical education. My research sought not only to establish a foundation for understanding and evaluating these technologies but also to ensure that the adoption of such innovations would be driven by their genuine potential to improve patient care and medical education, rather than simply the novelty of new technology.

Co-design and user involvement are also critical aspects of my research, emphasising the importance of engaging healthcare professionals, patients, and other stakeholders in the development and evaluation of these technologies. This collaborative approach ensures that the resulting solutions are tailored to the unique needs and contexts of healthcare, maximising their potential impact on patient care and medical education. This research aims to address the essential need for context-specific definitions and understanding of emerging technologies within healthcare, emphasizing the importance of interdisciplinary collaboration, co-design, and a focus on both technical and non-technical skills training. By investigating the potential of technologies such as VR, AR, and MR in medical education and practice, my research seeks to create a foundation upon which healthcare professionals can make informed decisions about their adoption and implementation. This work also highlights the importance of remaining critical and discerning when it comes to embracing new technology, ensuring that the driving force behind their adoption is their genuine potential to improve patient care and medical education, rather than merely the appeal of novelty. Ultimately, the research aims to provide a practise informed resource for healthcare professionals as they navigate the rapidly evolving landscape of digital health and emerging technologies. By establishing context-specific definitions and understanding, promoting interdisciplinary collaboration, and focusing on both technical and non-technical skills training, this work seeks to ensure that healthcare professionals are well-equipped to make informed decisions about the adoption and implementation of these technologies, maximizing their potential impact on patient care and medical education.

In addition to addressing the challenges of defining and understanding emerging digital health technologies, another major issue identified through my research is the noticeable absence of these technologies from the curricula of various healthcare professionals. This is particularly evident among foundation year doctors, who are expected to incorporate digital tools into their professional development and future careers. Additionally, other healthcare groups, such as nurses and allied health professionals, often lack sufficient training or knowledge about these new digital technologies. To address this gap, it is essential to create opportunities for safe exploration and play, a term that is not often associated with healthcare but is important for breaking down the fear and uncertainty surrounding foreign technology. Play allows healthcare professionals to experiment with digital tools and technologies in a low-risk environment, fostering confidence and competence in their use, and this in part marked the creation of a Digital Futures lab within the Trust.

As part of my research, I have identified the need for a shift in the approach to digital health, moving away from industry-driven definitions and applications that may not be useful or accessible to healthcare professionals. Instead, I advocate for an approach that is more grounded in the humanities, focusing on understanding human behaviour and desire as a means of overcoming the "wow factor" often associated with shiny new technology. This approach enables healthcare professionals to evaluate and adopt digital tools based on their genuine potential to improve patient care and medical education, rather than being swayed by novelty or hype. Additionally, the work, through experiences gained and practice, emphasises the importance of co-design and consideration in the development and implementation of new technologies in patient pathways. By involving healthcare professionals, patients, and other stakeholders in the design process, we can ensure that digital tools and technologies are tailored to the unique needs and context of the healthcare environment, ultimately leading to more effective and sustainable outcomes. By addressing the gaps in the curricula of various healthcare professionals and promoting a more humanities-driven approach to digital health, my research aims to empower healthcare professionals with the knowledge, skills, and confidence they need to effectively harness the potential of emerging technologies in their practice. This, in turn, will contribute to improved patient care and outcomes, as well as enhanced professional development for healthcare professionals in the rapidly evolving landscape of digital health.

The creation of the Digital Futures lab has also been instrumental in providing a space for rigorous testing and evaluation of emerging digital technologies in healthcare. With unique considerations such as hygiene, usability, material protocols, and safety, healthcare environments demand a higher level of scrutiny when implementing new technologies. The digital futures lab aims to ensure that these innovations meet the needs of both patients and staff in a robust and well-evaluated manner. As a dedicated space within a healthcare setting, it brings together a multidisciplinary team to explore, evaluate, and test emerging digital technologies for their potential application in healthcare. The lab's primary objective is to ensure that these technologies meet the unique demands of healthcare environments, such as hygiene, usability, material protocols, and safety, ultimately leading to improvements in patient care and staff experiences.

One of the primary focuses of the lab has been on Extended Reality (XR) technologies, which encompass Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR). When used correctly and with a specific purpose, these technologies have the potential to foster human connections and enhance the overall healthcare experience. For instance, by enabling healthcare professionals to virtually step into the shoes of their patients, they can gain a deeper understanding of the patient experience and the unique challenges faced by those receiving care. This empathetic approach can lead to improvements in patient-provider communication and overall patient satisfaction. To ensure the successful implementation and adoption of XR technologies in healthcare, it is important to provide clear explanations, guidelines, and support to both patients and healthcare professionals. This includes the development of training programmes, best practice guidelines, and ongoing support to ensure that these technologies are used effectively and safely. By taking this comprehensive approach, the digital futures lab aims to harness the power of XR technologies to create a more connected, patient-centred healthcare system that puts people first.

In one of the areas of high-technology usage in medical simulation, high-fidelity manikins are computerised, sophisticated pieces of equipment costing around £60,000 on average. They boast a range of features, including dilating eyes, pulse rates, breathing chests, and even sweat glands. Despite their impressive features and complexity, high-fidelity manikins have limitations, particularly in terms of appearance and realism to touch. Their plastic-like texture, which does not feel like human skin, can create a disconnect for healthcare professionals practising tactile skills such as palpation or wound care. Furthermore, their facial expressions and movements can be limited or unconvincing, hindering trainees' development of skills in interpreting patient cues and responding appropriately to their emotional and psychological needs – particularly when these are presented through subtle expressions and gestures. Also, the marketing of high-fidelity manikins often focuses on the technical skills aspect of training, with images depicting healthcare professionals performing procedures like injections, intubations, and checking vital signs. While these are undoubtedly essential skills, this focus on technical proficiency can overshadow the need for cultivating humanistic skills, such as empathy, effective communication, and understanding patient perspectives. Another issue with high-fidelity manikins is their reliance on technology and the complexity involved in their maintenance and repair. The technical expertise needed to troubleshoot and repair these devices may not always be readily available within healthcare settings, leading to delays in training programmes and a potential negative impact on learning outcomes.

My filmmaking background and the influence of arts and humanities have proven insightful in reshaping simulation programmes to focus on the patient perspective and address the gaps in manikin-based training. By leveraging my experience in visual storytelling and communication, I have been able to introduce new perspectives and methods to enhance the learning experience. This has involved not only acknowledging and addressing the limitations of high-fidelity manikins but also emphasising the need for a more holistic approach to training that incorporates humanistic skills alongside technical skills. This comprehensive approach to healthcare education ensures that the workforce is better equipped to provide patient-centred care and adapt to the evolving needs of the healthcare landscape.

Many manufacturers involved in creating high-fidelity medical simulators also have a history of developing simulation equipment for other industries, notably aviation. Aviation simulation has long been driven by the pursuit of realism, with a focus on accurately replicating the technical interface of an aircraft's cockpit and addressing the human factors elements necessary for pilot training. Unlike aviation simulation, which has a clear mandate for technical realism, medical simulation faces unique challenges in replicating the complexity and variability of human anatomy, physiology, and patient care. High-fidelity manikins, while offering a range of advanced features, can be costly and may not provide the most realistic experience in terms of appearance or tactile feedback. Additionally, the interpersonal and humanistic aspects of patient care, such as empathy and communication, are not as easily addressed through high-fidelity simulations alone. Considering the distinct histories and requirements of aviation and medical simulation, it is important to recognise that the high-fidelity approach that has been so successful in aviation may not be directly applicable to medical simulation. Instead, medical simulation should strike a balance between technical realism and the development of humanistic skills, considering the unique challenges of healthcare training. This might involve revaluating the role of high-fidelity manikins, exploring cost-effective alternatives, and integrating arts and humanities in the design and implementation of medical simulation programs. By doing so, medical simulation can more effectively prepare healthcare professionals for the multifaceted nature of patient care and ultimately contribute to better patient outcomes.

In the early 2000s and up until recently, high-fidelity medical simulation manikins were predominantly designed with an emphasis on replicating anatomical features and interactions, such as chest breathing, blood flow circuitry, and bowel movements. This focus on technical aspects took precedence over the manikins' appearance, size, weight, and tactile realism. As a result, many of these manikins resembled rugby players in their stature, with large, bulky bodies to accommodate the computerised components and expressionless faces.

This prioritisation of technical accuracy over appearance and touch was a reflection of the belief that high-fidelity simulation was primarily geared towards technical skills training, rather than non-technical or soft skills that might benefit more from realistic appearance. Consequently, the early days of medical simulation within the NHS were characterised by an overemphasis on high-technology use and the accompanying high price points of these manikins. This approach is problematic for several reasons. Firstly, the term "high fidelity" is often misinterpreted and conflated with concepts like heightened realism, high-tech, and veridical simulation, even though these are distinct ideas. Using "high fidelity" as a catch-all term for various simulation approaches can lead to confusion and hinder the development of effective training programmes. Additionally, relying solely on high-technology manikins may exclude certain institutions or healthcare professionals due to the prohibitive costs associated with these devices. In this thesis, I will attempt to address these issues by re-examining the definitions and roles of high-fidelity simulation in medical training. We will explore alternative approaches to simulation that strike a balance between technical and non-technical skills, taking into account the need for realistic appearance, touch, and interpersonal interactions. By clarifying the distinctions between high fidelity, heightened realism, and high-tech simulation, the aim is to promote a more nuanced understanding of medical simulation and advocate for more disciplinary inclusive, cost-effective, and diverse training opportunities for healthcare professionals. This, in turn, will help to ensure that medical simulation remains a valuable tool for enhancing patient care, both in the technical and the holistic approaches to care, and improving outcomes across the healthcare sector.

As a simulation technician at the beginning of this research, I had the opportunity to closely observe and maintain high-fidelity manikins used in weekly simulation sessions at Torbay. It became apparent that many of the advanced features marketed by manufacturers were rarely, if ever, utilised in practice. This led to a redundancy of technology, highlighting the need for a more tailored approach to simulation that considers the specific learning objectives rather than adopting a one-size-fits-all mindset. Additionally, technical issues with the manikins and their inability to accurately represent certain clinical aspects often served as a distraction for participants, drawing their focus away from the scenario's narrative. In very recent years, a new generation of simulation manikins has emerged, prioritising realistic appearance, touch, and overall physical realism over advanced technical features. This thesis examines the factors driving this shift and provides evidence for its necessity. Interestingly, these newer manikins have been developed by individuals with clinical backgrounds in simulation, reflecting a service-driven need rather than manufacturer-driven expectations. This trend interestingly aligns with the early days of simulation, when clinicians created task trainers and other simulation tools out of necessity before mass production took over, which I discuss further in Chapter 1 while providing a contextual history of simulation. Also, the design of these new manikins has been influenced by the film industry, which is known for its attention to detail and realistic body dummies.

This connection to the film industry will become particularly relevant later in this thesis when exploring the influence of film theory on our understanding of compassion, as opposed to the technological and scientific perspectives provided by medical imagery. By examining these intersections, it can develop a deeper understanding of the factors shaping the evolution of medical simulation and, ultimately, enhance the efficacy and value of simulation training in healthcare.

As discussion expands on the role of imagery in medical simulation and in medical diagnostics and treatment, it becomes clear that the observational monitor, often found beside a patient's bed, plays a significant role in healthcare professionals' interaction with the patient. Displaying vital signs such as blood pressure, ECG, and in more advanced settings, CO2 and pulse oximetry, this monitor provides essential information for the medical team. However, its technical nature and encoded interface require a medical background to interpret its readings accurately. In medical simulation, the observational monitor becomes the primary focus of attention, as participants closely track the patient's condition through changes in the displayed data. While this is understandable, given the monitor's critical role in providing information about the patient's status, it can inadvertently detract from direct interaction with the patient. This phenomenon raises questions about alternative ways to use imagery in medical simulation that can complement or even enhance the understanding of a patient's condition beyond what the monitor provides. One possibility is to incorporate visual aids that depict the patient's personal and social history, providing a more comprehensive understanding of the individual's background and circumstances. By incorporating photographs, illustrations, or even video clips, learners can better understand the patient's narrative and develop empathy towards the patient, thus improving their non-technical skills. My purpose to introduce this new form of video imagery in medical simulation was driven by my background in film theory and experience as a filmmaker, observing this training activity weekly as a simulation technician. However, a personal encounter with the healthcare system as a patient experiencing a suspected heart issue significantly deepened my perspective. This unexpected event allowed me to view the hospital environment through the eyes of a patient, revealing how impactful, and at times, frightening these spaces can be. This profound change in perspective reinforced my belief in the importance of incorporating compassionate education and soft skills training into the medical workforce. By capturing these new perspectives through innovative camera techniques, perhaps we could help healthcare professionals better understand the experiences and emotions of their patients. This approach could ultimately lead to more empathetic and compassionate care, benefiting both patients and healthcare providers alike. Moving towards a medical simulation model that incorporates more compassionate and empathetic approaches to patient care, it is essential to consider relevant theories that can support this endeavour. One such theory is the concept of "empathy" as proposed by Carl Rogers, a prominent psychologist and founder of person-centered therapy. According to Rogers, empathy is the ability to perceive and understand another person's feelings, thoughts, and experiences from their perspective. Rogers in his book “Freedom to Learn’ emphasised the transformative power of empathy in educational settings, distinguishing it from evaluative understanding. He argued that genuine empathy—seeing the world through the student's eyes without judgement—allows individuals to feel truly understood, fostering an environment where they can 'blossom and grow and learn.' This approach, he noted, is regrettably rare in classroom contexts. Extending Rogers's insights, it can be argued that such empathetic engagement could also have profound implications for learners in medical simulation settings, suggesting the potential to enhance learning outcomes by fostering a deeper understanding of patient perspectives and experiences.

Another relevant theory is the concept of "situated learning," as proposed by Jean Lave and Etienne Wenger. Situated learning suggests that learning is most effective when it occurs in a context where the knowledge or skill is applied. In the case of medical simulation, situated learning implies that by placing healthcare professionals in scenarios that closely resemble real-life patient encounters, they are more likely to learn and apply the necessary skills in actual clinical settings. By using immersive video imagery that captures the patient's perspective, there is an opportunity to create more authentic and meaningful learning experiences for healthcare professionals. In an effort to further the understanding of humanistic skills in simulation, the application of film theories such as Laura Mulvey's "Visual Pleasure and Narrative Cinema" and Jean Baudrillard's concept of "Hyperreality" can prove instrumental. Mulvey's theory centres on the idea of the "male gaze" in cinema, where the camera often assumes the perspective of a male viewer. This perspective shapes the narrative and the way characters are portrayed. Similarly, in medical simulation, the choice of camera angles and perspectives can influence the narrative and the way healthcare professionals interact with patients, particularly regarding empathy and communication. By applying Mulvey's theory and repositioning the camera to a more intimate and immersive level, it can challenge the traditional "gaze" of medical simulation and encourage healthcare professionals to engage with patients in a more compassionate and empathetic manner. Baudrillard's concept of hyperreality, which describes the blurring of the line between reality and simulation, can also be applied to medical simulation, and I touch on this in particular and its relevance when reviewing the contemporary landscape of simulation, where technology and minimal viable simulations potentially clash.

The personal experience of being hospitalised highlights the significance of the environment in shaping patients' perceptions and experiences. This revelation underscores the importance of empathy and the ability to understand and respond to patients' needs. By incorporating immersive camera techniques and innovative perspectives, I believed we could create a more authentic simulation environment that fosters empathy and humanistic skills among healthcare professionals. For example, one could use 360-degree cameras or virtual reality technology to capture the simulation from multiple angles and provide a more comprehensive view of the patient-provider interaction. This approach allows healthcare professionals to step into the shoes of the patient and truly understand the impact of their actions and communication styles. Ultimately, incorporating film theories and innovative camera techniques could perhaps help create a more accurate and holistic representation of patient care in medical simulation. This approach enables healthcare professionals to develop and hone their non-technical skills, such as empathy and communication, which are crucial to providing compassionate care. By challenging traditional perspectives and promoting a deeper understanding of the patient experience, we can contribute to the development of a healthcare workforce that excels not only in technical proficiency but also in compassionate care. In considering the use of video recordings in medical simulations, it is important to consider the implications of the current camera setup and explore potential alternatives that could enhance the learning experience. The authoritative and surveillance-like nature of the existing camera angles, ceiling mounted, wide angled, distantly framed and fly-on-the-wall video feeds into a separate monitored control room coupled with the difficulty in capturing subtle aspects of the simulation, raises concerns about their effectiveness in supporting the development of both technical and non-technical skills.

It is also important to contemplate the significance of capturing facial expressions, gestures, and touch during medical simulations, as these elements contribute to the development of empathy, communication, and teamwork. The current camera setup often overlooks these nuances, thus limiting the richness of the debriefing process. So by rethinking the way video recordings are captured, it can open up new possibilities for more immersive and informative learning experiences. Considering alternative approaches, such as incorporating multiple cameras at different angles and heights, may provide a more comprehensive view of the participants' interactions with the patient manikin. This could lead to a better understanding of the emotional and non-verbal aspects of the simulation, ultimately supporting a more effective debriefing and learning process. Additionally, the idea of a filmmaker working in the NHS might inspire a further expansion and value towards other NHS organisations exploring the possibility of involving trained videographers who can actively film the simulations, adjusting camera angles and focus as needed to capture the most relevant and informative moments. While this approach could be more resource-intensive, it has the potential to significantly enhance the quality of the footage and contribute to a richer learning experience.

As I explored the potential of capturing simulation scenarios from the manikin's perspective, I noticed the powerful impact that these images and videos had on the viewer's understanding of the patient experience. The imperfections, motion blur, and prolonged focus on blank ceiling spaces revealed the true nature of the patient experience, often characterised by feelings of vulnerability and isolation. In addition, the out-of-view conversations and fleeting glances of concern offered insights into the subtle ways that healthcare professionals communicate around the patient, rather than with them. These materials not only provided valuable insights for debriefing sessions, but they also inspired the idea of creating specific stand-alone patient perspective scenarios that would emphasise the importance of communication, compassion, and empathy in patient care. The patient perspective films constitute some of the practical aspects of the research (and became a registered innovation within the NHS), as they serve as tangible tools for healthcare professionals to reflect upon their interactions and develop a deeper understanding of their patients' experiences. By capturing these moments, the films provide valuable material for discussion and improvement of non-technical skills such as empathy, communication, and compassion. In Chapter 3 of the thesis, I discuss the production and early trials and evaluations of these patient perspective videos, which were initially viewed using rudimentary virtual reality (VR) hardware. The immersive nature of VR allowed for an even more powerful and compelling experience, as viewers were able to use some agency with the patient perspective by looking around and gaining a focused and peripheral viewed understanding of the non-technical aspects of patient care. The overwhelmingly positive reaction to these patient perspective scenarios ultimately shaped the way our trust views and utilises digital technology in medical simulation and health education. By incorporating these innovative perspectives into our training, we have been able to foster a greater appreciation for the humanistic skills required in patient care, and in doing so, promote a more empathetic and compassionate healthcare workforce. Additionally, the use of patient perspective videos and VR technology has opened up opportunities for interdisciplinary collaboration, as healthcare professionals from various fields can come together to engage in discussions and reflections on their shared experiences. By creating a common ground for understanding and empathy, these patient perspective scenarios serve as a catalyst for fostering a more patient-centred approach to healthcare, ultimately leading to improved patient outcomes and satisfaction.

In the later years, especially when Covid-19 struck the NHS, the approach we took to learning from the patient perspective became even more critical. The trust recognised the need to make the patient journey more comfortable, particularly as PPE like face visors and masks disrupted our ability to convey empathetic gestures, smiles, touch, and even eye contact. By creating materials that showcased the Covid-19 experience from the patient's perspective, we aimed to re-establish a language of comfort and reassurance. The skills developed during the practical outputs of this thesis have influenced national documentation for the adoption of virtual reality 360° video content creation. This medium has been used to promote the adoption of perspective and embodied-based learning in medical simulation. In addition, 360° video has been employed for training materials where a change in perspective, such as switching between roles during a cardiac arrest, can prove invaluable for understanding human factors considerations in such time- and stress-critical situations.

Much like the patient observation monitor requires an intellectual understanding to decode the numbers and provide meaningful information, which is an essential part of the education for trainee doctors and healthcare professionals, understanding imagery from a film theory perspective is also important when capturing elements such as compassion and empathy. To effectively interpret filmic images, it is important that the audience is familiar with the process of creating these images, which led to the development of the "clinicians as content creators" workshops. These workshops aimed to train a new audience in this medium, and I discuss this initiative in Chapter 4 of this thesis. Additionally, the research and practical work conducted during this PhD research have gone on to inform national strategies and guidance. This includes documentation on creating virtual reality and 360° content, as well as evaluation frameworks for the adoption of virtual and immersive reality technologies in healthcare trusts.

From the thesis, practical components contribute to the conversation surrounding the implementation of a humanistic skills approach in medical simulation. However, the impact of the research and practice extends beyond this scope, influencing and generating several national guidance documents for the adoption of virtual and filmic-based technologies in simulation programs across England. This broader impact demonstrates the potential for film theory and immersive technologies to transform the way healthcare professionals are trained, focusing on fostering empathy, compassion, and effective communication skills. As a result, the healthcare system can benefit from more patient-centred care, ultimately improving patient experiences and outcomes.

The journey through this research, the incorporation of film and perspective elements, and the unprecedented challenges faced during the Covid-19 pandemic have ultimately led to the development of a minimal viable solution approach to medical simulation. This approach focuses on achieving a balance between technical and non-technical skills while offering cost-effective and adaptable training methods that can better serve the needs of healthcare professionals in various settings and situations.

One of the key insights from the research was the importance of perspective in enhancing the understanding of humanistic skills in medical simulation. By adopting a patient-centered viewpoint, the research highlighted the potential for immersive technologies, such as virtual reality and 360° video, to provide healthcare professionals with the ability to gain a deeper understanding of empathy, compassion, and effective communication. This approach was further reinforced by the challenges faced during the Covid-19 pandemic when traditional empathetic gestures were disrupted by the necessary use of personal protective equipment (PPE). The pandemic also revealed the critical need for healthcare systems to adapt and respond to rapidly changing circumstances. As healthcare providers faced increased workloads, limited resources, and constantly evolving guidelines, it became clear that traditional training methods might not be sufficient in addressing these challenges. The concept of a minimal viable solution approach to medical simulation emerged as a potential answer to this dilemma, offering a more agile and resource-efficient way of addressing the training needs of healthcare professionals during times of crisis.

In addition to the importance of perspective and adaptability, the research also emphasizes the value of incorporating film theory and principles into medical simulation. By understanding and applying the principles of film and storytelling, the research found that medical simulation could be enhanced in a way that fosters a more holistic and patient-centered understanding of healthcare. This, in turn, contributes to the development of a healthcare workforce that is better equipped to provide compassionate and empathetic care in an ever-evolving landscape.

Additionally, the research demonstrated that when healthcare professionals are equipped with the skills and knowledge necessary to create and interpret filmic content, they can engage more effectively with the material and become active participants in their own learning process. This active engagement has the potential to deepen the understanding of humanistic skills and contribute to the overall efficacy of medical simulation training.

The minimal viable solution approach to simulation, as informed and explained in the tail end of the research, is one that achieves a balance between technical and non-technical skills while still providing a comprehensive learning experience for healthcare professionals. This approach also takes into consideration the need for cost-effective and easily accessible training methods that can be rapidly implemented and adapted to suit the unique challenges faced by healthcare systems. As a result of the insights gained through this research, the minimal viable solution approach to medical simulation has had a significant impact on the development of national guidance documents for the adoption of virtual and filmic-based technologies in simulation programs in England. These guidance documents have facilitated the widespread adoption of immersive technologies in medical simulation, ultimately contributing to the improvement of healthcare education and patient outcomes on a national scale. In conclusion, the minimal viable solution approach to medical simulation is a demonstration to the power of innovation and adaptability in the face of unprecedented challenges. By incorporating film and perspective elements, leveraging immersive technologies, and drawing from the experiences of the Covid-19 pandemic, this research has contributed to the development of cost-effective, balanced, and patient-centered simulation practices that can better serve the needs of healthcare professionals and, ultimately, improve patient outcomes. This approach has the potential to transform medical simulation education and lead to lasting, positive change within the healthcare sector.

iv. Brief overview of the thesis chapters

Taking into account the context discussed throughout the introduction, this thesis is organised into the following chapters, each building upon the previous one and contributing to a comprehensive understanding of the integration of film and arts concepts into medical simulation training and the ongoing digital transformation in the NHS:

Chapter 1: Unpacking the preface as a story In this chapter, I will explore the historical and contemporary landscape of medical simulation, examining its origins, development, and current practices within the context of the National Health Service (NHS), often referring to the experiences and practice within Torbay and South Devon NHS Foundation Trust (TSDFT). I will provide both theoretical and experienced context towards the limitations of traditional veridical (also known as high fidelity) simulation approaches that have primarily focused on the acquisition of technical skills and begin to describe the policy-recognised need for incorporating humanistic skills, such as empathy and compassion, into medical training, which I will unpack and further contextualise in subsequent chapters.

Chapter 2: Resistance to the Camera: This chapter inspects the principles of film theory and its application to the patient perspective in medical simulation training. I will explore the process of capturing empathy, compassion, and humanistic skills through the lens of the camera, and how this perspective can enhance the overall effectiveness of simulation training. Additionally, I will examine the resistance to the use of cameras in medical simulation and how it relates to the history of the technology and ideas from other disciplines.

Chapter 3: Practice and Innovation details the practical use of deploying cinematic filmmaking techniques, including patient perspective films and VR. I will discuss the development, evaluation, and adoption of these technologies, as well as the ways in which they have been used to enhance training and address the challenges posed by the COVID-19 pandemic.

Chapter 4: The Human Factors Question Insists on the Arts and Humanities: I will explore the concept of clinicians as content creators and how training healthcare professionals in film theory and production can contribute to more effective and engaging medical simulation training. This chapter will also discuss the symbiotic relationship between the arts and humanities and medical simulation training that has emerged as an important conduit for novel approaches to healthcare education.

Chapter 5: The Innovation of the Debrief. This chapter explores activity and change during Covid-19 and in particular how simulation practice needed to change, giving opportunity for the minimal viable solution approach to simulation, which has been influenced by the film and perspective elements of the research and the need to adapt training to become more collaborative in its design. I will discuss the benefits of this approach, including more cost-effective and balanced simulation practices that can be applied in various healthcare settings.

Chapter 6: Reflections at the Human Machine Interface outlines how the research and practice from this thesis have gone on to influence national strategy and guidance for the adoption of virtual and filmic-based technologies in simulation programmes in England. I will explore the development of diagnostic toolkits and materials that support digital literacy and innovation within the NHS and overcoming the uncanny valley.

Final Discussion and Further Research. This final chapter synthesises the findings and insights from the previous chapters and highlights the implications of this research for the future of medical simulation training and the digital landscape of the NHS. I will discuss the potential for further interdisciplinary collaboration, the function of minimal viable simulation (MVS) and the continued evolution of simulation training in a post-pandemic world. Within this chapter, there is a section called executive summary which might otherwise be termed 'for colleagues in a hurry'. This is a concise summary of the key research journey and findings that offers an essential framework of the thesis for a lunchtime reading. This feature is to help ensure accessibility of the document in recognition of busy healthcare and executive staff members who often want information presented in a compact format. This chapter completes with the final conclusions from the research.

Each chapter will provide a detailed analysis and discussion of its respective topic, contributing to a comprehensive understanding of the integration of film and arts concepts into medical simulation training and the ongoing digital transformation in the NHS. By exploring the impact of the COVID-19 pandemic and the increasing importance of digital literacy in healthcare, this thesis aims to offer valuable insights that can inform future developments and interdisciplinary collaboration within the health sector.

Chapter One: Unpacking the Preface as a Story

This chapter will investigate the historical and current state of medical simulation within the National Health Service (NHS), focusing on its origins, evolution, and current practices, with specific reference to Torbay and South Devon NHS Foundation Trust (TSDFT). I will discuss the limitations of traditional high-fidelity simulation approaches that focus on technical skills and argue for the inclusion of humanistic skills like empathy and compassion in medical training. I will present a first-hand account of the difficulties and drawbacks of depending only on high-fidelity simulation technologies for medical education. I will draw on my experience as a simulation technician as well as my later career advancement through this research to head the Digital and Simulation programme. I will present the argument for the inclusion of arts and humanities influences in simulation training to make it a more comprehensive and successful learning environment for medical professionals through a study of relevant literature and evidence-based examples. In the following sections, I will explore the progression of medical simulation from basic task trainers to advanced computerised manikins and virtual reality settings. I will discuss the significance of the debriefing process, which is closely linked to the simulation, and its ability to improve the development of non-technical skills. By the end of this chapter, I intend to establish a strong basis for comprehending the present status of medical simulation and the acknowledged necessity for a more human-centred approach in medical education.

1.1 The Reason for the Research

Both the Francis Report (2013) and the Berwick Report (2013) have had a significant influence on the healthcare industry. Both of these reports have highlighted the significance of promoting a culture of compassionate care and giving non-technical skills a higher priority in professional education and training for medical professionals. These findings brought to light the need to address the emotional and psychological components of patient care in addition to technical capabilities. They acted as a catalyst for change within the healthcare industry and were the driving force behind this research. A detailed examination of the serious errors in patient care that occurred at the Mid Staffordshire NHS Foundation Trust was conducted in 2013 and was referred to as the Francis Report. Based on the findings of this analysis, it was discovered that the inability to provide quality patient care was caused by a number of human factors and a lack of empathy and compassion, as well as an inadequate attention to abilities that were not technical in nature. It was recommended in the study that medical education and training should place a greater emphasis on the development of non-technical abilities, as well as a renewed emphasis on compassionate care provided to patients. These proposals brought to light the critical need for a paradigm shift in the approach to healthcare and medical education, with a greater focus placed on empathy, compassion, and care that is centred on the patient.

In a similar vein, the Berwick Report (2013) was a reaction to the findings of the Francis Report. It advocated for a culture inside the NHS that prioritises empathy and compassion in the delivery of healthcare, and it focused on the patient. The findings of this analysis highlighted the need for fostering a culture of continuous learning and growth as well as providing healthcare personnel with an atmosphere that is supportive of their work. It acknowledged the significance of cultivating empathy and compassion as a means of enhancing results for patients and bringing about a transformation in the healthcare system. The healthcare industry has been profoundly impacted by these investigations, which have made it abundantly evident that the development of non-technical qualities, such as empathy and compassion, should be given priority in the training that is provided through medical simulation. Specifically, this change would require shifting away from a paradigm that focuses primarily on the development of technical skills and towards a more balanced approach that recognises the significant role that communication, empathy and compassion play in the provision of comprehensive patient care. The purpose of this research project, which started in 2014, was to investigate novel approaches to integrating non-technical skills training into medical simulation. In particular, the project aimed to draw on both practical and theoretical practises from the arts and humanities. This was done with the intention of addressing the challenges and recommendations that were highlighted in the Francis and Berwick reports.

In order to accomplish this objective, the research investigates several various ways and methodologies that may be utilised to improve empathy and compassion training within the context of medical simulation. This research intends to make a contribution to the transformation of medical education and training by examining the impact of these approaches on the development of non-technical skills. In doing so, it will undertake a novel and innovative solution that will ultimately align it with the recommendations and priorities outlined in the Francis and Berwick reports. The greater purpose of this research is to provide assistance to the healthcare industry in the process of cultivating a culture of compassionate care and providing improved patient outcomes through the incorporation of empathy and compassion into medical simulation training, as medical simulation training, which a widely used method for training clinicians, has to place a higher priority on the development of non-technical skills in order to keep up with the growing acknowledgment of the significance of these abilities in the healthcare industry. In order to do this, there would need to be a change in emphasis away from the development of mostly technical skills and towards a more balanced approach that recognises the significant role that empathy and compassion play in an educational and training setting towards the provision of patient care.

1.2 Regarding the terms used in simulation (for clarification before we begin)

Veridical simulations and high-fidelity simulations are not interchangeable terms; yet, it is necessary to understand and address the distinction between the two types of simulations, since they are linked but not the same thing. When discussing simulations in the field of medical simulation, the phrase "high fidelity" is frequently used to refer to simulations that entail a specific level of technological sophistication and advanced interfaces. Simulations with a high level of accuracy are designed to produce an environment that is as close as feasible to the clinical conditions that really occur in the real world. It is important to note that the phrase is also used to describe the degree of realism that is present in a simulation, which can result in some misunderstanding. Conflating high fidelity with realism can be problematic because it fails to differentiate between the technological features of the simulation and the accuracy of the scenario that is being represented. This can lead to inaccurate representations of the scenario. It is possible that this will lead to an excessive focus on the technology itself, which may cause one to ignore other crucial components of the simulation, such as the development of non-technical abilities such as empathy, communication, and collaboration. In spite of the fact that the phrase "high-fidelity" is used in the advertising and description of flight simulators, it is one that is used throughout the simulation industry across a variety of verticals and sectors. Simulators that are based on reality, on the other hand, are designed to provide a realistic and detailed picture of situations that occur in the actual world. The word "veridical" originates from the Latin word "veridicus," which may be translated as "truthful" or "speaking the truth." Veridical simulations, when characterised as such, strive to produce a learning experience that covers not just the physical environment but also the many sensory, cognitive, and emotional elements of a particular situation. This is the goal of the simulations.

The use of the term "veridical" in medical simulation, despite the fact that it is not commonly used, can be useful in highlighting the significance of giving an accurate portrayal of real-life scenarios. This is in contrast to concentrating exclusively on the level of technological sophistication or realism that the simulation possesses. When educators and practitioners differentiate between realistic and high-fidelity simulations, they are able to gain a better understanding of the various factors that contribute to a successful simulation experience. This approach encourages a more holistic view of simulation design, taking into consideration the learning objectives of the trainee and ensuring that the simulation provides. High-fidelity simulations, despite the fact that by definition they offer an 'immersive' and technologically advanced environment, may not necessarily guarantee an exact or full picture of situations that occur in the real world. Veridical simulations, on the other hand, place a greater emphasis on the genuineness and precision of the educational experience, taking into account a wider variety of elements that play a role in the growth of the trainee or participant. This difference serves to highlight the significance of striking a balance between the use of technology and realism in conjunction with other essential parts of simulation design, such as the formulation of scenarios, the pursuit of educational goals, and the growth of abilities that are not technical in nature. By recognising and appreciating the differences between high fidelity and veridical simulations, medical simulation teams and clinicians, who are the target audience for this thesis, are able to make more informed decisions when designing and incorporating other influences and disciplines into simulation-based training programmes. This, in turn, ultimately results in trainees having experiences that are more focused on non-technical skills.

The thesis therefore focuses on the objective approach toward veridical simulation to distinguish it from other types of simulations and promote a comprehensive approach to simulation design. Nevertheless, accurate simulations have their constraints. Accurately replicating real-world scenarios, especially complex human interactions and emotional responses, may not be the most effective approach for improving simulations. This could potentially overwhelm participants both physiologically and emotionally, as current simulation environments are not designed to handle such intricacies. Constraints related to resources, time, and skill may limit the use of veridical simulations in specific scenarios during the design and implementation process. By identifying its constraints, it establishes a guideline for determining the optimal amount. The main distinction between veridical and high-fidelity simulations is in their emphasis. Veridical simulations focus on accurately representing real-world circumstances, whereas high-fidelity simulations emphasise technical sophistication and immersive experience. High-fidelity simulations may lack a comprehensive or authentic context for the scenes they replicate. They could concentrate on particular elements of a problem, such as physical or technical abilities, while overlooking other crucial components, such as social, cultural, or emotional dimensions. At times, the concentration on high-fidelity technology may detract from the desired learning outcomes, resulting in technical diversions or a neglect of the simulation's primary aims.

Various industry influences can be found in these words. The technology and engineering industries have an impact on high-fidelity simulation as they consider fidelity to be a crucial component of system design and assessment. High-fidelity medical simulation is frequently linked to the production and promotion of advanced manikins and virtual reality platforms. Since these technologies have the ability to provide realistic and immersive training experiences, they are frequently regarded as highly desirable. Conversely, the notion of legitimate simulation stems from a more extensive scholarly setting, wherein the precision and genuineness of the simulation scenario have greater significance than the technology employed. This viewpoint highlights the significance of attaining the intended learning outcomes through the design and execution of simulation situations and is more in line with the principles of educational theory and practice. It emphasises the importance of focusing on the educational goals and objectives of the simulation rather than solely on the technology used.

1.3 The limitations of veridical simulation

The original goal of constructing very realistic simulations for medical education was to help trainee doctors hone their technical abilities in repeatable and safe environments. Trainees could practise processes before carrying them out in real life thanks to simulations, which offered a realistic learning environment (Gaba, 2004). During my time as a simulation technician, I saw that maintaining the equipment and striving for authenticity were essential components of the training process. Historically, medical task trainers have been used for centuries, with roots dating back to antiquity. To illustrate the clinical characteristics of illnesses and their consequences for individuals, models of human patients were made out of clay and stone (Kneebone, 2003). While Dr. Giovanni Antonio Galli created a three-dimensional birthing simulator in Italy to instruct his students and midwives[1], Angélique Marguerite Le Boursier du Coudray[2] used a cloth childbirth simulator in the eighteenth century to teach her skills to midwives and surgeons (Perciaccante et al., 2016). In the early

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[1] During the Renaissance, there was a significant interest in the mechanics of childbirth, leading to the development and use of various devices to assist in the process. These "macchine da parto" (birthing machines) ranged from simple chairs to more complex apparatuses designed to aid in difficult deliveries.
[2] Angélique Marguerite Le Boursier du Coudray, lived from 1712 to 1790. She is credited with creating the first obstetric simulator, dubbed interestingly as 'the machine', which allowed midwives to practice handling difficult births in a controlled setting. By training fellow midwives in rural France using her innovative mannequin, Madame du Coudray is regarded as a pioneer of simulation in medical education.

20th century, there were obstetric simulators, also known as obstetrical phantoms. Nevertheless, the handmade method of the creative clinician has given way to a manufactured business in medical simulation in recent years. Consequently, producers who profit from the high-tech sale of truth as a commodity have had a significant effect on medical simulation technology (McGaghie et al., 2010). Because of the emphasis on realistic simulations, acquiring technical skills has received more attention than developing soft skills like empathy and compassion. Studies show how crucial humanistic principles are to the development of humanistic doctors who can build effective doctor-patient relationships (Guo, K et al., 2020). The claim that the primary goal of simulation was to develop technical skills is strongly backed by the kinds of tools utilised in medical education, such as sophisticated manikins and computerised equipment. Kneebone et al. (2003) underlined in their study the value of simulation realism and how it pertains to the growth of technical proficiency. They contended that students might hone their technical abilities in an environment that closely mimicked actual clinical settings thanks to high-fidelity simulations. The development of soft skills, which depend more on appearance and touch than on technical accuracy, has not, however, benefited from this approach to simulation technology (Kneebone, 2003). Medical simulation's focus on technical proficiency has led to a disregard for the human elements of healthcare, such as empathy and compassion, which are just as crucial for providing patients with high-quality treatment. Shiau, S. J et al (2008) highlights the vital significance of developing humanistic skills in medical education and argues in favour of an educational strategy that integrates humanistic care, reflection, and critical thinking. It highlights simulation as an essential method to developing these abilities. According to the paper 'Reflection and critical thinking of humanistic care in medical education' the goal of medical education should be to create health professionals who are flexible, critical, reflective, and at ease with ambiguity so they can deliver true patient-centered care.

Additionally, it's vital to comprehend realistic simulation within a limited framework. When simulating clinical settings, simulations and the technology that supports them frequently aim for a high degree of realism. But they can—and often do—unintentionally leave out or fail to appropriately address some crucial components that add to a more complete and genuine context. These simulations might overlook important elements that are crucial in actual healthcare settings, even if they frequently concentrate on particular components of a scenario, such as the development of technical or physical abilities. In this regard, the portrayal of ethnic variety in simulated patients is one of the aspects that is frequently disregarded. Throughout the course of their history, makers of simulation manikins have made models that are devoid of cultural and racial variety. They have frequently defaulted to producing white manikins that are expertly portrayed. This finding was brought to the attention of one of these manikin manufacturers, and the response I received was that they produce manikins with the goal that the end user or simulation site may customise the manikin with aspects such as make-up and cosmetics, as well as articles of clothing, and so on. All of this is done very well (and it is a skill and activity that is well-practiced within the Torbay Simulation team), but it is important to note that this may not be a consistent activity and realisation across all simulation sites. Additionally, it is dependent on the simulation team to be culturally sensitive, as they frequently create scenarios based on their own clinical experiences. When it comes to the technical manufacturing element, this restricted representation can be detrimental to the development of key cultural competency skills among healthcare professionals. This is because it does not expose them to the diverse backgrounds and identities that they are likely to face in the course of their work. Additionally, it is possible that even realistic simulations may not fully address the feelings and relationships that are involved in the delivery of healthcare. Real-life clinical circumstances can entail a range of complicated feelings, difficult communication, and nuanced relationships between healthcare workers, patients, and their families. These interactions are frequently influenced by the cultural and behavioural story of the person. As a result of the failure to incorporate these aspects into the technical infrastructure of the simulation, the training may not adequately prepare healthcare professionals for the wide variety of human experiences they will encounter in the course of their work. Also, it is not entirely accurate for manufacturers to market their products as a tool for both technical and non-technical skill training.

During my time working as a simulation technician for the NHS as a member of Torbay and South Devon NHS Foundation Trust (TSDFT), I had the opportunity to observe first-hand the limits of the use of realistic simulation in the context of addressing the development of soft skills. There was limited potential for creativity in training approaches that may build empathy and compassion in trainee doctors because of the emphasis placed on technical realism and the influence of manufacturers in moulding the landscape of medical simulation. As a consequence of this, there is a gap in medical education, which is characterised by the prioritisation of the acquisition of technical abilities above the development of humanistic qualities, which are essential for providing comprehensive patient care as detailed in the 2013 Francis report and subsequent national documentation. It is without a doubt that the more recent introductions of virtual simulation into the field of medical education has resulted in an increase in the technical skills of healthcare practitioners. Virtual simulation in healthcare pertains to the utilisation of screen-based simulations that prioritise three-dimensional (3D) graphics, sound, and navigation to construct immersive and interactive learning environments for medical and nursing students (Wu, Q 2022). Nevertheless, it is of the utmost importance to recognise the constraints that these simulations encounter when it comes to the development of compassionate and empathic care. There is opportunity to gain a better understanding of these constraints and highlight the need for more effective training approaches to increase non-technical abilities by looking, as one example, at the video-gaming industry and investigate a variety of game examples. The goal of video games, particularly those that are designed to give players realistic experiences, has been to immerse players in virtual settings that are designed to closely resemble real-life scenarios for a very long time. These games, such as "Red Dead Redemption 2" and "The Last of Us Part II," which have received widespread praise from critics, make use of advanced visuals, physics, and artificial intelligence in order to provide players with an experience that is extremely engrossing and blurs the line between reality and fiction. Nevertheless, despite the fact that they are equipped with cutting-edge technology, these games sometimes struggle to depict the entire range of human feelings, relationships, and interactions. It is possible to draw similarities between this difficulty and the limits of virtual simulations in the field of medical education. In order to facilitate the development of the trainees' technical skills, the fundamental purpose of these simulations is to establish a convincing environment that provides sufficient support. Nevertheless, the emotional connection that the player attempts to form with the virtual characters frequently fails to materialise. Virtual characters may have a 'lifelike' appearance and respond to the activities of the player, but the complexities of their feelings and relationships are typically limited to programmed exchanges and predetermined consequences. When it comes to the teaching of empathy and compassion, this restriction becomes even more apparent when it is considered in the context of medical simulation. The importance of human contact and emotional comprehension is sometimes overlooked in the context of high-fidelity simulations, which tend to place a greater emphasis on technical skills and diagnostic capabilities. The high-fidelity manikins that are used in these simulations are technically impressive in their ability to simulate human physiology, yet they do not possess the emotional depth and response that are necessary for training medical personnel in compassionate care. It is possible, for instance, for a manikin to correctly imitate the respiratory discomfort of a patient or even produce tears; nevertheless, it is not capable of expressing the subtle signs of dread, worry, or hope that a genuine patient could experience. As a consequence of this, the trainee is now concentrating on finding a solution to the technical problem rather than attending to the emotional requirements of the patient.

The debrief session and the clinician in charge (clinical simulation lead) of the simulation were responsible for extracting and supporting non-technical skills obtained due to the technical nature of medical simulations. The debriefs quality and efficacy in addressing soft skill development relied heavily on the supervising clinician's expertise and sensitivity. The dependence on the clinician's capabilities led to an inconsistency in the soft skills learning process, as not all clinicians had the required knowledge to support reflection and development in these areas (Fanning & Gaba, 2007). Fanning and Gaba (2007) highlighted the significance of the debriefing phase in simulation training, noting that it provides learners with a chance to contemplate their performance and pinpoint areas for enhancement. The success of the debrief in encouraging non-technical skills development depends on the facilitator's expertise in guiding the discussion and emphasising the pertinent parts of the trainee's performance. Consequently, there was an increasing acknowledgment that medical simulation should go beyond its emphasis on technical accuracy to better tackle the enhancement of soft skills. This transformation necessitated a change in the simulation design and execution strategy, transitioning from a manufacturer-driven model focused on high-tech accuracy to a more holistic and human-centred learning environment that included the arts and humanities. Some scholars advocate including arts and humanities in medical school to enhance the cultivation of empathy, compassion, and other humanistic skills in healthcare practitioners (Kumagai & Wear, 2014; Shapiro et al., 2009). Kumagai and Wear (2014) highlighted the significance of integrating narrative medicine and reflective writing into medical education to enhance empathy and self-awareness in healthcare professionals. Shapiro et al. (2009) emphasised the advantages of incorporating cinema and literature into medical education, suggesting that these mediums are effective for exploring into the intricacies of human experiences and emotions. However, one obvious failing of the medical humanities has been its inability to be present in ongoing education and CPD for clinicians in a post-trainee and qualified stages. In short, medical humanities is rarely studied or has protected time beyond the university. However, expanding on Shapiro et al.'s (2009) findings on the advantages of using film and literature in medical training, my experience as an experienced filmmaker prompted me to examine the present application of cameras and visual media in medical simulation. The technology was present in some form or another, but not being effectively used to enhance the development of soft skills. Instead, the emphasis was mostly on following the manufacturer's instructions, which emphasised technical features and placement (such as cameras being positioned on ceiling locations).

Recognising the significance of the arts and humanities in expressing emotions and intricate concepts, it was evident that there was a chance to utilise these methods to improve medical simulation. Studying film theory and visual storytelling may offer useful insights into how framing, composition, and editing techniques can evoke emotions and enhance comprehension and look towards how to reconsider the deployed visual tools, like cameras. Integrating artistic viewpoints into medical simulation might enhance the realism and emotional depth of the experiences, hence improving the readiness of healthcare staff for actual patient encounters. By acknowledging the advantages of incorporating imagery as influenced from the arts and humanities into medical simulation, it may visualise a more comprehensive and efficient training method that encompasses all the necessary abilities in the healthcare field.

Therefore, even though simulation has greatly advanced and evidenced the technical abilities of medical students in a safe to practise environment, it is becoming more and more clear that this method has drawbacks when it comes to the development of soft skills like empathy and compassion. The emphasis on technical realism and the influence of manufacturers have led to a gap in medical training where the development of technical abilities takes precedence over the acquisition of humanistic qualities, as I saw as a simulation technician at Torbay. In order to solve this problem, medical simulation approaches need to rebalance. They must go beyond the high-tech concept of authenticity and instead include the humanities and arts to give healthcare workers a more well-rounded and comprehensive learning environment.

1.4: Introducing a new context overview from the arts and humanities to a clinical audience

The landscape of medical simulation has evolved from a technical 'features' standpoint over time, but as new technologies have emerged and educational strategies advanced, the need for balance between realism, learning outcomes and technology delivery has become more apparent. This equilibrium is especially important when, in the context of this research, one evaluates what aspects of the simulation may be carried over into the post-simulation conversation, which is also referred to as a debrief. This is done in order to assist both the learner and the trainer as an object of reflection and evidence of performance. This specific research project focuses on one such aspect, which is the function of film theory and the visual media captured in the simulation that can be used and learnt from in a discussion or debrief session in the pursuit of emotional cognition and rebalancing towards the soft skills of learners.

In my experiences at my trust, I have seen a difference between the expected and actual patient narrative in simulations and how accurately this is discussed at the debrief. This discrepancy arose due in part because there was a lack of technological consistency between the two activities, and in part because the way the technology (such as the manikin) was viewed and understood. If we take the camera as another example of this (and the way in which the camera and its imagery was both used and read) changing just this feature from the almost prescribed technical set up would potentially be a hard sell because film theory, arts, and humanities fall within a different discipline than this very clinically and technically established practise, which has traditionally been more procedural and process-driven. However, the importance of integrating these fields I felt would be of great benefit. Historically, medicine has been, within the literature of the humanities at least described as an art (Kirklin, 2003). This viewpoint emphasises the importance of human interactions, empathy, and understanding in the practice of medicine. Despite the artistic aspects of medicine, medical simulation had (and continues in many places to still do so) primarily focused on technical skills and procedural knowledge. The backdrop of reflection and modification in medical simulation has evolved over time, and the realisation that a balance between realism and technology delivery is needed has become increasingly apparent.

When it comes to the utilisation of imagery to elicit emotional reactions and assist learning, film theory provides a uniquely insightful perspective. In 1949, Eisenstein, who was considered to be one of the pioneers in the field of cinema theory, underlined the significance of montage in terms of its ability to generate meaning and evoke feelings through the juxtaposition of images. The concept can be utilised in the field of medical simulation, where the strategic arrangement of images and scenarios has the potential to boost the emotional engagement of the learner, ultimately leading to an improvement in the overall process of learning. André Bazin (1967), another famous film theorist, said that the force of realism in cinema lies in its ability to develop an emotional connection between the viewer and the topic of the film. This approach can be used in the field of medical simulation, where it is necessary to strike a balance between realism and the delivery of technology in order to establish an atmosphere that enables students to cultivate empathy and improve their comprehension of the experiences that patients go through. Furthermore, the idea of the "affective turn" in film theory, which has been championed by academics such as Shaviro (2010) and Massumi (2002), implies that feelings play a significant part in determining how we come to understand and perceive visual pictures. It is possible for educators to harness the power of emotions and emotional responses in order to produce more successful training experiences by incorporating these insights into medical simulation.

It is emphasised by Issenberg et al. (2005) that learning objectives and feedback should take precedence over technological fidelity in the context of simulation-based medical education. It is the authors' contention that a learner-centred strategy, as opposed to a technology-driven one, is essential for the achievement of successful medical instruction. The emotional and cognitive influence of imagery in film has been stressed by film theorists such as Sergei Eisenstein (Eisenstein, 1949) and Christian Metz (Metz, 1974). These theorists argue that the manner in which images are presented can elicit emotional responses and change our view of the world. This viewpoint is consistent with the objectives of medical simulation, which has as its primary objective the creation of environments that are both immersive and realistic. As a result of my experience as a filmmaker, I feel that incorporating film theory and imagery into medical simulation could open up new avenues for the development of soft skills, aiding toward designing simulation experiences that are more emotionally engaging and narrative rich by employing the principles such as montage (Eisenstein, 1949). These experiences could encourage trainees to acquire empathy and communication skills in addition to their technical talents. In accordance with this concept, I began to investigate the works of film theorists such as David Bordwell (1985), who proposed that the manner in which audiences see and process films is an active cognitive activity. In his argument, he stated that "comprehension is guided by a series of tacit assumptions and expectations that we can call schemata" (Bordwell, 1985, page 34). One possible application of this idea in medical simulation, where the emotional cognition of students might be influenced by the images and visual storytelling techniques that are carried out to enhance the patient backstory and perspective. It is possible that the incorporation of cinema theory and images into medical simulation could provide a much-needed balance between realism and the delivery of technology, in addition to providing a more nuanced approach to the acquisition of training abilities that are not technical in nature. Additionally, the use of film and imagery in medical simulation can provide an opportunity for wider interdisciplinary collaboration, as healthcare professionals, educators, and experts from the arts and humanities work together to create realistic and emotionally engaging simulations. By fostering such collaboration, medical simulation can benefit from the richness of diverse perspectives and enhance the overall learning experience for trainees. The reflection and modification processes in medical simulation have led to a growing understanding of the need for balance between realism and technology delivery.

1.5 The Necessity for Change in Medical Simulation

It is important to go deeper into the need for change in medical simulation, since we have covered the constraints of realistic simulation and the possibility of incorporating film theory and imagery to solve some of these limitations. Empathy and compassion are important factors in medical simulation that need to be prioritised. These two non-technical abilities, sometimes known more problematically as "soft skills," are essential to patient care and the delivery of healthcare as a whole. Positive patient-provider interactions, increased patient satisfaction, and improved health outcomes are all facilitated by empathy and compassion (Hojat et al., 2011). Therefore, in order to guarantee that medical professionals are suitably trained to deliver patient-centred care, it is imperative that these important components be included in clinical skills training and in turn medical simulation practise.

During the initiation of this research project, a BBC piece that was also a topic of discussion within the NHS focused on exploring empathy in healthcare, titled "Do Doctors Need to Be More Empathetic?" Harrison (2013) references Dutch theologian Henri Nouwen's insights from his work, The Wounded Healer. Nouwen (1972) emphasises the emotional consequences of impersonal treatment and a lack of empathy on patients, noting that individuals may leave the hospital physically recovered but emotionally wounded from the indifferent care they experienced. The article highlights that, instead of technical abilities, most professional encounters centre on the importance of listening and communicating effectively with patients (Harrison, 2013). Empathy is crucial for healthcare providers to build rapport with their patients and deliver optimal treatment. Patients do not anticipate that health practitioners will sympathise with them, but they do desire to be listened to and comprehended (Harrison, 2013). Healthcare workers must dedicate time to listen respectfully, appreciate the patient's perspective, and reply empathetically. In this respect, could the practise or activity of 'active' listening should be a criterion observed and scored in simulation scenarios, and could this be evidenced in filmed materials from the simulation within the debrief? Several studies have provided more evidence that demonstrates the value of empathy in the field of healthcare education. An example of this would be the discovery made by Neumann et al. (2011) that empathy decreases throughout the course of medical education as more technical skills are introduced. This finding highlights the necessity of interventions that aim to maintain and improve the empathic capacities of medical students, or at least retain a balance of importance in what is taught and valued as outcomes. Furthermore, Hojat et al. (2011) found that clinical competence is positively associated with empathy in medical students, underscoring the significance of empathy in the teaching of healthcare professionals. This decline has been investigated by a number of studies, which have provided useful insights into the possible mechanisms that are responsible for it as well as its consequences for patient care. A decrease in empathy was reported among medical students during their clinical years, with a more significant fall being observed among male students, according to Chen et al. (2012). It was advised by the authors that interventions should be implemented in order to offset the decline in empathy among medical students, as this could have long-lasting repercussions on the professional practice of medical students. The outcomes of this research indicate that there is a possibility that medical students' levels of empathy and compassion will decrease as they move through medical school and particularly when they enter professional practice. It is possible that medical simulation training, which is largely geared towards the development of technical abilities, may unwittingly contribute to this reduction, creating an environment in which students see empathy and compassion as being less significant, perpetuating a culture that places a higher priority on clinical knowledge than human connection (Fraser et al., 2012). Empathy and compassion may diminish during the duration of medical school and into professional practice, as indicated by the research of Hojat et al. (2009) and Neumann et al. (2011). This decline has the potential to lead to worse patient outcomes and decreased patient satisfaction. Nevertheless, healthcare personnel are less likely to experience exhaustion when they actively exhibit empathy and compassion (Wilkinson et al., 2017). In reality, empathy and compassion can serve as protective factors against burnout by cultivating a sense of purpose and connection within the healthcare setting (Trzeciak & Mazzarelli, 2019).

In order to address the probable connection between simulation training that focuses on technical skills and a reduction in empathy and compassion, medical educators need to make sure that empathy, communication, and interpersonal skills are incorporated into simulation training. According to Riess et al. (2012), there is data that suggests that including training in empathy and communication in simulation-based teaching can lead to improved patient outcomes and satisfaction. One example is the research conducted by Howick et al. (2017), which discovered that training that focuses on empathy and takes place in virtual environments has the potential to result in increased patient satisfaction and a decrease in patient anxiety. According to the article published by the BBC, one of the most important aspects of providing medical treatment is making an effort to comprehend the viewpoint of the patient and to empathise with the circumstances that they are facing (Harrison, 2013). Through the utilisation of cameras and the incorporation of applicable film theory principles into medical simulation training, might we better prepare medical personnel to offer the kind of compassionate and empathic care that patients require and deserve?

The incorporation of empathy and compassion into medical simulation, on the other hand, has proven to be a difficult task due to the fact that the technology that is currently available is mostly centred on technical skills and diagnostic learning outcomes. When it comes to eliciting empathetic and compassionate responses from trainees, high-fidelity manikins, which are frequently constructed from plastic and artificial materials, are lacking in the expressive traits that are necessary. This is because the appearance of the manikins, which frequently lack genuine facial expressions and other nonverbal indicators, does not effectively assist in the development of these crucial soft skills. The idea that I have referred to as "plastic shell syndrome" refers to the limits of manikins in this context, in particular, manikins are unable to demonstrate genuine facial expressions and emotional cues, which are fundamental for effective communication and the construction of a caring narrative. Due to the fact that trainees may find it difficult to interact with an artificial patient who is not responding to their actions, the lack of facial response can be detrimental to the development of empathy and compassionate care among trainees. For the purpose of representing patients in a extensive variety of training scenarios, the manikin and an apparatus or 'tool' is incapable of conveying the whole range of human emotions and facial expressions to match, despite the fact that they are able to successfully imitate some physiological activities, such as breathing and heartbeat. It is possible that this shortcoming results in a disconnection between the person participating in the simulation and the manikin, which will hinder the development of crucial non-technical qualities such as empathy and compassion, which are then essential in real-world healthcare situations beyond the training environment.

Figure 1 Laerdal's Simman 3G is an example of a high fidelity medical manikin used in simulations to present the patient with diagnostics.

During the course of simulation-based training, Rystedt and Sjoblom (2012) conducted a study that investigated the effect that the lack of emotional expressiveness of Manikins had

on the level of involvement displayed by medical students. They discovered that students were more focused on the technical components of the work and paid less attention to the emotional condition of the patient. This finding highlights the necessity of providing simulation scenarios with more realistic emotional cues through the use of simulations.
In order to address this problem, a number of researchers have investigated various alternative methods that can enhance the level of realism of simulated patients. These methods include the utilisation of standardised patients (SPs) or virtual patients. As stated by Lewis et al. (2016), standardised patients are human actors who have been educated to depict particular medical problems and emotional states to the audience. Because they are able to portray a wide range of facial expressions and emotions (at least as effectively as an actor would), which are essential for the development of empathy and compassion, they offer the benefit of presenting trainees with an experience that is more genuine and emotionally engaging. It is important to note that the utilisation of standardised patients requires a greater investment of resources and availability and may not always be a viable solution for all training scenarios. Secondly, it is not consistent since one actor could be more convincing than others, and the time that is allotted to the actors to completely embrace their past story as well as subtle narrative motifs and behaviours is restricted.

Virtual patients, on the other hand, are an additional method that can be utilised in the field of medical simulation to circumvent the constraints that are associated with manikins, and this area has certainly seen an uptake due to technological advancements such as ai and nessessities caused by the covid-19 pandemic in reducing face to face training. Using these computer-generated avatars, trainees are able to comprehend and respond to the emotional requirements of their patients and repeat the practise (Cook et al., 2010). These characters can be created to convey emotional cues and facial expressions. However, in Cook's research, there was no consideration given to how to read these emotional clues, and the computer-generated characters were pre-scripted and unable to engage in conversation flow. Virtual patients present a flexible and generally cost-effective alternative to standardised or even physically simulated patients after they have been commissioned. However, they still face significant hurdles in terms of the level of immersion, 'buy-in,' and interactivity that they are able to deliver. This, once again, requires a very technological approach in order to represent and project behaviours that are inherently human in nature (along with the intricacies of gesture that can be involved). Manufacturers are investigating the creation of more sophisticated manikins and simulation technologies that can accurately replicate human emotions and facial expressions, including eye tracking and facial muscle movement, such as that with the Gaumard Hal series of manikins (again at a significant price), often these advancements involve incorporating animatronics and facial recognition technologies with medical manikins to enhance the realism and responsiveness of facial motions (White et al., 2011). The technology enhancements should improve students' emotional connection during simulation-based training, but they are adding more high-tech features to a product that is already expensive and hard to maintain and operate. The significance of touch in healthcare communication is vital, yet it is frequently demonstrated with a manikin or a virtual patient. Physical contact can express empathy, comfort, and support during interactions with patients, playing a vital role in providing compassionate care (Montague et al., 2013). The current medical simulation technology is inadequate because manikins do not provide the same warmth, texture, and subtleties of human touch as real patients, which hinders trainees from practicing and developing empathic and compassionate behaviours through physical connection, and this feedback and texture absence likely does not encourage elements such as touch to occur.

Medical simulation technology has focused mostly on technical skills and diagnostic learning results, neglecting the promotion of soft skill interaction. Michael A. West, a prominent academic in compassionate leadership, has highlighted the need for empathy and compassion in healthcare (West, 2013). West's research indicates that compassionate leadership promotes a culture of excellent treatment, ongoing enhancement, and assistance for healthcare staff, which can be used in the development and execution of medical simulation. One potential avenue for incorporating empathy and compassion into medical simulation is by rethinking how simulations are recorded and filmed. By reconsidering the use of cameras and repositioning them from their observational roles on ceilings to capture more meaningful interactions, this medical simulation material can be reworked to create a filmic narrative that focuses on soft skills reflection, such as care, compassion, and communication. This approach would involve drawing upon knowledge from film theory and practice, which recognises the power of cinematography and editing in shaping the emotional and narrative impact of a film. In addition to repositioning cameras, the adoption of various film techniques, such as close-ups, point-of-view shots, and lighting adjustments, could be employed to better capture the emotional nuances of the simulation. Additionally, integrating elements of storytelling and narrative structure into the simulation design can enhance the emotional engagement of trainees and promote reflection on empathy and compassion. By embracing filmic techniques and narrative structures, filmed medical simulations could create a more immersive and emotionally resonant learning environment that encourages the development of these vital soft skills.

1.6 Technical Distraction in High Fidelity Simulations

Technical distraction is a occurrence in which the trainee's/participants attention goes from the primary learning aim to the technical features of the simulation. High-fidelity simulations frequently include extensive and complex technological components, and these aspects, while intended to improve the learning experience, can occasionally distract the trainee from the fundamental principles being taught. For example, a trainee may become consumed with learning the operation of the simulation equipment or its technological output (such as the patient observational monitor and any irregularities) rather than focusing on improving their clinical skills. In Torbay on one occasion, our high-fidelity manikins eye lids function failed during a simulation, and a resulting winking manikin caused diagnosis confusion, with trainees deeming that technological issue to be a possible cause of the illness. Additionally, facilitators or teachers may become concerned with technology, dedicating an excessive amount of effort to setting up, debugging, and maintaining the equipment, and this is especially true where some simulation programs in NHS organisations do not have dedicated technician provision. This can lead to less time spent on debriefing, feedback, and reflection, all of which are essential components of successful simulation-based learning (Fanning & Gaba, 2007). As a result, the planned educational results may not be met, and the overall effectiveness of the simulation experience may suffer. In addition to technical distraction, the expenditures on infrastructure and technical support for high-fidelity simulations can be significant. To run smoothly, such simulations frequently require dedicated facilities, advanced equipment, and specialised staff, with the role of simulation technician often overlooked. These factors add to the overall efficiency, frequency and expense of maintaining and running the simulation programme.

Given the time-sensitive nature of medical training, particularly for newly qualified doctors, the price weight of high-fidelity simulation programmes can limit the accessibility and scalability of simulation-based teaching. In circumstances where trainee and newly trained doctors require fast, efficient, and effective training, the expenses of these programmes may be too high. Additionally, high fidelity simulations necessitate continuous maintenance and updates to ensure that the equipment, AV and software stay relevant and functioning, as well as dedicated space to operate (sim labs). This dedication to technical upkeep can put further burden on expenditures, particularly in healthcare organisations like the NHS, where resources are often restricted and the everyday clinical pressures overshadow educational time. On the other hand, low-fidelity simulation approaches, despite the fact that they lack the glitz and technological attraction that attract placements, may offer a more accessible and cost-effective method of offering time-sensitive training. These approaches rely on technologies and resources that are simpler and more economical.

i) Redundancy in technological systems:

When it comes to simulation equipment, the existence of elements that are either superfluous or unnecessary is referred in this thesis as technological redundancy. There is a possibility that not all technological elements in a manikin or in a simulation lab will be applicable or necessary for a certain training situation, despite the fact that high-fidelity simulation is designed to create a realistic atmosphere. An example of an advanced feature that could be included in a high-fidelity manikin is the ability to exhibit blinking eyes, perspiration, or a programmable pulse as well as more specialist and specific outputs. Based on the findings of Rudolph et al. (2008), it is possible that these characteristics are not required for all training scenarios. Also, the existence of these characteristics can lead to an increase in complexity, which may not directly improve learning outcomes. It is possible that the incorporation of unnecessary components may result in greater expenses, both in terms of the original investment and the ongoing maintenance. This will therefore make simulation less accessible to both educators and trainees. It is especially difficult for smaller institutions or settings with limited resources to finance the high expenses associated with state-of-the-art simulation equipment (Issenberg et al., 2005). This can be a particularly tough situation for these specific types of organisations, who may understand high fidelity in this context as the only route to realistic quality outcomes. Therefore, widespread adoption and equitable access of simulation-based training can also be hampered by technological redundancy, which is especially problematic in resource-constrained environments where simplicity and cost-effectiveness are vital considerations. When it comes to maximising the benefits of simulation training, it is vital to find a balance between realism and practicality, with this knowledge to understand and discern especially true for clinical educators themselves as often those that are proposing and writing the justification business cases to finance teams and influencing the uptake for these activities as part of curriculum. In certain circumstances, this may entail selecting simulations with a lower level of fidelity or alternate methods, such as standardised patients or virtual reality, which are still capable of delivering important learning experiences despite the limitations that are associated with high-fidelity equipment (McGaghie et al., 2010) without it being viewed as 'second best'.

1.7 So what does this all mean?

High-fidelity simulations in medical education are praised for their capacity to accurately mimic real-life clinical situations and emergencies. However, as the pursuit of technological accuracy intensifies, there is a danger that the humanistic aspects of healthcare could be eclipsed by the technical complexity of simulation equipment. The pursuit of technological exactness in simulation might divert attention from essential elements of patient care, such as empathy, communication, and understanding, which are crucial for delivering good healthcare. Although high-tech manikins may simulate several physiological reactions effectively, their lack of capacity to mimic human emotions and interactions may result in overlooking these crucial aspects during simulation training. A manikin can display physiological symptoms like tachycardia or hypotension, but it lacks the ability to express emotions such as fear, anxiety, or discomfort, or to communicate personal worries or health-related inquiries. Additionally, focusing on the technical parts of simulation, such as operating the manikin or using complex simulation software, may shift focus and literally time away from observing the essential empathetic and interpersonal skills needed for providing successful patient care. Emphasising technical abilities may result in a narrow perspective on healthcare, focusing only on the biological components of illness and therapy while neglecting the equally crucial psychosocial aspects of patient care. In addition, technological redundancies in the equipment might further disrupt the focus of simulation training. Regularly updating or replacing simulation technologies may emphasise the importance of technical complexity in the tools rather than their effectiveness in enhancing the skills of healthcare practitioners, and this in turn may be casting an image of simulation being complex and hard to operate, which will likely exclude other healthcare disciplines for wanting to get involved, therefore, in short, it is absolutely crucial to achieve technological balance in simulation training. Technological improvements can improve the authenticity of simulations and offer great chances for learners to strengthen their technical skills, but they should not overshadow the significance of humanistic care. The objective is to combine technological accuracy with a focus on empathy, communication, and understanding to develop a comprehensive simulation experience that prepares learners for the complex nature of patient care.

When seen in this way, it would be advantageous to reconsider the function that technology plays in the field of medical simulation. Technology should not be viewed as an end in itself but rather as a tool that may be used to improve learning. Training programmes should strive to employ technology in a manner that cultivates both technical and humanistic abilities. This will ensure that while progress and coverage continues in a trusts technological journey (particularly in a time of national positivist rhetoric towards digital transformation), we do not lose sight of the primary goal of healthcare, which is to deliver treatment that is compassionate and centred on the patient. When it comes to the ability to reflect the delicate emotional cues and intricate intricacies of a true patient, the manikin, despite being an essential component of simulation-based education (SBE), is fundamentally limited. Nevertheless, the manikin is but one of the many components that make up the total simulation environment. By shifting our focus away from the manikin and towards the more expansive experience features of the simulation, alternative strategies can be devised emphasise and foster humanistic behaviours within the learners without the weight of simulations technological trends and financial constraints.

A framework for the explicit adoption of these humanistic ideals is provided by the debriefing process, which is an essential component of SBE. Debriefing gives students the opportunity to participate in thoughtful conversations about their behaviours, feelings, and answers while they are participating in the simulation. However, in order to truly support a focus on these humanistic ideals, it is often necessary to have a physical reference point, which is a visual medium that allows the learners to see and comprehend the activity that has just occurred (video playback from the scenario is often relied on in the debrief to review) but in particular a consideration of the patient's point of view. This is where the investigation of film theory and a shift in the way the camera is used can play a significant part in the storytelling process. Film theory offers a diverse collection of ideas and approaches that can be utilised to convey the subjective experience of an individual in a manner that is nuanced and empathic and produce visual materials for debriefing that more successfully highlight the humanistic components of patient care if we have a thorough understanding of these strategies and put them into practice. This transition from a typical objective camera perspective from the ceiling to a subjective "patient's perspective" has the potential to have a significant impact on the learners' comprehension of the patient's experience. Learners are presented with the emotional and psychological aspects of the patient's experience when the scenario is viewed from the patient's point of view. These aspects are sometimes missed in standard third-person camera positioned simulations, but can be encountered when examining the scenario from the patient's perspective.

When I first started my research in 2014, the rush of innovative technologies such as virtual reality (VR) and 360-degree cameras was just beginning to ripple through a variety of industries, including the healthcare industry. These newly developed technologies were shrouded in a sense of novelty and wonder, and they provided a tantalising look into an imaginative future in which conventional boundaries could be pushed and surpassed. Although the temptation was strong, I was aware that it was essential for me, as a researcher, to avoid getting carried away by the surge of enthusiasm without first conducting adequate research. In particular, the 360-degree camera was exciting because it promised to provide a perspective that was all-encompassing and saw everything in every direction. Because it presented a novel perspective—that of the patient—it had the potential to bring about a revolution in the field of medical simulation. Compelling was the concept of putting students in the position of those they would later serve by putting them in their own shoes. Additionally, it offered the prospect of producing multimedia content that is both rich and immersive, with the potential to serve as a potent focal point for the purposes of reflection and debriefing. Yet, the novelty of the technology also posed a risk of distraction. One could easily be fascinated by the immersive experience provided by these cameras, and this approach to some extent would continue the trend of simulation technology I have begun to already highlight, but it is important to consider if this new perspective genuinely enhances the learning process or if it might take away from the fundamental aspects of healthcare such as empathy, compassion, and human connection. Another new (but not new in the wider lifecycle) technology at the time was virtual reality (VR), which posed a similar problem. It was certainly fascinating that it could create a completely new and immersive environment, but the question remained: did it improve learning or was it just a technological diversion? The term 'technical sublime', or 'wow' moments, describes the sensation of surprise and wonder we get when we use a new piece of technology for the first time[3]. Particularly in the context of medical simulation and healthcare education, these instances provide ideological weakness even though they can also be thrilling and transformative. These "wow" moments can be very compelling, leading people to believe that implementing the newest technology will inevitably result in better outcomes—whether they are related to the quality of care, the learning environment, or the effectiveness of healthcare procedures. Although this worldview makes sense given the frequent 'wonder' capabilities of new technology, it can result in the blind adoption and application of these innovations without a careful analysis of their true advantages or possible disadvantages.

In medical simulation, this susceptibility can appear as an excessive focus on technological accuracy and complexity, neglecting other important parts of healthcare education, especially those concerning humanistic qualities like empathy and compassion. The impressive features of a new high-fidelity manikin or an immersive virtual reality experience could distract learners from the importance of developing advanced communication skills, understanding a patient's perspective, and handling intricate ethical dilemmas. This possible issue does not imply that new technology should be avoided or not incorporated into medical simulation. Conversely, technologies like 360-degree cameras and virtual reality can provide beneficial new methods for promoting empathy and improving learning. It is

[3] David Nye: In "Technology Matters: Questions to Live With", Nye discusses the concept of the 'technological sublime', which refers to the awe and wonder that people often feel in response to new technologies. He warns of the potential for this feeling to lead to an uncritical acceptance of technology. Additionally, in his book "Technopoly: The Surrender of Culture to Technology", Neil Postman critiqued the uncritical acceptance and celebration of new technologies, arguing that this often leads to the loss of vital human-centric values and skills.

essential to thoroughly assess the real effects of these technologies on learning outcomes when implementing them. Technology's 'wow' moments should be viewed as the beginning of investigation and assessment rather than the ultimate goal. This method ensures that technology is used to achieve the educational objectives of medical simulation, rather than the reverse, and prevents the technology from becoming a goal in itself rather than a means to improve the development of a more empathetic and compassionate approach to patient care. Having an understanding of this ideological susceptibility is essential in order to assure that the major objective of medical simulation is maintained, which is to enhance the quality of care that is provided to patients by equipping healthcare workers with the knowledge, abilities, and attitudes that are necessary for them to perform their jobs effectively. It's about making the most of the potential that technology offers without letting the first 'wow' factor of the technology cloud an investment decision. As a result, the journey that is being undertaken in this research is not just about discovering the cutting edge of what technology may offer; it is also about critically evaluating technology and implementing it in a meaningful manner, and this is a theme that potentially has value across the NHS and not just simulation.

The answers to these questions were everything but apparent in 2014. Unquestionably, a central and exciting part of this research was the necessity to address them and investigate the possibilities of new technologies in enhancing medical simulation through practise to provide tangible examples for the NHS teams I worked with. It was imperative to make sure that the use of these technologies would not only make simulation training even more sophisticated but would also significantly advance the development of a more sympathetic and caring approach to patient care. I perceived the task as being to evaluate these technologies critically, to see past their flashy packaging and impressive features, and to ascertain whether or not they could actually improve medical simulation training. It was important to make sure that, if used, these resources would significantly advance the development of humanistic abilities rather than just impressing students with their novelty. The purpose of the research practise was to determine whether and how these tools may be used to create powerful visual aids for debriefing and meaningful contemplation, which would aid in the development of empathy and compassion in medical practitioners.

Chapter 2: Resistance to the Camera

In this chapter, I will discuss film theory ideas and how they might be applied to the patient perspective in medical simulation training. I'll look at ways to capture empathy, compassion, and humanistic skills through the lens of a camera, and how this perspective might improve the overall effectiveness of simulation training. In addition, I will look at the opposition to the use of cameras in medical simulation and how it links to the history of technology and concepts from other fields. As a later experimental concept, I will also propose 'clinicians as content creators' courses to overcome opposition and train healthcare professionals how to perceive visuals in the language of filmmakers. Furthermore, I will explain the possible benefits of employing cameras in medical simulation, as well as how they might improve the realism and efficacy of training, using actual projects and debriefing photographs as examples. The third chapter will focus on the project's practical aspects, including a more in-depth look at how to create patient viewpoint films. This chapter is divided into three key areas of investigation;

I. Resistance to the Camera in Medical Simulation: In this section, I will investigate the opposition to the utilisation of cameras in medical simulation and how it manifests itself in relation to the history of the technology as well as concepts from other fields of study. The growth of film and imagery techniques, as well as the significance that digital technology play in contemporary simulation practices, are all included in this. In addition to this, I will discuss the significance of visual literacy for those working in the medical field, as well as the ways in which the implementation of cinema theory can facilitate the growth of analytical and observant skills in a clinical environment.

II. Advancements in Camera Technology in the Healthcare Sector: In this section, I will discuss the possible advantages of utilising cameras in medical simulation, as well as the ways in which these cameras can enhance the level of realism and efficiency of the training. I will also provide instances of images that are utilised in debriefing with reference to practical projects. As part of this, I will be discussing the impact that perspective plays in enriching the learning experience, as well as the potential for virtual and augmented reality technology to further immerse learners in patient-centered scenarios that are realistic.

III. Introducing Film Theory to a clinical audience: This section discusses how film theory intersects with medical simulation, highlighting important concepts from film studies that are applicable to both viewing and creating film material and 360-degree video content. This section also begins to highlight the format of workshops for engaging and educating clinicians to understand imagery beyond medical diagnosis. This process will involve examining the creative process of filmmaking, including storytelling, cinematography, editing, and sound design.

Additionally, this chapter presents a comprehensive overview of the current state of medical simulation and outlines the major issues, such as repeatability, cost, accessibility, and the preference for technology over non-tech methods. It provides a personal perspective of the specific topic of medical simulation discussed in this thesis (teaching compassion and empathy) and how it has been overlooked in healthcare training. The granularity of realism in the simulation and the development of human factors awareness appeared to be at odds. Initially, the tension of the uncanny valley and the lack of human reality in the manikin were assumed to be the root of the problem, with increasing realism overcoming the uncanny effect. This chapter will connect compassionate teaching to the image in medical simulation, arguing that adjusting the camera position will improve this by offering a more authentic, patient-centered perspective, which may ultimately lead to a more empathic and compassionate approach to patient care.

2.1 Resistance to the Camera in Medical Simulation

2.1.1 The Camera as a Diagnostic Tool

There has been a shift in the perception of the function that cameras play in medicine, which is one of the reasons why there is opposition to utilising cameras in professional medical simulation. Throughout history, cameras have played an important part in the telling of stories and narratives, assisting in the communication of intricate concepts and feelings through the use of visual methods. Early photographic techniques were used to document case studies and give visual references for medical professionals. The primary objective of these approaches was to capture the experience of the patient as well as the emotional impact of a variety of illnesses. Early photographic techniques, such as those utilised by Dr. Hugh Welch Diamond in the 1850s, were utilised to document case studies and give visual references for medical practitioners. The primary objective of these techniques was to capture the patient's experience as well as the emotional impact of a variety of illnesses (Burns, 2003)[4].

Dr. Diamond's research at Surrey County Asylum focused on documenting the emotional conditions of his patients, viewing photography as a valuable diagnostic and therapeutic tool. Dr. Jean-Martin Charcot utilised photography in the late 19th century to record the development of neurological illnesses like multiple sclerosis and Parkinson's disease at the Salpêtrière Hospital in Paris. These initial instances demonstrate the utilisation of images and photography to document patient feelings and emotions in a manner that may be readily comprehended and empathised with by medical practitioners. These early examples illustrate how photography was used to capture patient experiences and emotions, in particular in portrait and framed close up form which could be easily understood and empathised with by medical professionals. Dr. Diamond

[4] Stanley Burns, a renowned historian and collector, founded The Burns Archive, which is noted for its significant collection of early medical photographs. These photographs, dating from the 19th and early 20th centuries, document a wide range of medical conditions, treatments, and patient experiences, providing visually captured insight into the history of medicine and medical practices of the time.

and Dr. Charcot's innovative use of photography for medical records showcased the effectiveness of visual communication in expressing intricate concepts and feelings, and highlighted the ability to cultivate empathy and comprehension among healthcare professionals and patients, although much of this activity it could be argued was to build a record of the study of certain mental health conditions.

The Direct Cinema and Cinéma Vérité Movement of the 1960s, led by directors like D.A. Pennebaker, Richard Leacock, and Frederick Wiseman, aimed to depict the actuality of their themes, sometimes featuring medical procedures and patient narratives. "Titicut Follies" (1967) by Frederick Wiseman is a notable example of a film that documented the conditions at the Bridgewater State Hospital for the criminally insane in Massachusetts. These documentary film methods were designed to offer an untainted portrayal of the patient experience, fostering an emotional bond with the viewers and promoting empathy (Wiseman, 1967). Medical educators can help trainees understand the value of cameras in capturing the patient perspective and fostering empathy by recognising the historical context of cameras in medicine and incorporating film theory concepts like Direct Cinema and Cinéma Vérité, along with the innovative work of Dr. Hugh Welch Diamond[5]. Overcoming reluctance to cameras in medical simulation can increase the learning experience for healthcare practitioners. But as medical imaging technologies advanced, the camera's function changed to become more technical and diagnostic. With the development of advanced imaging technologies such as magnetic resonance imaging (MRI), computed tomography (CT) scans, and X-ray imaging, the camera was no longer used to record the humanistic aspects of patient experiences, but rather to record the internal structures and functions of the body. Since the clinical and diagnostic uses of these technologies have eclipsed the previous emphasis on narrative and emotional engagement, there may have been reluctance to use cameras in medical simulation due to this shift in emphasis towards more objective and

[5] Dr. Hugh Welch Diamond's notable portrait "Patient, Surrey County Lunatic Asylum" exemplifies his significant contributions to early psychiatric photography and can be explored in the Metropolitan Museum of Art's online collection. Accessible via https://www.metmuseum.org/art/collection/search/283091

technical imaging. Medical simulation instructors could think about introducing film theory and cinematography skills into their training programmes in order to overcome this reluctance and reintegrate the camera's historical function in storytelling and emotional involvement.

2.1.2 The Ceiling-Mounted Camera and the Perception of Surveillance

The usual habit of installing cameras on the ceiling as part of the AV technical configuration is another aspect that adds to the reluctance towards the camera in medical simulation. Instead of using the camera to capture the patient perspective and improve emotional cognition, this location may foster a culture of watching and surveillance, making medical students view it as a vital instrument for performance evaluation.

In medical simulation, cameras positioned on the ceiling have become standard equipment, especially when it comes to audio-visual (AV) technical installations. Although the purpose of these cameras is to record the activities in the simulation room for future analysis and education, they may unintentionally foster a feeling of watching and surveillance. This misconception may cause medical students to see the camera not as a tool for developing empathy and capturing the patient perspective, but as a means of observing and evaluating their performance, which still holds value when considered from a purely technical skills assessment approach. A pertinent framework for comprehending this occurrence is provided by Foucault's Panopticon theory (Foucault, 1977). Jeremy Bentham proposed the Panopticon jail concept in the late 18th century, where a lone guard could watch over all of the prisoners from a central tower without being noticed. Expanding on this idea, Foucault investigated how, in diverse social circumstances, self-discipline and control might result from surveillance and the persistent sense of being watched. Similar feelings of constant scrutiny can be evoked in medical simulation using the ceiling-mounted camera, making trainees feel inspected and judged.

Creating a high-pressure environment in which trainees feel pressured to perform precisely might have a negative impact on their learning experiences (Laurillard, 2012). This can be a result of the feeling that they are being kept under observation. As a result of this pressure, trainees may be dissuaded from taking chances, making mistakes, and learning from those mistakes, all of which are critical components of the learning process. Additionally, trainees may be distracted from interacting with the patient perspective and establishing empathic understanding if they are focused on their own performance. The utilisation of several cameras and multiple screens has been a standard practice in the AV set up of medical simulation.

Figure 2 Quadrant view cameras for simulation playback and observation in the Torbay medical simulation suite. Peres, N 2013

This is done in order to capture a variety of viewpoints and perspectives of a training scenario. While this method does give a thorough visual record of the simulation, it also has the potential to create difficulties in terms of how the audience perceives the visuals and how they learn from them. The potential for cognitive overload is one of the problems that can arise when using several cameras and multiple screens. When numerous points of view are presented at the same time, it may be difficult for viewers to efficiently comprehend and integrate all of the information. The human brain has a limited capacity for processing visual information, and when it is presented with a large number of visual stimuli, it becomes more difficult to identify the components of the scenario that are the most important and significant (Sweller, 1994). Another issue is the fragmentation of the viewer's attention. When using many cameras and screens, the viewer's attention is split among various screens, which can complicate the ability to grasp the complete event. This fragmentation may cause challenges in understanding the narrative progression of the simulation and recognising crucial moments or interactions that require closer analysis or are told through more subtle details. Additionally, the use of multiple cameras and screens can unintentionally lead to a feeling of disconnection among those viewing the content. By showing several viewpoints, the trainees could find it challenging to fully engage with the patient's journey, thereby hindering the development of empathy and comprehension. On the other hand, using a single, carefully chosen camera angle could potentially, given our understanding from film theory (and indeed the way we are engaged in filmic experiences as an audience) effectively communicate the patient's perspective and establish a more profound emotional bond, improving the educational process. So medical educators may need to re-evaluate the use of multi-camera and multi-screen simulations and look into alternate ways that promote learning and empathy. For example, choosing a single, carefully chosen camera viewpoint that emphasises the patient's perspective can result in a more concentrated and immersive learning experience. Additionally, using film theory ideas such as narrative structure, camera angle, lighting, and framing can assist instructors in creating more effective and compelling simulation films that improve audience comprehension and empathy.

To address these concerns, numerous strategies that define the orientation of this research effort can be used:

1. Camera positioning: Experiment with various placements to minimise the sense of surveillance, such as placing cameras at eye level or using wearable cameras (Maggio et al., 2015). This approach shifts the focus from evaluating the trainees' performance to comprehending the patient's perspective and promoting empathy.
2. Clearly explain to trainees the purpose and utility of cameras in medical simulation, emphasising that they are tools for educational purposes rather than solely for monitoring performance (McGaghie et al., 2010). Efficient communication can alleviate anxiety and foster a favourable learning environment.
3. During debriefing and feedback sessions, it is fundamental to cultivate a welcoming and impartial environment (Fanning & Gaba, 2007). Trainees should be encouraged to openly admit their mistakes and view them as chances for growth, rather than fearing consequences, where an understating of the importance of graphics and the camera in creating content for debriefing these very situations.
4. Promote a culture of learning by emphasising the need of a growth mindset and the advantages of mistakes in the learning process (Dweck, 2006). Establishing a learning-focused environment may help to reduce trainees' camera shyness and enhance their commitment to empathy and patient care.
5. Lack of knowledge about the camera and its role in the hospital setting frequently leads to opposition from medical participants. Clinicians and practitioners may find it challenging to view the camera as a valuable tool in their practice due to its unconventional appearance compared to regular medical equipment. This lack of familiarity may result in a hesitancy to interact with cameras during medical simulations, which might restrict the possibilities for creative and efficient training techniques. The absence of creative camera exposure in healthcare rather than that of diagnostic can lead

to a limited comprehension of the technical features and advantages of utilising cameras in medical simulation. Clinical staff may lack awareness of how cameras might be utilised to capture the patient's perspective and improve non-technical skills due to a lack of exposure to these concepts during their training. By educating and exposing healthcare staff to the camera's capabilities in medical simulation at education level, they may become more open to the concept of using cameras in their training and practice.

Throughout my research and experience with cameras for medical simulation, I have continually discovered that using smaller cameras, and in particular when using 360-degree cameras is often preferable than using larger, more complex cameras. This decision is primarily motivated by the fact that smaller cameras are less visible and perhaps appear less strange in the healthcare setting. My decision to prioritise the integration of smaller cameras over larger counterparts, despite the potential compromise in technical quality and higher resolution, is based on the observation that these cameras allow for a more accepted and less disruptive intervention within the simulation process. As a result, the presence of the camera is less likely to distract or intimidate the healthcare professionals taking part in the simulation, allowing them to concentrate on the task at hand and fully participate in the learning experience. This practise based research-driven approach to camera selection in medical simulation emphasises the necessity of taking into account not just the technical capabilities of the equipment, but also the effects on participant comfort and capacity to interact effectively in the learning process. By recognising potential challenges to acceptance and taking steps to eliminate them, such as using less prominent cameras, we can contribute to a more favourable environment for effective and innovative medical simulation training.

Smaller cameras, especially those with a simpler appearance, may be more acceptable by healthcare practitioners for various reasons:

1. Less intimidating: Compact cameras may appear less daunting to healthcare professionals and anyone involved in medical simulations. Their inconspicuous size and design can alleviate tension and discomfort among staff, enabling them to concentrate better on the simulation exercise and their learning experience.
2. Smaller cameras can be integrated more easily into the medical simulation environment due to their modest size, creating less disruption. They can be positioned in various positions to offer diverse viewpoints without occupying significant space or disrupting participants' activities.
3. Diminished surveillance perception: Smaller cameras, being less prominent, can alleviate the sense of surveillance commonly linked to larger, more noticeable cameras. This can lead to a more relaxed and genuine simulation environment, enabling healthcare personnel to completely engage in the learning process.
4. Improved patient viewpoint: Compact cameras placed nearer to the patient's perspective can capture the nuances of non-technical abilities and human variables that are frequently overlooked by bigger and distanced ceiling-mounted cameras. This can offer valuable perspectives on the patient experience, fostering empathy and enhancing patient-centered care.
5. Enhanced acceptance: Utilising smaller, less noticeable cameras can result in increased acceptance and openness to engage with video technology among healthcare workers. Consequently, this can enhance the efficiency and creativity of medical simulation training.

2.2 Advancements in Camera Technology in the Healthcare Sector

Understanding the reluctance towards cameras in medical simulation requires examining the evolution of camera technology in healthcare. The camera's advancement in medicine has mostly concentrated on capturing medical images for diagnostic usage. Historically, medical photography was used for recording and education purposes, and the advancement of endoscopic cameras transformed minimally invasive surgeries. Advanced imaging technologies including MRI, CT scans, and ultrasound have strengthened the camera's use as a diagnostic tool. These advancements enabled medical personnel to observe internal structures and processes with exceptional detail, transforming their approach to diagnosing and treating patients. The evolution of camera technology in healthcare has prioritised diagnostic imaging over narrative and storytelling elements, leading to a decline in the camera's ability to foster empathy and human connection[6].

As a result, the present perception of cameras in healthcare is naturally centred on their diagnostic capabilities. The potential for using cameras to depict the patient's perspective, express emotions, and promote empathy in medical simulation training may have been ignored due to this trend, as well as simulation staff's clinical experiences. By examining the camera's historical role in medicine and investigating its storytelling potential, healthcare workers can gain a better understanding of the camera's ability to improve empathy in medical simulation. To overcome the opposition to employing cameras in medical simulation, it is critical to address these concerns and illustrate the benefits of introducing cameras into training. This can be accomplished by educating and exposing patients to the camera's capabilities, emphasising the potential benefits of capturing their perspective, and cultivating empathy through novel training approaches. To demonstrate the value of cameras in medical simulation, I thoroughly tested and

[6] In the appendix of this thesis, I offer a timeline history of the evolution of medical cameras that illustrates this core focus towards diagnostic imagery.

evaluated various 360-degree cameras in a variety of medical simulation scenarios, collaborating closely with clinical and our simulation teams to gather valuable feedback and insights into their suitability for healthcare settings. This hands-on, iterative approach has not only helped me grasp the practical consequences and problems of employing these cameras in medical simulations, but it has also allowed me to find the models that best fit the specific demands of medical professionals and patients.

The timeline below provides a description of the 360-degree cameras I tested during my research, highlighting the advantages and disadvantages of each model in terms of medical simulations. This examination of the evolving technology of 360-degree cameras, combined with practical experiences and clinical feedback, provides a unique opportunity to demonstrate their potential benefits within a healthcare context rather than borrowing learning from other industry in capturing the patient's perspective and creating an immersive simulation environment for use in training.

2015 - GoPro Rig

- Appearance: A DIY rig consisting of six GoPro cameras connected together, resulting in a larger, more visible configuration.
- Quality: 4K resolution, based on the GoPro model used
- Pros: Higher resolution and image quality, allowing for clearer recording of medical simulations and more precise analysis of participant performance.
- Cons: More time-consuming and complex to set up and synchronise, potentially causing delays in training sessions; larger and more obtrusive, perhaps disrupting the natural flow of medical simulations and making participants feel self-conscious.

2016 - Samsung Gear 360

- A small, white spherical design that blends in well with other medical devices as far as appearance is concerned
- For quality, a resolution of 4k, stitched between a front and rear lens.
- Pros: It is easy to use and provides good-quality imagery, which facilitates easier placement for patient views. Additionally, it is compact, unobtrusive, and widely accepted by medical professionals because of a familiar colour and design. This allows for smooth inclusion into medical simulations.
- Cons: The battery life is limited, and a Samsung smartphone is required for full performance.

2017 - Insta360 Pro

- The camera has a large, black spherical shape and six lenses, giving it the appearance of a highly advanced technological device.
- High-quality: resolution of 8K
- Exceptional image quality, which enables extensive examination of medical simulations; the capability to live stream and record in three-dimensional space, which provides an immersive training experience
- Cons: It is expensive; it is larger and more noticeable, which may have an effect on the realism of medical simulations and cause participants to feel self-conscious; it requires a strong computer for editing and processing.

2018 - GoPro Fusion

- The camera has a compact, rectangular design and is black in colour. It has lenses on both sides.
- Resolution of 5.2K is the quality.
- Pros: outstanding image quality and stabilisation, which provides stable and clear footage of medical simulations; easy to use and incorporate into medical simulations; rugged and waterproof design; image quality and stabilisation that are outstanding.

- Cons: The battery life and storage capacity are both limited, and key functionalities require a GoPro subscription in order to access properly.

2018 - Vuze XR

- Appearance: a small, black design with two lenses that can switch between capturing in two dimensions and three dimensions
- Resolution of 5.7K is the quality.
- Advantages: Dual-function camera that captures 3D video in both 360-degree and 180-degree angles, offering a wide range of alternatives for creating medical simulations; design that favours the user; simple to install and operate
- Cons: The battery life is short, and in order to fully utilise the device, you need a smartphone.

2018 - Yi 360 VR

- The appearance is a compact, rectangular form that is black and has twin lenses.
- Resolution of 5.7K is the quality.
- Pros: The device is lightweight and portable, and it has a user-friendly design. Additionally, it has live streaming capabilities, which allow for remote observation and feedback during medical simulations.
- Cons: It has a short battery life, and it needs to be connected to a smartphone in order to perform all of its functions. Additionally, it could not be as sturdy as other versions, which could potentially affect its longevity and reliability in medical simulation scenarios.

2019 - Insta360 ONE X2

- Appearance: a cylindrical shape that is compact and black in colour, with twin lenses
- Resolution of 5.7K produces excellent quality in lower light situations.
- The advantages include a design that is both waterproof and rugged; a superb image quality and stabilisation system that guarantees smooth and clear recording of medical

simulations; design that favours the user; built-in touch screen for user-friendliness, making it a more approachable instrument for medical practitioners to use
- Cons: The battery life is limited, and certain functionality needs the use of a smartphone, which may not always be available or practical in circumstances that involve medical simulation.

2019 - Insta360 Pro 2

- Large, black spherical camera with six lenses is the appearance of this camera.
- High-quality: resolution of 8K
- Advantages: Superior image quality, which enables highly detailed analysis of medical simulations; the capability to live stream and record in three dimensions, which provides an immersive teaching experience for medical personnel
- Cons: It is expensive, which may make it inaccessible to smaller institutions or facilities with limited budgets; it is larger and more noticeable, which may cause participants to feel self-conscious and may disrupt the natural flow of medical simulations; it requires a powerful computer for editing and processing, which adds complexity to the workflow.

The diverse selection of 360-degree cameras provides numerous options for incorporating them into medical simulation training. To maximise their potential and address the reluctance to use cameras in this situation, it is valuable to close the gap between the technical features of the cameras and the theoretical comprehension of their significance in narrative and empathy. Implementing training themed such as 'clinicians as content makers' can assist connect medical practitioners with the utilisation of cameras in medical simulation and training. These types of activity creates engagement to provide healthcare workers and clinicians with practical experience in utilising cameras, an upskilling opportunity as well as introduce them to the film theory principles that support their use in medical simulation training. Clinicians can enhance their awareness of the creative process and recognise the need of integrating cameras into their training programmes by immersing themselves in both the practical and theoretical elements of camera usage. Also, these workshops can cultivate a feeling of ownership and familiarity with the technology, ultimately resulting in more efficient and creative medical simulation experiences and illustrate how cameras enhance the authenticity and effectiveness of medical simulation training by citing realistic projects and instances of imagery used in debriefing. Applying a film theory approach to healthcare education provides distinct insights into analysing and interpreting pictures, especially in uncovering the humanistic characteristics and emotions conveyed in the visuals. Medical imagery like X-rays and ultrasounds necessitates technical knowledge to interpret, whereas film and photography excel at expressing emotions, narratives, and relationships using techniques such as camera angle, lighting, and framing. Films and images produce emotions and relationships that resonate with people on a personal level. Film theory can provide understanding on how images convey intricate stories and feelings, which can therefore enhance healthcare teaching. Incorporating film theory into healthcare training could offer significant advantages and is not necessarily a ground-breaking concept. Training healthcare practitioners to be more discerning interpreters of visual stories can help them gain a deeper understanding of the emotional and psychological dimensions of health and disease. This may result in a deeper comprehension of the patient experience, ultimately improving the empathy and communication abilities of healthcare workers. Additionally, the skill of analysing and interpreting visual stories can be used to assess medical simulations and wider training activities, such as those like breaking bad news, equality, diversity and inclusion (EDI) and confrontational encounters, aiding healthcare practitioners in identifying and comprehending subtle hints, perspectives and interactions that might be overlooked otherwise.

2.3 Introducing Film Theory to a clinical audience

This section will examine how film theory intersects with medical simulation, highlighting important concepts from film studies that are applicable to creating 360-degree content. These concepts can improve the design, delivery, and assessment of healthcare simulation experiences, especially when considering the camera apparatus as a tool that is already available but not fully utilised. Film theory and medical simulation, despite their apparent differences, both aim to create immersive and thought-provoking experiences that evoke emotions and facilitate meaningful learning and transformation, even with 360-degree or immersive content creation. First, I will present a few significant film theories that can provide helpful perspectives for medical simulation practitioners. The following theories are included:

1. Auteur Theory: The director, simulation designer, or educator is the main creative influence shaping the experience.
2. Apparatus Theory explores how technology and equipment influence the viewer's or learner's experience of a simulated scenario.
3. Reception Theory refers to the audience's active involvement in interpreting and creating meaning from their experience.
4. Dispositif is the idea that analyses the organisation and interaction of different factors, such technology, practices, and institutions, that impact the overall experience and interpretation in film and medical simulation.
5. Suture refers to how individuals are placed and included into a conversation or story, focusing on how individuals in a medical simulation are positioned inside the scenario and develop their comprehension.
6. Semiotics is the examination of signs, symbols, and their interpretation, specifically in relation to the visual and aural components of a simulated situation.

I will present a brief review of each theory, explain its relevance to healthcare simulation, and look into potential applications and consequences for simulation design, delivery, and evaluation. Throughout the chapter, I hope to bridge the gap between the film and healthcare industries by illustrating how film theory may provide useful insights and tools for improving the effectiveness and impact of medical simulations. I will look at the notions of dispositif and suture, and how they might help us better build and comprehend the medical simulation experience. I hope that by exposing these notions to an audience who is unfamiliar with film theory, it can foster a better awareness of the complex dynamics at work in medical simulation and inspire new approaches and perspectives for future practice.

Auteur Theory:

According to the Auteur Theory, the director, who is the major creative driver behind a film, imprints their own unique artistic stamp on the picture. This is the central notion of the theory and provides a better understanding of the significant part that individuals play in the formation of a cinematic work, as well as the significance of their creative vision in determining the final outcome. The Auteur Theory was developed as a reaction to the widespread belief that films were essentially the finished product of a collaborative process, with little consideration given to the unique influence of the director. Within the framework of healthcare simulation, comparisons can be drawn between the director of a film and the designer of a simulation or the educator running the simulation. The development of the simulated scenarios, the establishment of the learning objectives, and the supervision of the entire simulation process are all responsibilities that fall under the purview of these persons. The personal touch, the uniquely experienced perspective, and knowledge that they bring to the simulation have a substantial impact on the success of the simulation in terms of improving the participants' learning and skill development. One of the most important aspects of the Auteur Theory is the concept of "mise-en-scène," which refers to the way in which visual components, actors, and locations are arranged inside a certain scene (Kolker, 2006). In the context of medical simulation, the concept that is equivalent would be the design and organisation of the simulation environment. This would include the selection and placement of equipment, the positioning of the patient (or manikin), and the arrangement of the simulation space in order to provide the participants with an experience that is both immersive and realistic of the real world alternative, but provide movement and pathway opportunities to interact with these various elements, like a stage.

The camera's role in medical simulations can also be reassessed in light of the Auteur Theory as traditionally and already mentioned, cameras in simulation settings have been ceiling-mounted, providing a fixed view of the environment. This approach may limit the ability to capture nuanced subtleties, interactions, and behaviours during the simulation. By adopting the concept of the simulation designer as an 'auteur,' there is opportunity to experiment with more innovative and dynamic camera techniques to capture a more thorough and immersive portrayal of the simulation experience. For example, the simulation designer may opt to use many cameras or camera angles to obtain a more complete view of the participants' performance and interactions, but will want to consider how this is viewed rather than the convenience of a mosaic/quadrant arranged screen. This approach may expose parts of the simulation and areas of the environment that would otherwise be neglected, such as communication dynamics, teamwork, and nonverbal cues 'out of frame'. Furthermore, the designer may explore using 360-degree cameras to provide a more holistic picture of the simulation, allowing participants to examine and remark on their performance from various perspectives and the activity in these shadowed or lesser captured areas during debriefing sessions. By adopting an 'auteur' approach in the design and execution of medical simulations, this promotes experimentation and innovation in simulation design using tools not totally unknown or unfamiliar, potentially leading to more engaging, immersive, and successful learning experiences for healthcare professionals.

Apparatus Theory:

A film theory called apparatus theory explores the ideological consequences of cinematic technology and how it affects how viewers perceive and comprehend the world. Apparatus Theory, developed by prominent theorists like as Jean-Louis Baudry (1974) and Christian Metz (1974), posits that the cinema apparatus, comprising of the camera, projector, and screen, shapes the audience's experience by directing their emotions, thoughts, and reactions. It is important to take into account the possible effects of apparatus theory on participant experience, learning, and comprehension of the simulated scenario while using healthcare simulation. It is possible to view cameras and other technology used in simulation environments as a tool that affects how participants interact with and understand the simulation. Conventional camera setups, like ceiling-mounted cameras, could only offer a narrow view of the situation, thereby emphasising some parts of the simulation while hiding important information on human dynamics or non-technical skills. Participants in simulated situations may react negatively to the presence of cameras, feeling anxious or self-conscious about being recorded. This resistance might cause behavioural changes, reducing the validity of the simulation and perhaps impeding the learning process. Recognising and resolving this resistance allows simulation designers to investigate other camera placements, technologies, or techniques to reduce the impact of the camera device on participant behaviour and improve the overall effectiveness of the simulation.

High technology fidelity in simulation environments can also help to disguise non-technical skills or human issues, as already discussed in the context of medicine. The use of sophisticated equipment, such as complex patient simulators or virtual reality systems, raises the risk of overemphasising technical abilities at the expense of non-technical factors like communication, teamwork, and decision-making. Apparatus Theory encourages critical thought on the potential biases and restrictions presented by these technologies, inviting discussion of how they may impact the simulation's learning outcomes. To solve these challenges, it may be useful to take a more holistic approach to simulation design, taking into account the interaction of the camera apparatus with other technologies in the simulation environment. This strategy could include using unexplored and under-utilised camera angles to get a more complete perspective of the simulation, allowing for a more in-depth investigation of non-technical abilities and human aspects. Furthermore, simulation designers may investigate the use of less intrusive camera technologies or approaches, such as 360-degree video or wearable cameras, to lessen the impression of monitoring and encourage more realistic activity among participants.

The concept of spectatorship in Apparatus Theory provides useful insights into the experience of healthcare professionals who observe recorded simulations. It is useful to acknowledge that the camera apparatus and the presentation of the scenario might influence the observer's understanding and interpretation of the simulation. By broadening the scope of perspectives and providing a more comprehensive view of the simulation, observers can have a better understanding of the complexity inherent in the scenario and more properly evaluate both technical and non-technical skills. Apparatus Theory offers a valuable perspective on the function of cameras and other technology in influencing healthcare simulation experiences. By identifying the potential biases and limits provided by these devices, simulation designers might devise techniques to lessen their influence, such as employing different camera positions, several cameras, or investigating less intrusive camera technologies.

Reception Theory:

Reception Theory is a critical theory developed in the field of literary studies that emphasises the importance of the audience or reader in the interpretation of a text. This approach recognises that the meaning of a work is established not just by its creator, but also by how the audience interacts with and interprets the content (Holub 1984). When applied to healthcare simulation, Reception Theory gives useful insights into how participants engage with and interpret the simulated experience, as well as how this understanding influences their learning. For healthcare simulation designers and educators, addressing the viewpoints of participants is important for building effective learning environments. Simulation designers can use Reception Theory principles to create scenarios that consider participants' different backgrounds and experiences, ensuring that the information presented is accessible and engaging to all. This could include modifying the simulation to fit diverse learning methods, cultural settings, and levels of prior knowledge. Reception Theory emphasises the relevance of evaluating how the simulation environment effects participants' comprehension and participation. The layout of the physical room, the employment of props and equipment, and the presence of other participants or observers can all influence how participants interpret the simulation scenario. By keeping these criteria in mind, simulation designers can develop environments that encourage immersive and meaningful learning. Additionally, Reception Theory fosters continuing communication between healthcare simulation designers and the participants, by seeking input from participants on their experiences and perceptions, simulation designers may constantly tweak and improve their scenarios to better meet the goals of learners. This feedback loop is important for keeping healthcare simulations current and successful as the industry changes and new difficulties and themes in the NHS arise.

Depositif:

The term "dispositif" refers to the full experimental setup, including the camera or machine, that follows a specific practice. In the context of this research, the dispositif includes not just the film camera or 360-degree camera, but also the positioning of characters within the scene, structured discourse, the usage of a tripod or head-removed manikin to represent the body, and film stitching for playback in a VR headset. Bernard Vouilloux defines dispositif as a "structure in motion," (Ortel, P. 2015) referring to how the device functions for a certain purpose or situation. This notion is consistent with "Apparatus Theory," which investigates the interaction between a system's technical components and the larger social, cultural, and ideological forces that impact the production and reception of the pictures created. In this sense, the apparatus theory of medical simulation may serve to suggest the distinction, as well as the influence that simulation 'high-fidelity' technology has had on how cameras and video footage have been deployed and used for teaching purposes.

The concept of the dispositif, as applied to my practise covered in the following chapter, generating patient perspective videos in medical simulation, emphasises the significance of examining all aspects of the experimental setup rather than relying just on the technology used. By doing so, simulation teams may acquire a better understanding of how the various components interact to provide an immersive and effective learning experience for medical trainees and professionals. Expanding on this concept, the dispositif can be viewed as a dynamic system in which each component - the camera, performers, surroundings, and technology - interacts and impacts the others. In the context of medical simulation, this means that the simulation's effectiveness or level is determined not only by the technology's quality, as is the prevailing rhetoric, but also by the authenticity of the actors' and stooges (staff planted within a simulation to drive and direct the progression of a scenario) performances, the realism of the environment, and how these elements are combined in the final presentation. For example, medical trainees and staff may come to the simulation with preconceived views about the role of technology in medical training (as addressed in the preceding chapter) or with specific expectations about what they would see in the simulation. These elements can influence how individuals interact with the simulation and how open they are to learning from the gathered imagery - particularly the patient perspective. Christian Metz's idea of the dispositif can be used to investigate the link between technology, representation, and the spectator in the context of medical simulation and education. The medical professionals taking part in the simulation training are referred to as the spectators in this instance. According to Metz, the notion of the dispositif highlights the significance of the symbolic apparatus of film, which extends beyond its technical aspect. This viewpoint challenges us to think about the ways in which medical simulation and related technologies may be applied to produce a symbolic and representational experience that involves trainees and participants more deeply.

The dispositif could also be interpreted as a device used in medical education with the intention of tricking the participant into reacting more strongly to the simulation or engaging with it more fully. The simulation can effectively challenge the learner's preconceived assumptions and expectations by generating a realistic and immersive environment, which will ultimately result in a richer learning experience. However, as Metz suggests, the dispositif might also be seen from a more subjective perspective, in which the user's or the machinist's point of view is the main focus. From this angle, the medical person taking part in the simulation turns into an active learner who shapes the simulation's conclusion and interpretation according to their own experiences, expertise, and knowledge. When considering the camera and adding more inclusiveness to medical simulation, both dispositif techniques provide insightful information about how to design and use the tool to improve the learning process. Teachers and facilitators can start creating compelling simulations that take into account the role of imagery without being dependent on the predetermined standards of high-tech infrastructure by having a thorough awareness of the intricate relationships that exist between technology, representation, and the learner.

Suture & 360-degree medium:

Having examined the notion of 'dispositif' and its importance in healthcare simulation, it is useful to grasp its connection with another significant film theory concept, 'suture'. Dispositif and suture both involve the spectator's experience. Dispositif emphasises how elements are arranged in a scene and their effect on the viewer, while suture looks at how the viewer's subjectivity is formed inside the film's discourse. In healthcare simulation, the dispositif can be used to refer to the arrangement of components that impact a patient's experience, including the environment, interpersonal communication, and technical aspects of therapy. Suture can refer to how these components are displayed and how they create a particular viewpoint for the spectator, specifically the healthcare trainee or professional. By integrating the concepts of dispositif and suture, it is possible to gain a deeper knowledge of the intricacies of the patient experience and the role of healthcare providers in moulding it. In the following parts, I will go deeper into the notion of suture and look at how the unique medium of patient perspective and 360-degree video;

Exploring the concept of 'suture' in cinema theory and its connection to the healthcare setting involves analysing the shot/reverse shot or cutting from one perspective to another perspective technique and its impact on the viewer's perception. The shot/reverse shot and cutting technique in film alternates between shots of two people, usually taken over the shoulder of the other character, to provide a sense of communication or interaction between them. Shot/reverse shot can be viewed as a visual metaphor for the continuous exchange of information between healthcare providers and patients. The shot/reverse shot approach offers viewers alternating perspectives of each character in a dialogue, similar to the continuous flow of information and perspectives between clinician and patient that influences their mutual understanding. As previously stated, the audience of a film initially perceives the cinematic world as a complete and immersive environment, believing they have entire access to the events on screen (Metz, 1982). Similarly, healthcare workers may assume that their training and skills provide them with a complete picture of a patient's experience. However, as the film progresses, the audience realises that their perspective is limited by the confines of the frame. In the healthcare environment, professionals may discover that their perspective on a patient's experience is intrinsically limited by a variety of factors, including their own biases, preconceptions, and the specific circumstances of the patient contact. According to Oudart (1977), acknowledging these limitations in cinema and indeed healthcare might cause a sensation of disquiet or discomfort when the individual becomes conscious of their imperfect comprehension. These limits have been acknowledged in the field of medical education, as narrative medicine and reflective practice have gained popularity. Charon (2001) contends that "narrative competence" is required for healthcare practitioners to grasp patients' narratives and make sense of their own experiences. Similarly, Bleakley (2005) emphasises the value of reflective practice in medical education, arguing that "reflection is a way of standing back from the immediate in order to see it more clearly." In response to these restrictions, the usage of 360-degree video in healthcare settings may provide an alternate perspective, allowing practitioners to better understand and empathise with patients. 360-degree video captures the entire environment, providing a more thorough perspective of the clinical condition, including subtle or even unintentional humanistic skills activity in the corners of simulated areas. Finally, the adoption of 360-degree video in healthcare might be viewed as a speculative attempt to address the perspective limits inherent in both cinema "within the frame" and healthcare. While components of film theory are extremely valuable, the concept of seeing just around someone's vision may be more effective in capturing subtle or even unintentional humanistic skill activity in the unintentional interactions and those activities outside the usual field of view. 360-degree video may help to bridge the gap between theory and practice by providing a more thorough and immersive picture of the clinical environment, allowing healthcare practitioners to gain a better knowledge of the patient experience that presents itself to them, environment, sounds, machinery, ceiling spaces and all.

By using a 360-degree video approach, this may start to address these constraints and provide viewers, especially those who work in the medical field, with a more immersive and all-encompassing viewpoint on a specific scenario. According to Grau (2003), immersive imagery "gives the viewer the opportunity to investigate the entirety of the surrounding area, liberating them from the confines of the conventionally framed image". In the context of healthcare, this can assist medical practitioners in acquiring a more comprehensive awareness of the patient experience, which can ultimately result in improved communication and empathy. To be more specific, research conducted by Riva et al. (2016) has demonstrated that the use of immersive media, which includes virtual reality and 360-degree video, has the potential to improve empathy and perspective-taking in a variety of settings, including healthcare. A more profound comprehension of a patient's feelings, ideas, and requirements can be achieved through providing medical practitioners with the chance to experience a patient's point of view first-hand. Additionally, in incorporating film theory and related notions, such as suture, into the conversation about healthcare communication and simulation, there is a fostering of collaboration between professionals from other fields. A more thorough understanding of the patient experience and the factors that shape it can be fostered through the coming together of different fields of study, which can result in the development of novel techniques and fresh perspectives.

Semiotics:

Semiotics is a branch of study that focuses on the analysis of signs, symbols, and the meanings that they convey within a variety of forms of communication, such as film and other types of media. The studies of theorists such as Ferdinand de Saussure and Charles Sanders Peirce, who sought to understand the manner in which meaning is formed and conveyed through signs and symbols, are the foundation upon which it is built (Chandler, 2007). A clinical audience can benefit from the use of semiotics to medical simulation by taking into consideration the ways in which signs and symbols are utilised to generate meaning within simulated environments. In the context of medical simulations, signs and symbols can manifest themselves in a variety of ways, including but not limited to body language, verbal communication, technology, and even the layout of the simulation room itself. The way in which healthcare professionals understand and react to the circumstances that are presented to them can be influenced by the collaborative efforts of these aspects, which can work together to build a complex web of meaning.

Semiotics has been utilised in film theory to study a variety of aspects of cinema, including how visual and auditory elements convey meaning to viewers. For example, the mise-en-scene (the arrangement of everything in the frame, including actors, lighting, décor, and props) can be analysed via a semiotic lens to determine how each piece contributes to the overall meaning of a scene (Chandler, 2007). Applying this method to medical simulations allows a route to investigate how the semiotics of a simulated environment may influence the experiences of healthcare practitioners. For example, the choice of equipment, actor positioning, and use of lighting and sound can all contribute to a simulation's realism, potentially influencing how healthcare professionals interact with the scenario and interpret the various signs and symbols presented to them. Understanding the function of semiotics in medical simulations can also assist instructors discover areas for improvement in their simulation scenarios. Educators can make educated decisions about how to change or improve simulations to better achieve their learning objectives by studying the signs and symbols used in them and assessing their potential impact on participants' experiences.

In the context of this thesis, I believe that the various film theories discussed - Auteur Theory, Apparatus Theory, Reception Theory, Semiotics, Dispositif, and Suture - can be combined to create a comprehensive blueprint for medical simulation, driven by this understanding of technology balanced with audience and user reception. This alternative approach could serve as a guide for understanding how cinematic concepts and techniques can improve the design, implementation, and evaluation of medical simulations, where there is a need to consider different ways to create effective simulations without incurring the costs and technical infrastructure associated with high-fidelity simulation. For example:

1. Auteur Theory: This theory emphasises the role of the simulation designer as the 'auteur,' emphasising the significance of a clear, coherent vision in creating an effective simulation

experience. By having a comprehensive grasp of the desired learning results, the 'auteur' can ensure that every part of the simulation, from scenario design to equipment selection and camera positioning, supports the overall educational objectives.

2. Apparatus Theory: Drawing on Apparatus Theory concepts, the blueprint recognises the impact of the simulation environment and technology on participants' experiences. This involves thinking about how the camera's placement and the usage of high-fidelity technology might both disclose and obscure important non-technical or human variables. Being aware of these consequences allows simulation designers to make more educated judgements about the technology employed and its potential impact on the learning experience.
3. Reception Theory: Including Reception Theory in the blueprint highlights the need of knowing the various ways that healthcare practitioners may interact with and interpret the simulation. Educators can create more inclusive and flexible simulation situations that cater to each individual's unique needs and viewpoints by taking into account the different aspects that may influence their reactions, such as past knowledge, cultural background, or personal prejudices.
4. Semiotics: By including Semiotics into the blueprint, the thesis acknowledges the importance of signs and symbols in the creation and interpretation of meaning in medical simulations. This understanding can help to shape the simulation environment and its many parts, ensuring that the desired messages are successfully communicated and understood by the participants.
5. Dispositif theory emphasises the intricate interaction of a system's different aspects, including technology, participants, and the social and cultural milieu. By addressing the dispositif of medical simulations, designers can gain a better understanding of how various factors interact and influence one another, resulting in a more nuanced and

successful approach to simulation design that takes into account the complexity of the healthcare environment.

6. Suture: The notion of suture allows us to investigate the constraints and potential gaps in understanding that can develop in both cinema and healthcare settings. By factoring suture into the plan, medical simulation designers can be more aware of perspective's inherent constraints and solve them by experimentation with other modalities such as 360-degree video. This can result in a more comprehensive comprehension of the simulated environment and a higher awareness of the nuances of humanistic skills in these settings.

The idea of the film theory blueprint for medical simulation is to integrate many insights and concepts from several film and connected theories to create a comprehensive framework for improving the design, implementation, and assessment of medical simulations. This blueprint intends to enhance the effectiveness and engagement of healthcare workers' learning experiences by using unutilised or previously viewed unrelated concepts to medical simulation in healthcare education, principally re-evaluating the camera aspect in medical simulation. The medical simulation community can enhance their approach to camera usage, positioning, and overall understanding of its function in simulation design by integrating auteur theory, apparatus theory, reception theory, semiotics, dispositif, and suture perspectives.

The auteur theory can be used as a basis for the simulation designer to guide the placement and motion of the camera in order to achieve the desired learning objectives. The apparatus theory highlights how the camera can expose or hide significant non-technical or human elements, prompting designers to thoughtfully assess the impact of the camera configuration and technology in the simulation environment. The theory of reception emphasises the significance of comprehending the diverse interpretations and reactions of the participants, since this might impact the way in which the camera is utilised to accommodate varying learning methods and preferences. However, semiotics guides the camera's attention to the tiny hints that can improve the learning experience by reminding us to pay attention to the signs and symbols present in the simulation. In order to make sure that the camera successfully supports the goals of the simulation, the notion of dispositif can assist in identifying the particular configurations of the camera, technology, and participants in a simulation. Finally, suture theory highlights the limitations of the camera's viewpoint and the necessity of taking into account alternate strategies, including 360-degree video, in order to provide a more comprehensive picture of the simulated environment. The medical simulation community can develop a dynamic and flexible approach to the camera element by combining these ideas from film theory, making sure that it both supports and improves the learning process and is cognizant of the intricacies of human factors, technology, and varied participant perspectives.

However, although I have tried to within this chapter, it is important to further translate these film theory concepts into more understandable language for the medical simulation community. One way to do this is to highlight the practical applications of the theories through demonstratable practical examples, as covered in the next chapter, but also creating opportunities for content creation workshops, which were initially offered to the facilitator and simulation team to give them some creative agency and practical understanding of the theories discussed above. The idea behind the workshops was to provide the clinical audience a chance to view different examples of film types and to try out various camera angles and tactics, leading to a greater understanding of the relevance of these ideas in simulation planning and implementation. While participating in the workshops, clinicians have the opportunity to take on the role of a director for creating their own content. They are responsible for making decisions regarding the location and movement of the camera in order to emphasise significant areas of the simulation or narrative, and through this activity, to gain abetter understanding of the impact that such choices have on the learning outcomes as a result of this hands-on experience. Within the framework of apparatus theory, clinicians have the ability to investigate various camera configurations and technologies, analysing how each of them influences the visibility of non-technical or human aspects within the simulation. This enables a critical review of the technology that is being utilised and the potential limits that it may have.

Workshops might expand to also include talks on how participants interpret and respond to simulations, based from feedback of previous participatory sessions, and this would support the incorporation of reception theory, giving clinicians the opportunity to adjust camera techniques to meet a variety of learning styles and preferences.

Clinicians can practise detecting essential signs and symbols in the simulation environment, and they can use the camera to emphasise these features, which further enriches the learning experience for participants. It is possible for workshops to involve testing with different combinations of camera, technology, and participants in order to determine the most effective configuration for accomplishing particular simulation goals throughout the workshop. Clinicians can investigate other ways such as 360-degree video in order to acquire a more comprehensive view of the simulation environment if they acknowledge the limitations of typical camera perspectives and acknowledge that these perspectives themselves have limitations. 360-degree video's immersive nature captures a sphere of activity and potentially missed details and provides a picture of the surroundings, making it potentially an ideal format for medical simulation review and reflection.

Chapter Three – Practice and Innovation

This chapter will explore the practical use of film theory in medical simulation, building upon the knowledge acquired in Chapter 2. Chapter 2 exploration uncovered opposition against using cameras in the medical simulation sector due to variables like privacy concerns, perceived intrusiveness, and technological intimidation. Guided by these understandings, I aimed to confront this opposition by rethinking the function and application of the camera in the simulation setting using practical illustrations. This chapter will focus on film-based interventions in medical simulation training. The interventions consist of a series of video materials that included a range of film styles and approaches. Various interventions, such as observational documentaries and immersive 360-degree videos, were created to challenge traditional perspectives and encourage greater involvement and empathy by providing unfiltered views of medical scenarios and placing viewers directly into the patient's experience. The film-based interventions were not just used for capturing simulation scenarios but were intended to influence the perception, interaction, and learning process of medical simulation, as well as provide materials to use as examples in subsequent and related education and training opportunities. The goal was to not only address the reluctance to use cameras but also to showcase the significant capacity of film to improve empathy and humanistic abilities in healthcare staff and clinicians. This chapter will examine the practical aspects of this research, including the creative process, the deployment of interventions in the training environment, and the resulting impacts and insights gained from their application. The goal is to offer a detailed explanation of how film theory may be practically applied realistically to medical simulation and how this implementation can potentially enhance the training process, while enabling others methods in which to do the same.

3.1 A filmmaker in the NHS

The investigation began by creating simulated patient story films. The videos were produced in a documentary format, with actors who played the role of patients and recounted their personal backgrounds during the handover process. This content was created to help participants transition from a traditional classroom setting to an immersive simulation experience prior to entering the simulation suite. Three brief video biographies were produced, each featuring an actor portraying a unique patient character with individual medical and personal histories. The objective was to craft compelling and genuine narratives to elicit empathy from the trainees, prompting them to approach the simulation as they would a real patient engagement. The actors' performances were carefully managed to avoid theatrical exaggeration, attempting to accurately portray the authenticity, and nuanced human conduct observed in a real patient interview. The primary goal of these videos was to enhance the connection between medical trainees and the patient manikin during the simulation. By using engaging and humanised patient backstories, the interventions aimed to help the trainees see the manikin not just as an inanimate object, but as a representation of a real person with a unique narrative. This was an attempt to tackle the issue of the 'plastic shell syndrome,' where the manikin's artificial appearance can prevent trainees from completely participating in the situation. Another essential aspect of these films was their role in connecting the classroom environment with the simulation suite. The 'threshold' concept suggests that moving from a traditional classroom to a simulation environment can be a significant adjustment for trainees and participants, therefore these first films were designed to help learners move to simulation learning by providing a video pre-experience with a patient narrative structure for emotional and cognitive engagement. This was an exploratory attempt to see if such a mechanism could enhance the overall learning experience by grounding the simulation in a rich narrative context. The speculative nature of this research was centred on the central question: could these strategies indeed foster a stronger, more empathetic connection between the trainees and the manikin, and could they facilitate the threshold transition effectively? If successful, these simulated patient story videos might propose a viable method to counteract the 'plastic shell syndrome' and enhance the overall authenticity and educational impact of the simulation experience.

The second practical feature of this research moves away from standard static simulation capture approaches and towards a dynamic, filmmaker-controlled environment. Drawing on my filmmaking background, I approached the simulation space as if it were a movie set. This meant that, rather than being a passive observer, I became an active participant in the clinical training scenarios, using the camera to enhance the representational and emotive characteristics of the content. Using filmic approaches, I adjusted the camera to capture intimate close-ups, focus pulls, and timed movement. These strategies helped to highlight the intricacies and nuances that are sometimes overlooked in typical simulation capture. Close-ups allowed an intimate view of key actions or reactions, increasing the feeling of detail and intensity. Focus pulls fluidly switched the viewer's attention between different aspects in the scene, bringing depth and vitality to the video. Paced camera motions also reflected the scenario's rhythm and flow, immersing the viewer even more in the environment. Once filmed, these situations were edited to reduce the events into a more tolerable viewing duration and also deploy cuts. Suturing, editing, and colour changes were used to control the footage's tempo, tone, and visual impact. Suturing, for bringing together distinct shots or sequences, provided an impression of continuity and fluidity. Cutting techniques compressed the story by removing unnecessary or repetitive footage, keeping viewers engaged. Colour alterations altered the visual tone and atmosphere of the footage, heightening the emotional impact of the situations. The purpose was to highlight the intricacies and intensity of clinical settings. The goal of using film techniques was to capture and portray the simulation's richness and depth in a way that would make for a more compelling and immersive viewing and reflecting experience.

It is important to emphasise that this method was exploratory in nature, driven by the following main question: may the use of filmmaking techniques in the recording and editing of simulation scenarios improve the viewers' engagement and educational value?

Creating films from the perspective of the patient was the third practical component of the research, which helped to further this. These patient-perspective films provided a distinctive look at the patient's journey through the healthcare system and to see these clinical environments in a different way than what the staff had become accustomed to in their everyday. To begin with, this was accomplished by putting a camera on the patient's head to record interactions and movements between several clinical settings in real time. I will go into more detail about this method in this chapter, but one important example involves a patient who is having chest pain. The patient is followed throughout the film, starting in the ambulance on the way to hospital and ending in the resuscitation (resus) department and finally the operating room. The first-person perspective used to record this patient pathway creates a point-of-view journey that enables the audience to fully immerse themselves in the patient's experience. The film was shot in 180 degrees to further improve this immersive experience[7], a technique meant to somewhat mimic human curiosity and peripheral vision looking around the environments. This gave viewers a deeper, more thorough perspective of the patient's surroundings by enabling them to examine the area surrounding the patient more thoroughly. The idea was to provide viewers the opportunity to experience the clinical setting as the virtual patient could have by putting them in the patient's shoes to some extent. After it was recorded, the video was edited to remove unnecessary scenes but to maintain the original timeline. This was a deliberate decision to preserve the integrity of the patient experience, especially the long intervals between visits and

[7] This makeshift camera rig consisted of two GoPro hero 3 cameras positioned next to each other that captured an extended field of view as well as layered to created a 3D image, although I never used the 3D version due to the film feeling uncomfortable in VR.

interactions, where the frequency of fast paced urgency was met with bouts of abandonment and silence in the in-betweens. Typical simulation recordings rarely depict these times, which usually involve the patient staring at the ceiling or just waiting for the next interaction in the clinical setting. However, these forgotten moments play a significant part in the patient's experience, which is full of suspense, unknowns, blank ceiling spaces and the background noise of the clinical environments. The intention behind including these scenes in the film was to give a more accurate account of the patient's journey. This method calls into question the function of waiting periods, of the anxious next step and the quiet found in the ambient noise of the space. Could the learning process be improved by this additional realism? Could it encourage a more thorough comprehension and empathy for the patient's situation? These are a few of the inquiries that this research aimed to explore.

The research concluded with a study of the innovative usage of Virtual Reality (VR) devices for 360-degree filming and playback. This experiment was done in the summer of 2015, with subsequent films created throughout 2016, when the technology was still in its infancy and not widely used. By actively designing its use in the field of medical simulation training, the research intended to be at the forefront of this technological frontier. The adoption of 360-degree video technology was motivated by two factors: firstly, it provided a hitherto unseen chance to place trainees and clinicians virtually in the shoes of the patient, capturing not only their direct interactions but also the smaller and subtle details of their surroundings. Second, it made it possible to record the full spectrum of activities occurring within these spaces, giving rise to a comprehensive picture of the patient experience that was also sensitive to aspects of human factors-based activity[8].

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[8] This term Human Factors refers to the study and analysis of how things like system design, environment, technology, and interactions can impact human performance and behaviour within a healthcare setting. It considers how these factors can influence safety, efficiency, and effectiveness in the

The 360-degree video technique necessitated a different shooting method. As a detached observer, the camera was positioned in the middle of the action. 360-degree shooting requires a hands-off approach because to its immersive nature, unlike traditional cinematography where the director actively controls the camera. This is similar to how cameras are usually used passively in medical simulation training, through remote control. Although the filmmaker is not physically present during the recording (obviously otherwise would be captured in the shot), the final product provides viewers with an immersive media experience. It records information "beyond the frame," resulting in an activity sphere that viewers can explore. This technology, in essence, provided an innovative platform for learners to immerse themselves in the simulation, fostering a deeper understanding of the patient's experience. Consequently, the focus of this chapter will predominantly be on the evolution of the filmic activity that reached a point where the application and implications of 360-degree video technology in medical simulation training (and the innovation journey that will play out and inform the subsequent chapters) were considered. This was also driven as a modality due to its novelty and the considerable attention the technology was starting to garner, yet there was no substantial use cases or evaluation of it at the time. However, it is important to keep in mind that this research was not restricted to this one method, rather that it was reached through an evolution of different techniques being tested and deployed. Other film-based interventions – in parallel simulated patient story videos, documentary-style simulation scenarios, and patient perspective films - were also created and trialled. Each intervention introduced its own unique values and learning opportunities, contributing to a comprehensive understanding of film's potential in enhancing medical simulation training.

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delivery of healthcare services. Human factors can range from the physical layout of a hospital or clinic to the usability of medical devices, to the ways that healthcare teams communicate and work together.

I will investigate the initial advancements in utilising VR technology to provide an immersive experience for end users, without depending on the sophisticated illusion commonly linked with high-fidelity medical simulation, alongside patient perspective films. I intend to enhance the discussion surrounding the utilisation of patient perspective films and virtual reality in medical simulation by analysing their advantages and obstacles. This analysis aims to explore how these technologies can enhance the authenticity, efficiency, and compassionate aspects of medical simulation training when applied appropriately. The appendix contains an expanded list of practical initiatives and research materials generated throughout this research.

Building on prior conversations, it is important to recognise the difficulties presented by the innovative and emerging technology utilised in the initial phases of this research, specifically in 2015. During that period, the process of capturing and editing 360-degree recordings, and transferring them for viewing on VR devices, was still in the early stages of development. Therefore, I had to officially file this work as an innovation in the Torbay and South Devon NHS Trust's innovative intellectual property (IP) system. Registering allowed me, as an innovator, to have a greater impact on similar projects in the organisation that used the technologies or content type I was creating. This also permeated across national NHS innovation coverage, and through that activity it also allowed the trust to discuss and reference the innovation in its network and technology strategy. During that time, the trust had an underdeveloped technology strategy, therefore adopting new and innovative methods for medical simulation was useful for advancing the organisation as a whole. Registering my work as an innovation with the Trust encouraged the exchange of knowledge and ideas, aimed towards promoting a culture of collaboration and experimentation. This increased awareness highlighted the advantages of utilising new technologies like VR and 360-degree video in medical simulation training and education. These film types and materials played a role in improving medical simulation training that went beyond their basic practical application. They had a dual function, serving as a significant resource for educating clinicians, particularly in the later run "content creator workshops"[9]. The workshops provided clinicians with a taste to interact with and discover the integration of film techniques into medical practice. The films showcased in the workshops show a variety of formats, including documentary-style interviews, immersive patient perspective films, and 360-degree videos, providing a wide range of context-specific examples. This practical, experiential method enhanced comprehension of film's potential in medical simulation training, allowing clinicians, particularly those involved in simulation to go into and understand the intricacies of each style.

The context-specific examples were also enhanced by chosen pieces from the wider influence of film production. This method helped expand the clinician's comprehension of film as a medium for its capacity for communication and storytelling. The combination of context-specific and mainstream film examples in the structure of the workshops is an important aspect for providing clinicians with the tools and knowledge needed to apply and modify film strategies in their respective practice environments, offering examples they may already be familiar with outside of their work remit, but also provide a context of how healthcare is looked at and represented from external perspectives. The purpose also extended to encourage conversation and curiosity, perhaps triggering some motivation to think creatively and find new approaches to improve patient engagement and empathy. The practice of this research therefore was not just a means to an end. The material has helped in developing a versatile, interactive and insightful educational resources, with the hope that the materials might inspire doctors and clinicians to see films in a contextually relevant way, and through the viewing of perspectives and understanding the construction of imagery, create a more compassionate and imaginative approach to patient care.

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[9] Clinicians as Content Creation workshops are going to be explained in the following chapter as a part of the talks on implementation and the reliance on the arts and humanities for the implementation of technical advancements.

3.2 Patient Stories and Thresholds

Figure 3 A screenshot from an actor led patient story film, based from a real account for educating staff on compassionate care. Peres, N 2014

I used actors to play patients who were either in the hospital bed waiting for attention or who were travelling to the hospital in order to create short films telling their stories. Everyday phrases like "I hope I get home in time to walk the dog" were infused into these characters and blended with their current medical conditions. Inspired by the realist film tradition, which places the focus on ordinary, everyday life, these stories incorporated everyday details to humanise the characters and increase the empathy of the audience. These characters were introduced in the films and then they carry those same personas into the simulation. They crossed over from being a human actor to a manikin while keeping their identity and appearance. The idea of using continuity editing to maintain a clear and coherent storyline resonates with the principles of classical narrative cinema. It served as a narrative thread that connected the video to the live simulation experience. The viewer's immersion was greatly enhanced by the camera's involvement in these films. In keeping with the subjective camera technique frequently employed in films to elicit emotional identification, it was positioned as an active participant in the dialogue. This gave the impression that the viewer was a person having a direct conversation with the patient. Direct communication from the patient to the camera further dissolved the distinction between spectator and participant and drew them into the story.

Another purpose of these videos was to provide a link between the pre-simulation and simulation environments. Typically, trainees wait in a classroom or a holding area until they are called into the simulation suite. This often marked a clear boundary between the two spaces, with the simulation beginning only when the participants entered the training area. The decision to film at eye level and include a direct address to the camera was strategic, with the goal of creating a connection between the viewer and the on-screen character. This technique is intended to subtly shift the viewer's role from passive observer to active participant, drawing them into the story and instilling a sense of care and empathy for the character. The use of a slow zoom throughout the video emphasises this sense of growing intimacy. This technique, which is commonly used in film to subtly direct the viewer's attention or indicate a shift in narrative focus, was adapted here to gradually bring the viewer (trainee) closer to the character. This visual progression reflects the intended emotional journey of the viewer, from initial detachment to increasing involvement and concern for the patient's story.

Figure 4 Image taken from the Sally Brown simulated patient narrative video. Peres, N 2014

This active camera role, while seemingly minor, is important in how the content is perceived and consumed. By visually representing the viewer's progression from the periphery to the centre of the narrative, I hoped that these techniques would increase the viewer's emotional engagement with the content, allowing for a more profound learning experience. However, it became clear that, while these techniques are effective in theory, they require optimal conditions in practice to truly resonate with viewers. The use of these films as part of simulation training is not as simple as pressing play; it necessitates careful facilitation, both technically and pedagogically. Technically, the setup of the viewing environment influences the viewer's engagement. The environment should be conducive to focused viewing, free of distractions and interruptions. Without the proper audio-visual setup, subtle cues embedded in the film, such as the slow zoom, risked being lost or diluted under the classroom's characterless lighting, reducing the intended impact. Similarly, if the viewing is rushed or ill-timed due to constraints in the simulation schedule, as was occasionally the case, the emotional engagement I sought to foster is jeopardised by some of the simulation facilitators' belief that these films are just a 'bolt-on' to the main event. The transition from watching the film to participating in the simulation or vis versa needed to be smoother, allowing the emotional engagement that began with the film to continue into the simulation.

So from an educational perspective, the films' introduction and facilitation are equally significant. In fact, this served to emphasise how crucial it is to teach trainees about the role that film plays in all of this, particularly when the programmes are run by clinicians. The role of the facilitator is to set the scene, interpret the meaning of the films for the audience, and help them make connections between the patient narrative and the next simulation scenario. Without this guidance, viewers could consider the films to be separate entities rather than integral components of the simulation, undermining the narrative consistency I made an effort to establish. However, in this specific case, the concept of 'threshold' was highly significant. It was observed that many participants, particularly those selected for the first training scenario of the day, felt anxious before entering the simulation room. The instructors and simulation tutors saw this as well. It seems that the threshold denotes not simply a physical gap between two locations, but also a mental and emotional transition from a safe and accepting setting to a high-stakes, performance-oriented one.

Understanding thresholds is significantly impacted by James Paul Gee's study on "embodied cognition" and "situated learning" in the context of digital encounters and game design. In his book "What Video Games Have to Teach Us About Learning and Literacy," Gee examines how skillfully crafted game mechanics and storylines might facilitate a player's transition from their real-world identity to their in-game avatar (Gee, 2003). 'Threshold notions,' first introduced by Jan Meyer and Ray Land, are also applied in the field of education. These are key concepts or learning stages that, when understood, totally transform a learner's perspective on a certain subject. It usually takes a rigorous and transforming learning process to go past the "threshold" of these concepts (Meyer & Land, 2003). It is clear that the idea of threshold goes beyond the confines of a straightforward physical border when one applies these realisations to the field of simulation training. The transitional state, sometimes referred to as a liminal environment, is a setting that may be designed and changed to affect participant engagement and learning outcomes. One could consider the application of cinematic interventions to be a novel approach to threshold design. It is the intention of this strategy to create a less startling and anxiety inducing transition into the virtual experience. Redefining this threshold by suggesting that the simulation could start outside of the actual training area was the goal of the introduction of film interventions. These patient story films attempted to facilitate the transition, lessening anxiety and resistance to involvement, but also providing context to why the patient was now in the clinical setting, by engrossing participants in the patient's story before they entered the simulation room. The films' ability to maintain narrative continuity may help participants bridge this barrier and lessen the stark distinction between the pre-simulation and simulation worlds. Thus, these videos served as more than just the patient characters' backstory. They functioned as a means of transitioning trainees from the pre-simulation setting into the simulation suite's immersive environment. The aims evolved towards being used to improve participant engagement, lessen early fear, and ultimately improve the training's overall educational value by redefining the simulation's threshold and start. In fact, the importance of these cinematic interventions in addressing the idea of threshold cannot be overstated, even in light of the implementational problems. This concept became a major lightbulb moment in our teams approach to simulation training was the concept of employing visual narratives to bridge the gap between pre-simulation preparation and the real simulation situation. These early patient story films were valuable not only for their immediate impact but also for the avenues of inquiry and creativity they provided for the development of immersive media in medical education. They also provided an acknowledged avenue for me and the team to experiment in new ways.

3.3 A filmmakers Simulation

Taking the stance of a filmmaker working in the simulation environment, this part will examine how applying the ideas discussed in Chapter 2 on film theory might provide a new angle when capturing simulation settings. Using my own knowledge and experience as a filmmaker, I present a flexible and responsive filmmaking technique that captures the ups and downs of the ever-changing medical environment.

A simulation scenario involving a paediatric patient is the primary focus of this investigation. It is an emotionally difficult situation where a mother seeks quick medical attention for her child struggling with respiratory distress. In order to provide trainees who are getting ready to start their career in paediatric care with an emotionally charged and rather difficult to train scenario, this simulation was built specifically for them. The simulation scenario was carried out in-situ, which means that it was carried out outside of the regulated limits of the typical simulation suite. This was due to the fact that it required specialised equipment and authenticity. Due to the fact that this was a rather specialist scenario, it brought with it a different set of difficulties, the most significant of which was the constraints imposed by the physical space, it became unfeasible to welcome all of the students into the environment each time the simulation was carried out. This obstacle, along with a number of others, was the driving force behind the decision to produce a video version of the simulated exercise.

Taking a small Digital SLR camera with me, I entered the simulation and recorded the story as it developed using the subtle perspective of a director. The intention was to capture the emotional significance of the situation in addition to documenting the clinical procedures and exchanges. The mother's anguish, the trainees' vital decision-making process, and the tangible sense of urgency were all essential components of the learning process. The final film served as an effective teaching aid for upcoming training sessions with its multi-layered storyline that provided a thorough and immersive insight into the simulated scenario. In addition to the pragmatic rationale for recording the simulated event, a secondary objective was to draw attention to the frequently underestimated significance of family members in such situations. In this particular case, the mother's presence and her interactions with the medical staff complicated matters further. One of the most important aspects of the training was learning how to properly interact with her in order to ease her fears and explain the ongoing operations. The filmed content was then intended to function as a contemplative tool, giving the trainees a chance to watch, evaluate, and enhance how they engage and communicate with family members in high-stress situations. This scenario offered a distinctive chance to utilise cinema theory in depicting the simulation. I aimed to craft a cinematic experience that highlights both the clinical aspects and the human relationships and emotional nuances of the situation. Methods like 'suturing' helped to metaphorically integrate viewers into the narrative, immersing them in the situation and increasing their emotional involvement. Quick edits were employed to uphold the feeling of urgency and intensity in the scene. The focus was intentionally changed to shift the viewer's attention between the infant, the mother, and the medical team, highlighting the interplay and reciprocal importance of their actions and reactions. Close-up shots were used to capture nuanced facial expressions and reactions, offering insight into the emotional depth of the situation.

Figure 5 A filmmaker's simulation: Utilising close ups, focus shifts and capturing details. Peres, N. 2014

The film's tempo was deliberately controlled to match the rhythm of the scenario. Time compression was employed to condense lengthy medical processes, keeping the story flowing while ensuring that key components were not neglected. However, key features from a storytelling perspective are frequently not important from a medical treatment perspective, thus it was critical to convey the goal of this particular film from the outset. The finished film was visually stimulating and impactful, capturing some fundamental human components that are essential to the practice of medicine. However, as I discovered during an initial screening with the team, I was possibly not focusing enough on elements such as the patient observation monitor, indicating a conflict between the desire for creativity and capturing human behaviour and the clinical nature of a successful simulation outcome as inquired by the clinical audience. In addition to the direct capture of the simulation, the post-production process had significant potential to further enhance and tailor the content, such as adjusting the duration, condensing, or extending parts of the simulation to accentuate specific themes. For example, sequences involving team discussion could be expanded to allow for in-depth analysis, whereas specific technical procedures could be reduced to retain narrative flow while maintaining realism. Furthermore, the usage of additional audio aspects was investigated to improve the immersive experience. Background sounds, such as monitor beeps or team murmurs, could help to create a more authentic environment. The strategic use of music in form of soundtrack was employed to create a more emotionally charged setting, raising the sense of urgency or stress at important points in the narrative. In terms of emotional engagement, the use of soundtracks in films has been extensively researched in the subject of film theory. Scholars such as Claudia Gorbman (1987) and Michel Chion (1994) have written about the emotional impact of music in film. Gorbman explains the concept of 'unheard melodies', which refers to how music in films frequently directs our emotional responses on an unconscious level. Chion, on the other hand, created the term 'synchresis' to describe the spontaneous and automatic link between a certain sound and visual image, which is a key approach in building emotional engagement in films[10]. The post-production process provided a creative area in which to experiment and create with a variety of film techniques, which ultimately resulted in an increase in the production value of the simulation material. It opened up the possibility of tailoring the content to match certain learning

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[10] Gorbman (1987) presents the concept of "unheard melodies" in order to account for the fact that music in films frequently operates below the threshold of conscious awareness, despite the fact that it has a considerable impact on the emotional experience of the target audience. A significant impact on the way in which we feel about the story, the characters, and the circumstances is exerted by the soundtrack, which is frequently incorporated into the picture in a manner that is not immediately obvious. This is especially important in the context of a medical simulation, where the learners' emotional responses could be discreetly guided by carefully selected music, so increasing the immersive quality of the simulation and the overall influence it has on the learners. A further major person in the field of film theory, Michel Chion (1994), is responsible for the development of the notion of "synchresis," which refers to the mental fusion that occurs between a sound and an image when they occur simultaneously. When it comes to generating emotional connection in films, this phenomena is absolutely essential. As an illustration, the sound of a pounding heart may be synchronised with a close-up of the face of a patient who is anxious, so establishing an immediate emotional association between the sound and the visual. Through the establishment of robust emotional connections that enhance the learner's immersion and engagement, this technique has the potential to be of great use in the field of medical simulations.

objectives, emotionally engaging the viewers, and producing a learning experience that was more immersive and impactful. Through the strategic application of 'unheard melodies' and 'synchresis' in medical simulation videos, it is possible to cultivate emotional involvement, hence making the learning experience more emotionally meaningful. Future filmmakers operating in a healthcare education space could explore towards subtle ways to steer the emotional journey of the learners by adjusting sound in conjunction with the visual narrative. This would increase the simulation's level of realism and immersiveness[11]. The effort of reducing a full thirty-minute medical simulation into a carefully designed six-minute short was both practically and theoretically hard. The application of concepts from film theory, such as the Kuleshov Effect and Eisenstein's idea of montage, made it possible for an interesting story to be told. Using these approaches, which have traditionally been utilised in the film industry, could bring about increased tension and focus, thereby providing an effective educational tool. In spite of this, a sense of humility dominated the situation, since it was well known that this format has some limits that must be taken into consideration.

The absence of a debriefing system, an essential component of medical simulation training, emphasised these limitations. The debriefing step, as described in Fanning and Gaba's (2007) significant research, is a crucial component of experiential learning. Learners have the opportunity to assess their performance, receive feedback, and most crucially, integrate their experiences into their cognitive frameworks. When using new technologies and channels for innovation, it became clear that the traditional structures and principles of pedagogical practice

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[11] Although the integration of music and sound in medical simulation films is an intriguing research topic, it is beyond the main emphasis of this thesis, which is primarily concerned with the visual aspects of filmmaking in this particular context. The theories of Gorbman and Chion offer insight into how sound might influence emotional reactions and increase learner engagement, indicating a promising area for further research. But given my experience and the direction this work is taking—namely, the development of immersive video and virtual reality technologies—a closer examination of the visual elements is required.

could not be ignored. Although the film was visually and emotionally powerful, it seemed to slightly deviate from accurately representing live simulation action. The film was primarily a product of my viewpoint as a filmmaker, designed to elicit emotional reactions that promote compassionate behaviour. This procedure generated a collection of impactful images, some of which are displayed here. However, it prompted significant questions. Was there a possibility that the portrayal of compassionate and empathic actions in detail could be swamped by cinematic exaggeration? Did the content shift from serving as an evidence-based resource to emphasising creative storytelling? This transformation was not intrinsically harmful; creative storytelling offers its own benefits, particularly in the arena of education. However, it strayed from the core concepts of medical simulation, which usually strive to offer an unmodified depiction of real-life scenarios. The goal was to find a compromise between the engaging nature of cinematic storytelling and the necessary veracity of medical simulation.

Nonetheless, this practise proved to be instructive, particularly in terms of the importance of imagery in teaching these non-technical or humanistic skills. These assets have since been reused and integrated into other learning resources, including content creation workshops, representing a sustainable step forward in our continuous effort to include more humanities into medical education through visual media.

Figure 6 An example of an image that was taken from the simulation film, that is now used in team building learning resources within TSDFT. Peres, N 2014.

3.4 The Patient Perspective

The journey of exploration through previous film projects led us to a significant juncture. The patient story films offered a compelling narrative, whilst the filmmaker-operated simulations showcased the power of creative storytelling within the clinical environment. Yet, there was a desire to go deeper, to capture the subtleties of the clinical space from an angle not yet fully explored: the patient's perspective. This idea was rooted not just in academic inquiry but also in a deeply personal experience. Having found myself in the unfamiliar role of a patient, I realised that the experiential dimension of being in clinical spaces was something we had not yet fully captured. This realisation brought a renewed focus to my work: to vividly portray the patient's journey in the healthcare system.

The medical literature has frequently underlined the importance of patient narratives in improving healthcare practice. These stories have the potential to increase empathy and understanding among clinicians. However, I wanted to take it a step further. Rather of relying primarily on verbal or written descriptions, I sought to graphically represent the patient's journey from their perspective. As a team, we attempted to engage trainees directly into the patient's experience by departing from the traditional third-person perspective views from the video feeds commonly used in medical simulations. A camera was strategically placed on the patient manikin's head, capturing an unfiltered view of their journey through the healthcare setting. The goal was to introduce students to the human aspect of healthcare, encouraging them to see patients as individuals with distinct experiences rather than just clinical situations. We believed that by presenting a more nuanced perspective of the patient experience, we could foster empathy in the clinic.

The concept of Point of View (POV), or first person perspective films, is not entirely new. Indeed, mainstream cinema has attempted to use this style, such as in the film noir "Lady in the Lake" (1947) and the action film "Hardcore Henry" (2015). These films framed their whole narrative from the protagonist's point of view, putting the audience in the shoes of the main character. Despite this novel approach, it has not received widespread acceptance in the commercial film environment. Perhaps the constant immersion would be overpowering for audiences, or the continuous first-person perspective will result in visual monotony. It is obvious that, for whatever reason, this technique has not attained widespread favour. Yet, when pivotting to the context of healthcare education, the potential of patient perspective films becomes apparent. These films provide an opportunity to illuminate the patient's journey, offering unique insight that could foster greater empathy. While there is need to be cautious not to oversell the implications, given effectively the practise is just a shift in camera position, it's evident that these patient perspective films offer something distinct from traditional medical simulations. They emphasise the importance of patient-centred care and offer an alternative perspective that can enrich the learning process. Even if these POV films might not be blockbuster material, their value in our specific setting is undeniable.

The initial stages of creating patient perspective films were both exciting and informative. We went on this expedition using a small GoPro camera and Google Glass (essentially a pair of glasses with a camera built in) capturing the perspective of a patient manikin in a variety of clinical circumstances. The footage unearthed an array of fascinating aspects that could have easily been overlooked when viewed from a third-person perspective, or through the traditional lens of medical simulation. Moments of interaction between the healthcare team and the manikin held a particular charm. The camera allowed us to observe these encounters from a unique perspective, capturing the clinicians' expressions and actions in a new light. Each gaze that met the camera, each posture around the patient, each gesture, however subtle, was recorded, offering a deeper insight into the dynamics of clinical interactions. But there was more to these films than these compelling interactions. An unexpected revelation was the prominence of the ceiling in the patient's line of sight, a view so often experienced by patients but rarely considered. The camera brought into focus these long stretches of inactivity, where the patient was left alone, staring at the ceiling. These periods, perceived as abandonment or isolation from the patient's perspective, underscored the subjective experience of time in a clinical setting, which is often marked by waiting and uncertainty.

The GoPro also recorded situations that could be characterised as 'imperfections' or 'messy'. These were cases that deviated from the idealised representations of clinical interactions commonly shown in simulation materials created and marketed by manufacturers. The frank, unscripted, and occasionally unpleasant moments provided a more genuine portrayal of healthcare practice. These instances offered a candid view of the human aspect of clinical practice, whether it was a brief expression of doubt, a temporary break in professionalism, or a subtle display of sincere empathy. Touch was also a factor in these stories. Learners were observed reaching out to the manikin in a reassuring manner, but then retracting when they realised it was not alive[12]. This highlighted the inherent human ability for empathy and comfort, but also suggested a hesitation about being accepted in using such mechanisms. Often, important events occurred off-camera, while the sounds played a crucial role in providing context. The sound in the films became a crucial element of the story, requiring the viewer to utilise their interpretative abilities to understand the situation. This involvement with multiple senses enhanced the immersion and authenticity of the event. Although the camera sometimes lost focus, the visuals were oversaturated due to theatre lights, and there were extended silent spaces, the rawness of these videos remained strong. These faults actually enhanced the authenticity of the scenarios by accurately depicting the unplanned and spontaneous character of clinical events.

Figure 7 An 'imperfect' image of a medical simulation, taken from the patient perspective during intense activity. Peres, N 2015

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[12] Here, the idea of the "uncanny valley" may also be pertinent. According to this hypothesis, as manikins (or robots) grow more and more like real people, they eventually approach the point where they're almost completely human, but not quite, and this subtle uncanny quality can be unsettling or frightening. This could affect medical personnel' capacity or inclination to show compassion towards manikins. Although this is covered in more detail later on as a crucial theme in language and debriefing, it is important to note here as a connection to the idea.

These flawed images reflect Julio García Espinosa's important support for a 'imperfect film' that values authenticity and cultural specificity more than polished, commercial aesthetics[13]. As we explored the patient perspective films, we began to focus on the accidental elements and faults. Communication theory includes a concept known as the 'signal-to-noise ratio'. It involves finding a balance between wanted and unwanted information. Clear communication is most effective when there is no interference. When considering engagement and concentration, certain 'noise' could enhance our focus. In aviation, air traffic controllers and pilots encounter this situation. Auditory noise frequently prompts individuals to listen more attentively in order to distinguish the important message from the surrounding background noise. Did the visual cacophony or the 'imperfect' components in these films prompt us to observe more attentively and interact more profoundly?

The camera on the manikin's head added an interesting dynamic. Directing eye contact towards the camera instead of the manikin's eyes added a surprising element of connection. The direct eye contact from the characters provided a strong feeling of recognition and involvement for the audience. We felt a sense of recognition and immersion in the incident, even though we were only watching it through recorded footage. Yet, this eye contact also acted as a clear indication of the camera's existence, essentially shattering the fourth wall. It emphasised a conflict between maintaining the genuineness of the simulation and capturing meaningful information. These

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[13] In film theory, the concept of "imperfect image" or "imperfect cinema" has been examined. Julio García Espinosa, a Cuban film theorist, wrote an influential essay titled "For an Imperfect Cinema" (1969). Espinosa pioneered the concept of a "imperfect" film, one that puts authenticity, cultural distinctiveness, and political significance ahead of glitzy, mass-market aesthetics. This is an intriguing idea because it also discusses the setting in which the information is given—the movie theatre—which may have bearings on the simulation area and how it relates to the information gathered. We can find similarities between Espinosa's need for cinema that portrays actual, lived experiences in their unadulterated form and the content of these patient viewpoint films. Those 'imperfect' moments that the GoPro records can be interpreted as examples of this authenticity, offering a more real and compassionate representation of healthcare practice.

results indicate the necessity of further investigating perspective imagery as a method to enhance our comprehension of patient care and enhance healthcare practice. They highlighted the potential of these 'imperfect photographs' to capture the spontaneous and unfiltered moments of interaction, emotion and human connectivity.

The process of shooting patient perspective films has been fascinating, exposing unexpected dimensions of interactions and events that the traditional observational cameras would normally overlook. However, due to intrinsic constraints, the camera lens was unable to record everything going on in the periphery. There was a desire to venture beyond the frame, to reach out and catch those elusive moments that occurred just out of sight. A trainee doctor expressed this desire for a more comprehensive vision, remarking after seeing a simulation, "I wish I could look around." This simple remark struck a deep chord, emphasising the urge to fully immerse oneself in the scenario rather than simply observe it. Motivated by these findings, I moved into exploring the relatively unknown domain of wide-angle and immersive 360-degree video. This technology, while still in its early phases in 2015 and 2016, promises a panoramic view that might potentially encompass the whole simulation world. The chance to break away from the limits of the frame was alluring. However, like any new technology, 360-degree video and virtual reality arrived with no manual or established standards for usage in medical simulation. We were entering a new area, full of market hyped promise and unforeseen challenges, a familiar encounter experienced with the history of simulation. As we moved forward, we were not only looking at the benefits of implementing a new technology, but also leading a new direction for its use in medical simulation.

3.5 Innovating 360-Degree Video and VR

I explored the emerging field of 180-degree and 360-degree camera technology with the goal of capturing more of the unseen. This new form of media provided an enticing chance to move away from the limitations of conventional framing, allowing the viewer to be fully immersed in a panoramic picture of the patient's surroundings. New opportunities brought forth new obstacles. 360-degree cameras were in the early stages of development, and customised solutions for our specific needs were not easily found ready-made. The task required a pioneering attitude, a readiness to explore new territory and create new ideas. Inspired by pioneers in 360-degree filming like Chris Milk[14], I decided to experiment by creating our own head-mounted camera setups through a process of trial and error.

Initially, we attached these rigs to the manikin, a natural progression from our previous methods. Yet, despite the manikin's value in mimicking patient physiology, it fell short in emulating the intricate subtleties of human interaction. We noticed that participants often exhibited hesitancy when expressing empathetic gestures towards the manikin. This could be partially attributed to the concept of the 'uncanny valley', (noted above) a phenomenon that highlights a discomfort or eeriness elicited when something appears almost, but not exactly, human.

Considering these observations, we chose to pivot, taking what felt like a decisive, albeit somewhat unusual, step. The manikin was replaced with a human actor, and I took on this role. This was not a random decision, or one borne out of convenience. It was, in fact, a deeply

[14] Virtual reality pioneer Chris Milk is well-known for calling the technology the "ultimate empathy machine." At first, this persuasive viewpoint was well-liked, especially because it offered hope for improving the humanistic elements of technology. Nevertheless, the idea quickly encountered difficulties when "empathy" started to be misused in VR technology promotion. It's possible that excessive use of the technology created irrational expectations. While virtual reality (VR) can provide distinctive experiences and viewpoints, empathy is ultimately fostered by the user's emotional engagement and introspection, not by the technology by itself.

personal one. Only a few months prior, I had found myself navigating the bewildering maze of healthcare, having been a patient myself. The experience was a jarring one, leaving indelible impressions that I felt needed to be shared. As I stepped into the role of the patient, I was not merely acting. I was reliving my own journey through the clinical setting, with the same scenario being played out. It was a strange, almost surreal experience, replicating my own encounters in such a way. But it felt right. It felt authentic at least. It felt like a powerful means of transferring a patient's story into a filmic format, imbuing the simulation with a degree of fidelity that a manikin could not achieve. This shift to a human actor - to me portraying my own experience - brought a new dimension of authenticity and emotional depth to the simulation. Interactions became more genuine, the hesitation previously noticed with the manikin gave way to more natural and emotive responses. It was a poignant reminder of the human element within healthcare, the personal narratives that are often overshadowed by clinical routines and protocols

Figure 8 The Patient Perspective, PatientVR into Surgery. Peres, N 2015

The importance of perspective is never more apparent than in a scenario I shot in an operating theatre. From the patient's perspective, the scenario was as expected: a group of healthcare professionals, dressed in surgical gowns, gathered around the operating table, assuring the patient that everything would be OK. However, as the patient's sight shifted upward, the picture of a burnt-out bulb in the operating light fixture became evident.

At first glance, this may appear to be a trivial aspect that was missed during filming. Upon watching the film, the importance of this seemingly unimportant piece became clear. A surgical staff member nonchalantly stated that a burnt-out bulb would not impede their job; they could proceed with perhaps limited hindrance. However, from the patient's point of view, this was a completely different issue. For a patient on the operating table preparing to undergo a procedure, every feature of their environment can become very important. In this situation, a burnt-out bulb may not just indicate a little equipment malfunction but could also cast question on the general quality of the treatment being provided. If a simple maintenance operation like changing a light bulb was neglected, what other important tasks could have been forgotten? This scene highlighted the significance of the immersive, patient-centered approach, emphasising the impact of subtle environmental cues on the patient's sense of treatment. The situation was a strong reminder that a patient's experience includes more than just the medical process and involves all aspects of their surroundings and interactions with healthcare personnel.

A compelling depiction of a patient's journey through many thresholds within the context of the healthcare environment is provided by the video example of the chest pain scenario. Not only do these thresholds represent physical transitions, but they also contain unique adjustments in language and attitude among healthcare workers, which have a substantial impact on the experience that the patient has. The patient is exposed to the paramedics' use of informal language at the beginning of the voyage. The paramedics communicate with the patient by using names like "mate." The nursing staff, who are known for their compassionate approach, commonly use affectionate expressions such as "my dear" when they are in the hospital. This is a significant transformation that occurs upon entering the hospital. Last but not least, when the patient arrives at the operating room, the surgeons greet them with a formal language that is characterised by the use of professional titles such as "Mr." Every change in language is a significant milestone reached and has the potential to significantly impact the patient's perspective and comprehension of their healthcare experience. The film examines various human behaviours in diverse environments, showing how actions, communication styles, and interpersonal dynamics change along the journey, possibly causing a cognitive burden on the patient. The film highlights the importance of thresholds as not only physical changes but also cognitive and emotional transformations that affect the patient's experience and results, by referring to earlier recorded patient stories.

Figure 9 PatientVR Chest Pain Scenario, the three thresholds. Peres, N 2015

Expanding the visual perspective using 360-degree camera technology had a dual effect. Initially, it enabled us to capture a more comprehensive depiction of the surroundings. I could record the organisation of the equipment and the general architecture of the bed space, which are usually not included in standard video recordings. This was not just about creating a more detailed visual documentation. Understanding the context of healthcare interactions is essential when addressing human factors[15] in healthcare. This visual experience positioned the participant in the midst of the activity. The viewer was given a level of agency to explore the scene, choose what to focus on, and engage with the information in a more active and personal manner. This feeling was heightened when observed through virtual reality (VR) hardware. The VR headgear enabled the viewer to see the scene by moving their head in a more natural and intuitive way. Previously overlooked peripheral areas in regular video captures are now accessible and open to exploration. The transition to a 360-degree perspective involved both technical and philosophical changes, requiring a fresh comprehension of space, perspective, and agency. Slater and Wilbur (1997) emphasise that a crucial aspect of immersive virtual environments is the user's feeling of presence in the environment and their capacity to engage with it. I aimed to fully embrace the immersive quality by capturing not only the patient's perspective but also their complete surrounding environment. As the creator of these original 360-degree films, I took on a more observant position rather than that of a conventional filmmaker. A novel storytelling strategy was needed due to the comprehensive capturing of the complete area. This method emphasised longer, uninterrupted views with minimal cuts or changes in camera angles. It quickly became evident that this broader viewpoint brought forth a fresh array of difficulties. Unexpectedly, we were not only recording the patient's direct line of sight but also the areas where there was no activity. This raised numerous intriguing concerns regarding the concept of agency in these films.

[15] In the field of healthcare, the word "human factors" has many meanings and is occasionally misinterpreted. It is consistent with ergonomic concepts in that it considers the interaction between the human element and the physical environment, including layout, equipment, and workflow. It examines how space layout and tool design affect efficiency, safety, and performance. It is a study of design and its influence on practice. We may begin to see and investigate these components in a different way by including the larger physical world in our films, which would offer even another level of comprehension to our work. However, the term "human factors" is sometimes used, albeit somewhat incorrectly, to characterise the psychological and cognitive facets of medical treatment. This wide interpretation addresses the interpersonal and psychological aspects of care, taking into account the ways in which interactions within the healthcare setting are shaped by attitudes, emotions, and cognitive processes. Although this is within the scope of our investigation, it merits a more in-depth and sophisticated examination, which we shall address in the next chapter.

Should we direct the viewer's attention by strategically placing crucial activities in their line of sight, or should we let them freely navigate the environment, similar to how a real patient would? This innovative method resulted in capturing prolonged periods of inactivity as perceived by the patient, during which the ceiling and ambient noises of the surroundings were prominent. These periods of quietness, which accurately reflect the patient's perspective, presented a difficulty because to the limited time available for medical students to interact with the content. This challenge prompted consideration of finding the correct equilibrium between authenticity and practicality. Does maintaining the authentic patient experience require compromising part of its reality in order to save time? Where should the boundary be set between accurately representing the patient's viewpoint and using cinematic methods like editing and time compression to meet the requirements of medical students?

Contemporary artists utilising 360-degree film describe the medium more akin to theatre than traditional filmmaking because of its capacity to arrange action all around the spectator (O'Dowd, 2015). This theatrical element seemed especially appropriate for the places we were filming in, such as operating rooms and hospital wards, where there was potential attention from all directions. Nonetheless, much as in conventional theatre, there was a need to direct the viewer's attention so that they didn't miss important portions of the action. A balance had to be achieved between freedom of inquiry and directing the viewer's attention to the most important components of the patient's experience. This was a delicate balancing act that required constant experimenting and learning.

While the immersive quality and wider viewpoint of 180- and 360-degree videography had great potential, these early experiments presented a number of technical challenges due to the novelty of the technology in 2015–2016. Stitch lines were a prevalent problem in which there were noticeable seams in the finished film because the video from various cameras wasn't exactly aligned. Another recurring issue was ghosting, a phenomena in which objects in motion seemed to have a "shadow" or "trail" following them. Furthermore, because the viewer's sight did not always align with the direction of the camera, the focal views occasionally felt strange. Despite their magnitude, these issues were not insurmountable. As a filmmaker, I tried to learn about the special qualities and limitations of this new medium so that I could modify my methods and approaches appropriately. For instance, I soon discovered how important it was to position the camera itself to minimise seam lines and ghosting. In a similar vein, I had to think about where I could be throughout filming without detracting from the immersive experience. In addition, I had to think about how comfortable the audience would be, since excessive or sudden camera movement could make VR viewers feel nauseas. As a result, camera movement was approached with care and consideration, making sure that it was steady and extremely moderate, and that direction changes were smooth and progressive.

After overcoming technological challenges and gaining valuable expertise in the sector, I was able to contribute to the establishment of national guidelines for Health Education England as part of an Immersive Technology toolkit. This development, which occurred years after my first foray into immersive filmmaking, was a watershed moment in the advancement of immersive technology in medical education. Along with the technical adventure, I unexpectedly evolved into an NHS innovator. The relevance of the work I was doing began to get notice, prompting me to officially register my proposal with the NHS Innovation Accelerator. This acknowledgment opened up new difficulties and potential that went beyond film and virtual technology. Suddenly, I found myself in the spotlight, not just as a filmmaker, but as a 'pioneer' in the field of medical education technology. I was thrust into the world of media coverage and public speaking at national events. This was a stark departure from the intimate, behind-the-scenes work of filming medical scenarios. It required a swift adaptation to new roles and responsibilities, and the development of new skills in communicating complex ideas to a wide audience. However, these experiences, while initially daunting, ultimately enriched the trajectory of my work. Engaging with a broader audience not only helped to raise awareness about the potential of immersive technologies in medical education, but also opened up new conversations, collaborations and perspectives that further shaped and informed the practice. The innovation, which I aptly named PatientVR, aimed to expand with a series of patient perspective films based on common and essential clinical scenarios. The first film, for instance, focused on a chest pain scenario that captured the patient's journey from the ambulance to the resuscitation bay and ultimately into the operating theatre. This innovative approach sought to provide a more realistic and immersive experience for medical professionals, allowing them to better understand the patient's perspective and enhance their empathetic skills. The process of filming PatientVR required close collaboration between the simulation and other clinical education teams. To ensure accuracy in language, medical details, and performance, everyone involved played their actual clinical roles during the filming process. This cooperation fostered a sense of unity among the participants, encouraging them to work together and strive for the best possible outcome. By involving real-life medical professionals in the creation of the patient perspective films, PatientVR became about the creation of a more authentic representation of the clinical environment. This realistic portrayal helped to bridge the gap between traditional medical simulation training and the actual experience of treating patients, equipping healthcare professionals with a deeper understanding of the patient's journey and the challenges they face. The primary goal of the PatientVR films was to depict the environments and interactions as realistically and authentically as possible, in line with the core principles of medical simulation. Additionally, the PatientVR project aimed to address a critical issue in healthcare - the need for healthcare providers to focus not only on treating patients but also on making them feel better. It illuminates the often-overlooked importance of small gestures, such as eye contact or a comforting touch, in improving the patient's overall experience.

3.6 – A Blueprint Summary

The journey of filmmaking in medical simulation offers a compelling narrative of innovation, experimentation, and continuous evolution. Each section of practise highlighted in this chapter—from patient narrative stories to filmmaker simulations, from 360-degree video and virtual reality to patient perspectives—serves as a stepping stone, influencing and developing the subsequent one. The way that various filming techniques interact and interact dynamically characterises the current state of immersive medical simulation and provides support for the importance of rethinking the camera's role. The idea of Patient Stories & Thresholds, in which films were made to give patient manikins a backstory, marked the beginning of the practice. These films aimed to help to lower anxiety and increase participant involvement by easing the transition into the simulation experience. 'Threshold' was a key idea in this phase, signifying not just a physical entry into the simulation suite but also a mental and emotional change. Hence, the videos functioned as a link, emphasising the environment and facilitator requirements while utilising the material while smoothing the line between the pre-simulation and simulation environments.

The second phase, A Filmmaker's Simulation, saw film theory applied to the simulation environment, resulting in an immersive narrative that was both strong and emotionally compelling. However, this method called into question the balance between cinematic storytelling and simulation fidelity. The issue was to create a balance between the engaging quality of cinematic storytelling and the veracity required for medical simulation. Despite these concerns, this method demonstrated the potential of visual storytelling by offering powerful imagery for teaching non-technical abilities, thereby further integrating humanities into medical education.

The third phase, known as The Patient Perspective, aimed to explore the clinical setting in detail, focusing on the nuances of interactions between the healthcare staff and the manikin. This stage emphasised the impact of 'imperfect' imagery, capturing candid, unscripted moments that provided a genuine and unfiltered view of the human aspect of healthcare practice. The camera mounted on the manikin's head generated a distinctive interaction, offering a strong feeling of recognition and involvement for the audience. The camera lens's restricted perspective prompted the investigation of wide-angle and immersive 360-degree video to broaden the vision.

The exploration concluded with the third phase, 360-Degree Video and VR, which attempted to capture a more thorough perspective of the simulation world. Although faced with technological obstacles, 360-degree shooting provided a comprehensive view of the area. When observed with VR hardware, the experience was heightened, allowing the viewer to explore the area by looking around and turning their head. Thresholds are not just related to physical changes between environments but also to the context of the material collected and examined, which may involve factors like language.

These various approaches show that these were not solitary experiments but rather a planned development, a research process involving practice and critical reflection, where one action informed and learned from the others. In addition to improving medical simulation as a practice, the difficulties and discoveries at every turn have created new opportunities for research and creativity. Thus, this developing guide for immersive medical simulation filmmaking not only captures the experience to far but also offers a starting point for further research.

Chapter 4: The Human Factors Question Insists on the Arts and Humanities

Reaching the fourth chapter, it is clear that the symbiotic relationship between the arts and humanities and medical simulation training has emerged as a key conduit for creative approaches to healthcare education. The primary goal of this chapter is to look at how moving imagery can be used to communicate and express oneself in the setting of medical simulation. The wider use and adaptation of moving imagery, an art form that has long been utilised to elicit emotion and empathy, has proven effective in medical simulation by instilling a stronger sense of patient viewpoint and highlighting small but critical aspects of patient care. The utilisation of 360-degree patient perspective films and virtual reality has increased the impact, producing an immersive environment that gives trainees an experience that goes beyond the manikin of patients' views. However, implementing these modern technology and approaches presents its own set of obstacles, particularly in terms of language and terminology. This project's multidisciplinary character requires a shared language that may bridge the gap between clinical and creative, technical and humanistic perspectives. The need of developing an accessible, inclusive language that captures the emotional and behavioural aspects of simulated experiences would help to enhance discussion, understanding, and collaboration between these previously separate fields.

It's also important to distinguish between the attraction of new technology and its educational value, even though the novelty and excitement of it can be alluring. In order to learn more about participants' acceptance of and emotional reactions to this technologically innovative medium, this research used questionnaires and feedback mechanisms. Following the current paradigm of medical simulation teaching, the research was conducted with an arts and humanities approach, which allowed for a deeper understanding of the impact of content on a humanistic skills level through discourse analysis, user interaction observations, and reflective feedback sessions.

Rethinking "human factors" and "soft skills" in various contexts is an important component of this research, in addition to an evaluation of the films covered in Chapter 3. The phrase "human factors" has historically been used in the healthcare industry to cover a wide range of topics, such as error management, teamwork, communication, and decision-making. But by viewing the films through a different lens, it has provided material to highlight and reframe "human factors" in the context of a broader set of "humanistic skills," which has helped to clarify the relationship between the humanities and healthcare. This chapter looks at the implications of this reinterpretation of human factors, focusing on how reading the films and comprehending these "humanistic skills" can improve the efficacy of medical simulation as a training tool for healthcare professionals. Specifically, the 360-degree and patient perspective films are particularly noteworthy. All of the films' objectives were to offer a chance to close the gap between clinical practice and the humanities by using the language of film to explore human behaviour in a healthcare setting in a nuanced way, even though the main practical "innovation" that will be highlighted is 360-degree videos. In the films, the intersection of these domains opens up new emotional ground that begs to be explored. The idea that clinicians can also create content is finally introduced in this chapter. The chapter suggests a novel method for incorporating film theory and the humanities into healthcare education by providing a template for clinician-led workshops that seek to close the gap between language and practical skills. In addition to giving clinicians the tools to better understand the nuances of visual language and its impact on audience perception and understanding, these workshops emphasise a creative approach to creating and interpreting such narratives. They also equip clinicians with the skills necessary to create their own material and subsequently create experiences for simulated education.

The chapter will be divided into the following sections in order to examine these different components:

i. Audience Reaction, Apparatus Interaction and Feedback

Examining participant feedback and how the participant handled or interacted with the content and device (whether high or low tech VR) is key to determining the films' impact. Widely varying responses to the films provided a plethora of insights into the real-life experiences that these stories depicted. A great deal of empathy was expressed in several comments, indicating a deep connection to the characters and their narratives. The responses revealed a shared affinity with the themes of the films, promoting a more profound comprehension of patient experiences and the various thresholds present in a healthcare setting.

ii. Technical Learnings

The making of the films also yielded insightful information that influenced national guidelines on filmmaking and 360-degree content creation in virtual environments. Compelling narratives were developed through the application of several technical elements, including sound design, immersive environment creation, and high-quality visuals, as well as learning approaches that didn't work. The knowledge gained from these technical procedures strengthened the films' goals and increased their authenticity and pedagogical impact.

iii. Language, Content, and Simulation: Bridging Human Factors and Humanities

The significance of empathy, emotional intelligence, and proficient communication in providing high-quality healthcare is emphasised by humanistic skills. The films demonstrate how these abilities, when understood and used, can greatly increase the efficiency of medical simulation training for medical professionals. Examining the viewpoints of patients essentially takes us into the domain of experience narratives. The distinct narratives of patients, expressed via their individual encounters, function as a potent instrument in shaping medical procedures and comprehending patient requirements. But this strategy has been subject to critique, predominantly because these accounts are based on personal experiences which are inherently subjective, and thus, do not lend themselves easily to public verification. In the clinical setting, where the foundation of medical practice is the reliance on empirically verifiable data, this presents a problem. Personal narratives, full of nuanced emotional interpretations and subjective judgements, are difficult to place comfortably inside the conventional framework of clinical evidence. In spite of this, narrative techniques are becoming more and more popular in the NHS and other global healthcare systems. Patient narratives are valuable as a supplemental type of evidence that can offer deep insights into patients' lived experiences, according to an increasing body of research. These discoveries have the potential to impact public health initiatives at the societal level, institutional policy, and individual care levels. For example, Charon (2006) has advocated for the use of narrative medicine to comprehend patients' stories, saying that medical professionals can employ narrative competence to hear, comprehend, and be inspired to act upon the suffering of others. In this sense, using patient perspectives can help healthcare providers develop empathy by enabling them to see the patient's experience from their point of view.

iv. Blueprint for Clinicians as Content Creators

Creating workshops for clinicians that aim to serve as a guide for becoming content creators is another important aspect of this exploration and may offer a means of connecting the theoretical, practical, and language aspects (as well as supporting a larger national piece of work around digital literacy and upskilling the healthcare workforce). Through the provision of an instructional framework on how to interpret and produce such narratives, these workshops sought to close the gap between language and practical skills. The creative process was central to these sessions. Clinicians were instructed to become active creators rather than just passive viewers of these films. They were taught how to read, analyse, and eventually write stories and instructional materials that were influenced by their experiences in various settings and domains.

The goal was to make it easier to comprehend the subtleties of visual language and how they affect the perception and comprehension of the audience. Clinicians are introduced to a fresh perspective on their own and their patients' experiences through this creative exercise. In doing so, they hope to better understand the narrative power of their work and establish a deeper connection with the humanistic aspects of healthcare by taking on the dual roles of healthcare providers and content creators. The goal of this blueprint is to develop a new generation of medical professionals who can effectively communicate about healthcare using the tools of the arts and humanities, which will enhance patient comprehension, foster greater empathy, and ultimately result in better care delivery.

In this research, the focus shifts from the traditional practitioner's perspective to the patient's, from the clinical facts' concreteness to the cinematic language's subtlety, and from the human factors' rigidity to the humanistic skills' fluidity. This chapter explores these aspects, covering the following topics: audience response and feedback; technical takeaways from the films; language, content, and simulations; and a guide for clinicians wishing to create content. I evaluate the films from Chapter 3 using a critical lens that is presented in each section of this chapter. It is at the intersection of medicine, the humanities, and the arts as it pursues this critical examination. By challenging the status quo, I hope to shift the focus of our simulation work in the direction of more compassionate and humanistic considered healthcare education. Despite its complexity, this journey aims to illuminate the fundamental aspect of healthcare: the human experience.

4.1 Audience Reaction, Apparatus Interaction and Feedback

Before moving into the critical analysis, its useful to start with the audience's response and comments to the VR 360 immersive film experiences. This approach, applied mainly in the 'Patient Perspective' and '360-degree Videos', promoted a better comprehension of the patient experience and helped to develop humanistic skills. The simulation and wider education training team participated in the first testing 'film screening' phase. The participants expressed fascination and intrigue towards the immersive quality of the VR films, indicating an overwhelmingly positive experience. Two participants in the experience were moved to tears as they related their own personal accounts of undergoing similar journeys (either as patients or as relatives) and commented on how powerful it was to see an experience from the perspective of the patient. The staff members who had played parts in the patient perspective films and were now seeing themselves treat the "virtual patient" from whose perspective they were now viewing, however, had one of the most profound reactions and realisations. When these healthcare workers put on the VR headset, they discovered an unexpected reflecting mirror—they had played parts in the films. Seeing their own professional behaviour through the eyes of the patient, they were experiencing a deeply unsettling but incredibly illuminating self-observation. Observing oneself as they provided care for the "virtual patient" from that patient's point of view sparked profound insights and intense feelings.

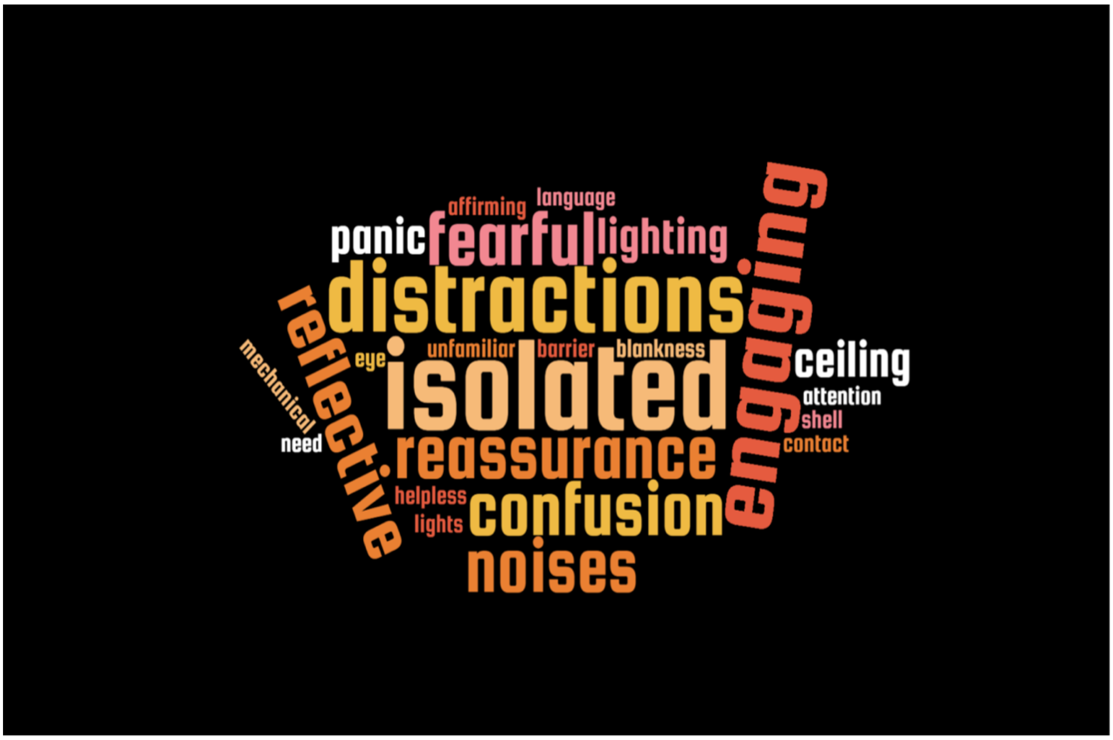

Figure 10 word cloud of common expressive feedback from patient perspective chest pain scenario

This phenomenon of immersive self-observation has its theoretical foundation in the works of Mel Slater, who was a pioneer in the field of virtual reality and the study of 'presence' in virtual environments. 'Body ownership' in virtual reality is a concept that Slater has extensively researched. This concept proposes that individuals can experience a sense of ownership over a virtual body when it is presented from a first-person perspective. The experiments that Slater has conducted with what he refers to as the "Body Swap Illusion" are especially illuminating in this particular setting. The participants in these studies observe themselves from the point of view of another individual, which frequently results in changes in self-identification as well as changes in attitudes and behaviours towards other people (Slater, Spanlang, Sanchez-Vives, & Blanke, 2010). When healthcare professionals were able to view their own interactions with patients from the perspective of a patient, they experienced a profound shift in understanding. This concept resonates with our observation that this occurred.

At the core of Slater's thesis is the concept that virtual reality (VR) could facilitate empathy, self-reflection, and eventually a change in conduct by allowing users to experience the world from the perspective of another person. This idea is consistent with observations of the healthcare professionals who were featured in the patient perspective films being viewed through virtual reality. These professionals experienced a shift in perspective, which resulted in a greater comprehension of their own actions and behaviours from the perspective of a patient.

Creating a sense of embodiment through the use of computer-generated imagery (CGI) avatars is the primary focus of Slater's work. In this type of work, participants are immersed in a virtual world and interact with avatars that mirror their own behaviours. In contrast, the research that I conducted utilised actual 360-degree video perspectives, which provided a depiction that was more authentic and unfiltered of the surroundings as well as the people who were participating. It is the work of Slater, however, that provides a vital theoretical underpinning. He suggests that when individuals observe their avatars performing acts in the virtual environment, it might lead to major changes in their self-perception, attitudes, and future behaviour. He referred to this phenomenon as the "Proteus effect."

Initially, linking Slater's CGI-based research with my film-based VR project appeared to be a theoretical stretch, as this was comparing two different mediums of content development and function, however the fundamental principle of observing oneself from an alternative viewpoint remains consistent. In my initiative, healthcare professionals are not observing a computer-generated replica but rather their own genuine self, recorded and displayed in a lifelike setting.

Considering the impact of film theory on 360-degree video in medical simulations, the use of prolonged, almost painfully extended, sequences is particularly relevant[16]. This technique intentionally disrupts the usual quick editing and scene transitions seen in mainstream cinema or media. Instead, it reflects the realistic pace of medical situations, which often include periods of waiting, observation, and anticipation mixed with moments of intense action.

Within the immersive environment of 360-degree video, deviating from typical narrative pacing becomes more significant. By prolonging the duration of scenes captured by a 360-degree camera, it encourages viewers to carefully examine the entire scene without interruption, fostering a contemplative and observant mindset that mirrors real-world clinical practices. The attention to detail encourages viewers to notice small yet crucial changes and cues in the virtual environment, fostering a heightened degree of awareness and analysis that is challenging to get through traditional video forms. Deleuze's (1989) cinema theory, particularly his concept of the 'time-image,' is closely related to the prolonged sequences found in 360-degree films. Deleuze's

[16] It is also interesting to note the recent trajectory from published VR educational software around soft skills training and empathy, such as that of Bodyswaps (https://bodyswaps.co/) that are choosing to deploy CGI based avatar and environments for user customisation over raw, observational material, perhaps implying the scalability and high-tech aspect of CGI being a more attractive medium for monetary exchange over that of filmic based material. Creating CGI based environments also comes at a far more significant time cost than 360-video, which is another reason I wanted to look at a filming method instead.

concept of the 'time-image' diverges from conventional narrative frameworks, stimulating the viewer's perception of time and encouraging profound reflection. The additional segments in the 360-degree videos showcase this idea by creating a feeling of deep involvement and control for the spectator, encouraging them to actively participate in the evolving situation. This involvement goes beyond the first visual attention and encourages a contemplative, observational approach that mirrors the demands of real-world clinical practice. The immersive experience is improved by the familiarity of the characters, environments, and scenarios in the 360-degree simulations. These simulations resonate with the spectator by accurately depicting the clinical scenario. This resonance, along with the viewer's capacity to observe and select their own focal point within the scene, despite the limited agency offered with 360-degree content, enhances emotional bonds and empathetic reactions as there is an action required beyond just observation. Emotions are essential in how viewers interact with and comprehend narratives in films and immersive 360-degree simulations, as demonstrated by Plantinga's research (1999)[17]. The genuine depiction of events in these 360-degree simulations enhances their instructional usefulness by evoking emotional engagement.

When probing deeper into the insights that emerged from the self-observation process, it is noteworthy to see the subtleties that viewers started to notice when watching their own performance from the standpoint of the patient. The most attention was drawn to the intricacies and complexities of their professional conduct—aspects of the engagement that could have gone overlooked or underappreciated in traditional training or reflective practice. For example, viewers became acutely aware of how they were positioned around the patient's bed and how

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[17] Plantinga explores the concept of 'affect,' or emotional response, as a crucial element of filmic storytelling. He discusses how films strategically use cinematic elements such as visuals, sound, and narrative structure to elicit specific emotional reactions. These emotional reactions are not just by-products of watching a film but integral to the viewer's overall comprehension and interpretation of the narrative.

their physical presence in the room would affect the patient's comfort and perspective. They observed the height at which they interacted and considered how this could impact the patient's perception of the hierarchy in the care relationship or even their feeling of inclusivity in the conversation. They took note of their speaking patterns, the intervals between their answers, and the importance of quiet in the patient-caregiver exchange. This increased self-awareness was not just a token gesture to minutiae; rather, it highlighted how important these "little things" are in influencing patient experiences and adding a human element to healthcare interactions. One particularly powerful story was related by Tod, an anaesthetist consultant. Participating in the patient perspective films gave him the rare chance to see himself as a professional from the patient's point of view. Tod described the encounter as incredibly illuminating. He talked about observing and considering every little aspect of his professional behaviour—details that he might readily change to improve the experience for the patient. These weren't always enormous adjustments necessitating in-depth instruction or significant practice overhauls. Rather, these were modest adjustments, little changes in strategy and viewpoint that could have a big impact on the quality of patient-provider interactions[18].

Still, there were several unsolved questions following this initial welcome. Was the allure stemming from the novelty of virtual reality technology, or from the sheer 'wow' element of being able to move one's head and explore a 360-degree visual sphere? Or was it the engaging material—the representation of a patient's perspective in a medical environment—that struck a chord with them? This "wow" moment, as termed by tech enthusiasts[19], describes the initial

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[18] A video clip of Tod's response can be found within the film and media list in the appendix and serves as additional illustration in this section, giving a first-hand perspective of the significant impact that virtual reality (VR) self-observation may have on medical practitioners.

[19] The term "wow moment" is frequently used across various industries, particularly in technology and customer service, to describe an experience that is so impressive or unexpectedly good that it surprises or delights people in a significant way. While the term itself is not proprietary or specifically tied to a single source, it is widely used in popular media and industry publications.

excitement felt while interacting with a new technology that suppresses critical judgement in the context of technology adoption. As the novelty wears off, this event is frequently followed by a decline in excitement, which could provide a problem for the long-term adoption of new technologies. This trajectory is similar to the Hype Cycle theory proposed by Gartner, which states that new technologies usually go through a phase of exaggerated expectations, a disillusionment trough, and then a productive stage. Using this approach, I may hypothesise that the VR technology's "wow" moment represents the "peak of inflated expectations." This peak frequently carries with it a potential vulnerability: the possibility that the favourable reactions people initially had to the VR experiences had more to do with the novelty of the technology than with the immersive content. This conflict begs the fundamental question: what had a greater influence—the new technology's attraction or the sympathetic viewpoint of the patient? The capacity to analyse and comprehend this "wow" moment is important in the general advancement of virtual reality in medical education. If the novelty of VR was the main reason for the first positive reactions, then once the novelty wears off, one might expect a possible decline in interest. However, if the majority of the criticism was content-driven, there may be hope for VR's durability and efficacy in healthcare education[20]. When it comes to the adoption of technology, especially in the healthcare industry, it's critical to discern between the flash of new technology and its long-term benefits. Based on the findings of researchers like Csikszentmihalyi and Rochberg-Halton (1981)[21], we know that people have an emotional bond with technology,

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[20] Unravelling the complex interplay between the novelty of the technology and the potency of the content is key to understanding the sustainability of VR's impact I believe in any field – Healthcare does provide a useful industry for this learning. Ascertaining whether the initial positive responses were fleeting, driven by the technological novelty, or if they indicated a deeper connection with the patient-centred narratives portrayed in the films.

[21] In their book, "The Meaning of Things: Domestic Symbols and the Self", Mihaly Csikszentmihalyi and Eugene Rochberg-Halton explore the relationships people have with objects in their environments. They argue that the objects we surround ourselves with, including technology, hold symbolic meaning that contributes to our self-identity and influences our actions.

which affects how valuable and useful the thing is judged to be. But the relationship might not last long if the only thing bringing you together is the new technology. On the other hand, this relationship might be more enduring if it is based on the technology's perceived usefulness or transformative potential, such as improving empathy or comprehension of patient experiences.

The first experimentation with 360-degree video and virtual reality (VR) simulation used state-of-the-art technology that, although remarkable in its power, had considerable practical challenges. The early phases of this project were in fact individualistic because a tethered headset that needed a laptop connection was necessary. It was also an expensive and time-consuming undertaking that required one-on-one facilitation. However, the low-tech, accessible, cheap, literally made of cardboard introduction of "cardboard VR" quickly held up the promise of completely changing our approach to using VR simulations in the context of medical education. 'Cardboard VR', a concept and then a mass released product from Google[22] became available around a year after virtual reality was first implemented into our simulation training in late 2015 and into 2016. This new idea entailed a cardboard viewer that was not only straightforward and inexpensive, but also had the capability of harnessing the power of a user's smartphone in order to provide an immersive virtual reality experience. Consequently, this brought about a significant paradigm change, shifting the focus from an individual, high-tech experience to one that is collective, accessible, and inclusive.

[22] Google Cardboard's development stemmed from Google's “20 percent project" where employees are able to have protected and dedicated 20% of their time to new ideas and innovations. Cardboard started as a low-tech solution to VR to make virtual reality accessible to everyone. The key bit was that users could assemble the cardboard viewer themselves and use their smartphones as the display, offering a basic VR experience. Google continued to develop the concept, releasing new versions and promoting the creation of VR content.

Figure 11 CardboardVR being utilised with surgical teams to view the patient perspective 360-degree content. Peres, N 2015

For the first time, a group environment more akin to a classroom or simulation training group could engage in viewing 360-degree video simulations. This created additional opportunities for group-based feedback and enabled a group learning process that was more analogous to conventional simulation debriefing sessions. In addition to encouraging a sense of community learning, this offered a chance to eliminate any technological novelty that might have obscured the instructional material. The introduction of cardboard VR was a significant innovation in this context. Cardboard VR reduced the need on expensive optics and advanced computer processors by utilising a common device like a smartphone, which lessened the sense of wonder typically linked to high-tech gadgets. The transition from a sophisticated headset to a basic cardboard viewer, which users could assemble themselves (and keep at the end of a session rather than concerning with hygiene protocols), aimed to simplify the technology and minimise possible technological obstacles whilst spreading the use of the modality by allowing the participants to keep and show others. The NHS workforce has varying levels of digital literacy and confidence[23], which complicates the process of digital transformation. Introducing new technology or systems through familiar tools like smartphones and tangible materials like cardboard offered a unique approach. The focus shifted from the delivery system to the material itself, specifically the distinctive patient perspective provided by these simulations. This was a significant step towards the greater goal of strengthening 'humanistic skills' in healthcare training. When considering the use of immersive technology in healthcare, the main concerns typically focus on its complexity, cost, and accessibility. Virtual reality (VR) technology, although becoming more accessible over the past eight years (2015-2023) is still considered complex to new, non-digitally confident users, costly, and can be daunting when presented in an unfamiliar context. The introduction of cardboard VR was a game-changer for introducing new audiences, offering a user-friendly entry point into the immersive medium without the risk of breaking it or feeling responsible for expensive equipment in hand. The simple device shifted focus from a high-tech appearance of a technology to the patient's perspective, emphasising the content and unique insights gained from the immersive experience.

From the perspective of the technology sector, the idea of cardboard virtual reality has frequently been regarded with amusement. It was considered a peculiar and rather absurd attempt to cram complex virtual reality (VR) systems into a format that didn't require a lot of money or technology. A great number of people believed that these devices, which appeared to be more suitable for a craft project than a cutting-edge technology showcase, were a watered-down illustration of the possibilities of virtual reality (VR). Cardboard virtual reality, on the other hand, offered itself as a solution of fundamental significance in the field of healthcare, which has a diversified workforce that spans a wide spectrum of digital literacy. Its inherent simplicity and approachability were its greatest virtues, because they served to eliminate preconceived perceptions of high-tech hurdles, which in turn made it easier for people to accept this unique

[23] Evidence the NHS long term workforce plan and emphasis of concern on digital confidence and readiness.

learning mode in a more comfortable manner. It also exemplified the value of a purpose driven low-fidelity approach to a learning outcome.

Figure 12 CardboardVR headsets after a group simulation session. Peres, N 2016

Constructed from flexible, unassuming material, the cardboard viewer was physically non-threatening. It bore the marks of its use 'gracefully', absorbing makeup stains and accumulating signs of wear that were testimony to its functionality. This modest artefact, which users were allowed to keep after use, thus transformed into a symbolic token—a personal passport into the high-tech world of VR. The 'no-frills' nature of the device put the spotlight firmly on the content and the powerful patient narratives they presented. The basic optics in the viewers at times created imperfect projection, occasionally causing focus issues, however to some degree this endeared its use even more, when looked from the perspective of the 'imperfect image'. This

echoes findings from media studies suggesting that technology often becomes 'transparent' or 'invisible' when it successfully immerses users in the content (Bolter & Grusin, 1999)[24] .
This concept of a "minimal viable solution" for a high-tech solution was not merely an anecdotal curiosity; rather, it was a model. The idea that the implementation of cutting-edge technology must inevitably be prohibitively expensive, intimidating, difficult, or exclusive was convincingly refuted using this method. Providing a feasible entry point into virtual reality for healthcare professionals, the cardboard VR not only offered a conceptual model that would continue to define the approach to medical simulation in following years, but it also presented a potential access point into virtual reality. It gave an example of how difficult concepts and cutting-edge technologies could be presented in clear, understandable ways without losing their meaning or potency. The usage of cardboard VR demonstrated that innovation in healthcare education did not always have to equate to high-tech complexity. Rather, it may sometimes simply require adopting a fresh viewpoint and being open to trying out unusual but workable ideas. This realisation turned out to have a significant impact on the pandemic years later, encouraging a more accepting and inclusive approach to the use of technology in medical simulation.

Upon transitioning to group-oriented cardboard VR viewing sessions, I had to modify my feedback methods to conform to the new methodology. A questionnaire I created was one of the instruments I used to gauge how well this immersive technology was received. This was utilised not just in my personal simulation project but was also integrated into the TEREMA

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[24] Jay David Bolter and Richard Grusin introduced the concept of "remediation" to describe how new media formats often reinterpret or "remediate" older ones. An essential aspect of this concept is the idea of "transparency" or "immediacy", which they argue is a defining characteristic of successful new media. In this way, when a technology is successful in delivering its content, it becomes "transparent" or "invisible" to the user. This means that the user becomes so immersed in the content that they forget they are interacting with a technological device. The technology facilitates an experience of "immediacy", where the medium itself disappears, and the user feels directly connected to the content.

course curriculum. TEREMA (Team Resource Management)[25] was run at the hospital regularly and intended to improve clinical teams' understanding of human aspects and promote efficient communication, with a focus on human factors for clinical teams. I was able to assess the VR technology's adoption by integrating it into this workshop programme, with the VR trialling including more than 100 internal clinical staff across a variety of roles and departments. Following strict guidelines for quality and service improvement, the goal of this research was to understand a level of user experience, value and technological acceptance using VR as a training and intervention tool within a classroom and group teaching environment. Determining whether the participants—many of whom had never used VR or immersive video before—would view this type of experience as helpful was essential. Their degree of technological comfort and digital literacy was important to the possible success and broader adoption of VR as a training tool in healthcare education[26].

Figure 13 CardboardVR with Theatre Communication Scenario in use during TEREMA session 2016

[25] Since 2001, TEREMA has provided NHS Risk Management and Team Resource Management human factors training. They emphasise healthcare Team Resource Management (TRM) to distribute expertise and capabilities, drawing on human factors training and theory to improve patient safety. TEREMA is not currently run at the Trust due to financial and capacity issues as TEREMA is a paid programme, despite utilising facilitators within host NHS organisations.
[26] Further information on the TEREMA work, questionnaires and engagement can be found in the appendix.

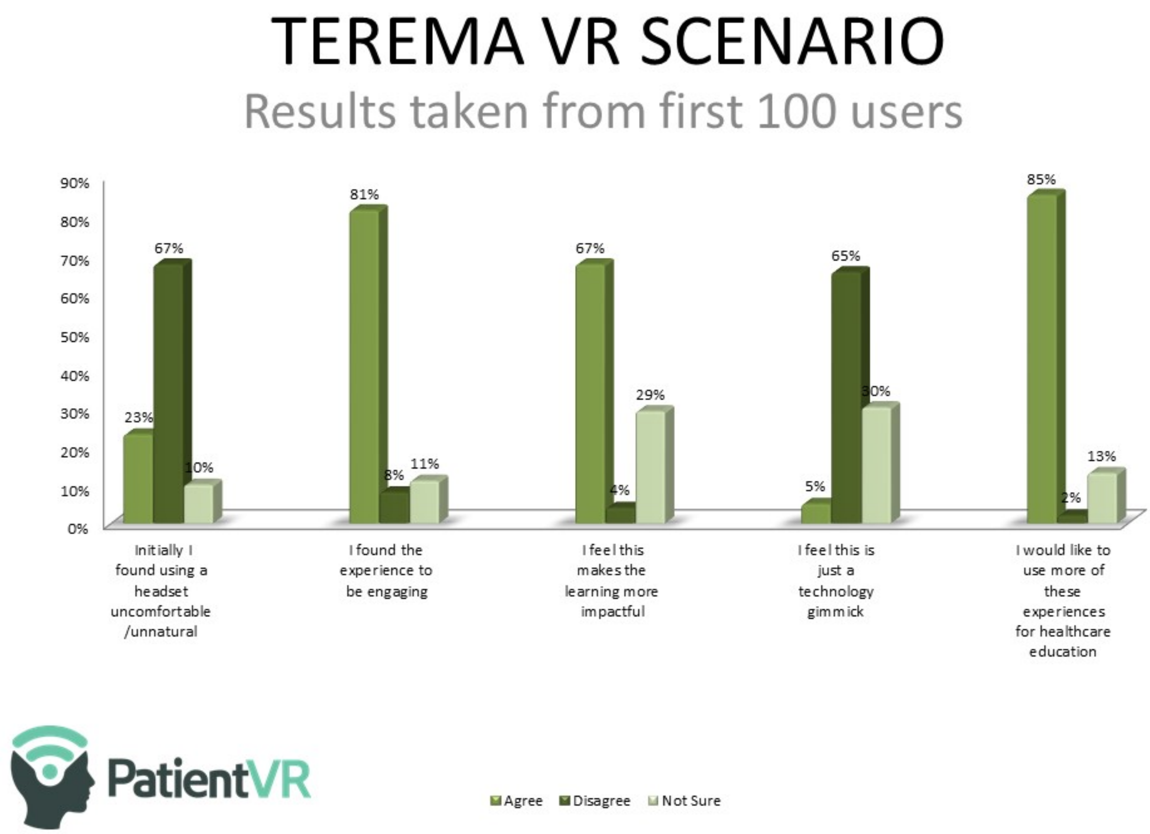

Figure 14 TEREMA results from 100 users of trialling cardboard VR Patient Perspective. March 2017

I discovered that I was increasingly pulled to understanding the emotional terrain that the participants navigated as they engaged with the virtual reality films. This was despite the fact that the technological feasibility and acceptance of virtual reality were key components of my research. Quantifying emotional reactions and levels of empathy through the use of rating scales and questionnaires was the objective of a tandem research project that was carried out in partnership with Plymouth University[27]. On the other hand, my own perspective, which is deeply entrenched in the arts and humanities, veered in the direction of a more qualitative approach.

27 This study overview, along with the statement of ethics and outline can be found in the appendix, where I am listed as a co-author. However, this piece of research was escalated beyond my direction due to my job role remit at the time.

Instead of using numerical statistics, I was drawn to the detailed emotional impact and the development of 'humanistic abilities' conveyed by the immersive content. Utilising discourse analysis as a research tool, I examined the language, implicit meanings, and common understanding among participants as they interacted with the VR videos. This strategy is in line with Clifford Geertz's concept of "thick description" in cultural anthropology, which involves offering a thorough, detailed, and contextually sensitive analysis of a phenomenon (Geertz, 1973). Participant interaction and reaction observations were a crucial aspect of my research methodology, reflecting the evaluative techniques used in conventional medical simulation training. This approach allowed for a comprehensive understanding of participant involvement, offering detailed observations on their interactions with the VR technology as well as their responses to and impact from the immersive content. Questionnaires provide quantitative data and specific insights but are unable to fully encompass the complexity and depth of emotional responses triggered by the VR films. Realising this, I modified the method of contemplation and response after the virtual reality experience. The films were incorporated into the TEREMA educational model for instruction and contemplation. TEREMA's methodical yet flexible approach motivated participants to view, debate, and contemplate their immersive experiences. This created a setting that was favourable for discovering profound personal insights and transformative learning experiences. TEREMA participants engaged in the VR films (most notably the communication in operating theatres 360-degree scenario)[28] collectively in a group setting, leading to the emergence of a shared discourse as they exchanged and contrasted their personal experiences and perspectives. The conversation, based on their similar professional background and shared experience with VR films, provided a substantial amount of qualitative data and took the reflective conversation often out of the remits of human factors. Utilising

[28] The experience, Communication in Operating Theatres, which details a simulation scenario of a critical communication breakdown between a junior and senior clinician can be viewed from the film materials list found at the front and in the appendix of this thesis.

discourse analysis in this setting enabled me to acquire a profound comprehension of the shared language, prevalent themes, and collective insights among the participants. This approach, which has its roots in the social sciences like sociology and linguistics, made it possible to examine language use and communication in a particular setting and identify hidden themes, patterns, and meanings in written or spoken text (Gee, 2014). As a result, it offered an indispensable resource for investigating the subtleties of interpersonal communication and interaction in simulation scenarios. When I first started working as a simulation technician, observing and running simulations was almost like a weekly ritual. I was able to watch the scenarios play out from the safety of the other side of the tinted glass in the AV room in the simulation centre. With the help of this ongoing observation and an introduction to discourse analysis, I was able to gradually become more aware of the subtleties of spoken language in the simulation environment as well as patterns of behaviour and interactions. This observational acuity proved to be an invaluable tool for my research as well as essential for my work as a simulation technician. I was taught to pay attention to details, observe the environment, and exercise patience when working with the material partly because of my experience as a documentary filmmaker[29]. When I looked more closely at the connection between discourse analysis and simulation debriefings, I noticed that the "good" and "experienced" simulation leads and facilitators were probably already using some of the methodology's principles without even realising it (though maintaining consistency across national simulation faculties is still a concern). Discourse analysis techniques used in social studies and linguistics were mirrored in the rich narrative data they were extracting and analysing from the simulations. This practice of deep debriefing, where the nuances of interactions, choices, and behaviours during simulations were dissected and discussed, essentially followed the

[29] This very much forms a reflective point I have only realised since writing up this work, that my background as a filmmaker allowed me to be a good and well receptive simulation technician that was able to pick up on details and enhance the scenarios, as well, on occasion to help run the debriefs, something not normally done in the simulation technician role.

principles of discourse analysis - probing into language use and communication in a particular context to identify underlying patterns, themes, and meanings. What was required here was an awakening; a shift in perspective to recognise that the qualitative analytical methods, often associated with social studies and humanities, were already being used in the simulation arena. At first, the use of film in the context of medical simulation seemed novel, but upon closer examination, it became clear that this was not an unusual idea. There were significant parallels between the debriefing sessions' use of discourse analysis and film analysis. Their commonality was the observation and interpretation of a story, whether it was told in a film scene or a simulated clinical setting. This realisation strengthened the argument for the inclusion of the arts and humanities in simulation-based medical education by demonstrating the connections between medical simulation and film studies. These sessions' underlying qualitative and interpretive methodologies proved their worth in fostering a more in-depth comprehension of the interactions and experiences within the simulation scenarios. Essentially, film language was already ingrained in medical simulation. All that was needed to draw comparisons between the two fields was a focused lens and an openness to draw parallels between these two fields. The addition of film into simulation acted as a catalyst, illuminating the dormant commonalities between the two disciplines and showcasing the benefits of an interdisciplinary approach. It was then my responsibility to alert the simulation staff to these similarities and this reality. I could draw attention to the intrinsic worth of these qualitative methods by demonstrating how closely their debriefing procedures resembled elements of discourse analysis and film analysis. I wanted to demonstrate to them that they were already proficient with elements of these tools—they had just realised it through a different context and name. This acknowledgment might then open the door for the deliberate and purposeful application of these strategies, improving the simulation's educational value and enriching the experience.

Additionally, I noticed more during these group feedback sessions than just the participants' spoken reactions. I observed the participants' nonverbal clues, reactions, and interactions closely, drawing inspiration from the techniques employed in medical simulation training. I was able to observe the participants in a group context where they were able to openly share and discuss their VR experiences, which gave me the opportunity to acknowledge a wider range of emotional reactions and reflections than I may have in an individual feedback environment.

This method supported the notion that providing feedback and thinking back on virtual reality experiences are social and intensely emotional processes rather than just cognitive exercises. It was underlined that the VR films affected the participants emotionally, inspiring empathy, compassion, and a greater comprehension of the patient's viewpoint in addition to providing an interface for practice reflection. This in turn helped identification of "humanistic skills," which include emotional intelligence, sensitivity, and regard for their patients' human dignity in addition to clinical competence.

I gradually moved from the phrase 'human factors', which largely focused on cognitive and physical components of performance, towards the concept of 'humanistic skills' as I dug deeper into the emotional terrain that the participants were navigating. This reorientation is in line with the main goal of my research since it acknowledges and values the relational, moral, and emotional aspects of healthcare practice. The integration of 360-degree virtual reality films into the TEREMA training, together with the ensuing dialogues, encouraged the trainees to consider these frequently overlooked facets of their professional behaviour. The films' immersive quality, which put viewers in the shoes of the patients, inspired empathy[30] and a greater comprehension

[30] I later struggled with describing this translation of learning output as empathy and began to consider 'compassion' instead. Based on participant reaction who spoke about wanting to make fixes to the experience and how to correct what they were seeing. compassion, while incorporating the empathic understanding of another's situation, also includes a desire to alleviate that individual's suffering or distress. It thus has a crucial action-oriented component. This differentiation can be observed in the work of scholars such as Neff (2003), who suggests that compassion, unlike empathy, involves more than

of their circumstances. This effect was enhanced by the conversation and group reflections that followed, which offered a nurturing atmosphere for individual development and the acquisition of "humanistic skills." This observation aligns with Mezirow's (1991) transformative learning theory[31], which posits that profound learning takes place when individuals are faced with experiences that challenge their existing perspectives, leading them to reassess their beliefs, assumptions, and values. The VR videos acted as a potent trigger for transformative learning experiences by offering an emotional and tactile insight into the patient's perspective.

4.2. Technical Learnings

Exploring 360-degree videos and virtual reality for instructional purposes involved encountering many technical hurdles and gaining insights. The method required a thorough grasp of the technology infrastructure, successful integration into current educational settings, and smooth facilitation to enhance learning experiences.

The primary technical apparatus for this deployment, before Cardboard VR was even a product was the Oculus Development Kit 2 (DK2), a VR hardware system which, at the time of the films' production, predated the mass release of VR technology, and in fact the headset hardware was not a commercial product, and was only available to developers and researchers. The VR method I utilised is fundamentally experiential, aiming to provide a subjective perspective to the

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sharing in another's emotional state but instead promotes understanding coupled with the motivation to help.

[31] Jack Mezirow's Transformative Learning Theory (1991) emphasises how significant learning can happen when an individual's existing beliefs or assumptions are challenged, leading them to reassess their beliefs, assumptions, and values. According to Mezirow, such a transformative learning process often involves a "disorienting dilemma" – a challenging event or situation that disrupts one's established worldview – followed by a period of critical reflection, leading to a "perspective transformation"

viewer. I aimed to achieve this by presenting the films on a VR headset while the participant was positioned on a hospital trolley. The purpose of this physical-virtual setup was to align the participant's actual location with the viewpoint of the patient in the film. This approach was influenced by the concept of thresholds, as explained in the preceding chapter. It aims to connect the significant differences in the environment and emotional condition that a patient encounters prior to, throughout, and after their healthcare process.

Utilising the threshold theory, this deployment method sought to connect the stark differences in environment and emotional condition that patients face before to, during, and following their healthcare experience. In this context, 'thresholds' refer to pivotal stages that indicate important changes in the patient's experience. These thresholds may be tangible, like transitioning from a hospital ward to an operating theatre, or intangible, like transitioning from a state of fear to relief. In fact, it is possible to claim that the VR approach itself acts as a threshold, onboarding into the headset and then exiting into a place of reorientation and debrief from the experience. Participants pass a crucial threshold when they go from being an outside spectator to an embodied experiencer, which opens up new perspectives that come from "being in the patient's shoes." The physical-virtual configuration becomes more than just a creative use of technology. Essentially, it is a tactical instrument intended to replicate the constraints encountered by a patient within a medical environment. Physical placement limits the participant's field of view, simulating the difficulties a patient may encounter in trying to comprehend their environment. This is an important point because it enables participants to feel elements of the same physical sensation of doubt and vulnerability that patients frequently do, which triggers an emotional recognition.

In the public domain, an ITV News piece about the PatientVR project ("Virtual reality helping doctors see through patients' eyes," ITV, 2015) offered a spotlight of the innovation, highlighting how the use if virtual reality could train doctors to become more empathetic. Not entirely the messaging I sought as again the technology took precedence in the promotion rather than the use and incorporation of the novel content. However, this very much helped the work gain traction and recognition within and externally to TSDFT into the wider NHS, and the tagline 'see through the patients' eyes" continued. Therefore, to begin this novel approach of using virtual reality (VR) for patient perspectives, vision, technological exploration, and frugal innovation were all necessary. In this case, VR was first used in an exploratory manner as a proof of concept to evaluate the viability and impact of using immersive films for medical simulation training. VR technology was still in its infancy at the time, which made it an intriguing and difficult proposition. The Oculus team (now known and consumed within Meta), recognising the potential for their technology in a healthcare context, offered their support. Meanwhile, the first 360-camera used in this venture was self-funded, marking the inception of this project as a passion-driven undertaking, as so often appears to be the case with internal innovations in the NHS, as I later discovered. Indeed, the entire setup embodied the essence of frugal innovation - the hoped ability to create significant educational impact using limited resources. This allowed an element of freedom to explore within the organisation, as I was able to demonstrate, albeit small, some momentum with a technology partner but also function as an active internal innovation in a rudimentary regional innovation network that the Trust could tick a box for.

The physical setting in which to present the content was an important technical factor. The later 360-degree films provided a realistic and immersive representation of the patient's experience because they were made to be viewed through virtual reality headsets, and for this it was important to have an efficient setup that allowed for easy interaction and comfortable viewing. Extensive testing and adjustment were necessary during this process to fine-tune elements like the viewer's physical placement and the viewing area's design. The physical setting dictated the ease of viewing and degree of immersion, which in turn influenced the viewer's overall engagement with the content.

Another essential component for the effective incorporation of these films into the classroom setting was facilitation. The simulation educator was responsible for providing sufficient context for the content, guiding the viewer, and creating an atmosphere that encouraged thoughtful discussion after the video. This aspect involved creating a facilitation technique that struck a balance between emphasising the material's emotional and humanistic components and providing technological guidance. An additional level of complexity was introduced to the simulation space with the addition of a 360-degree camera. It was vital to pay close attention to details because the placement and movement of the camera could greatly affect how the viewer experienced and perceived the patient's perspective. Learning how to integrate the camera into the simulation space while causing the least amount of disturbance to the original scenario required a dance between the technological and human components. In the second chapter, I discussed camera resistance and how acceptance, or at the very least a more comfortable inclusion, involved a less conspicuous camera in terms of size and placement, possibly sacrificing resolution and image quality in favour of comfort and more natural behaviour.

It's useful to remember that, despite all of the hype surrounding 360-degree film and virtual reality, these innovations were only considered means to improve the way that simulation-based learning was taught. Their application acted as a catalyst to encourage the participants' contemplation, conversation, and the development of humanistic skills. However, this method's inventiveness brought a special touch to the educational process and might have wider implications for the field of medical education. The process of developing and putting into practice these VR simulations and 360-degree films involved many technical lessons from various fields. All of the components—from the hardware arrangement to the facilitation technique to the actual physical installation of the camera in the simulation area—contributed to a deeper comprehension of the ways in which this emergent technology can be used productively in the context of medical education.

One of the most important technical lessons to be learned in the field of 360-degree filming for medical simulations is the strategic placement of the camera. A 360-degree camera, which captures the whole scene of the simulated medical situation, is mainly stationary during the scenario, in contrast to conventional filming where the camera is usually mobile and can follow the action. As a result, careful camera placement is essential to capturing all significant interactions and activities. Depending on the desired learning objectives, the camera in a 360-degree simulation environment takes on the role of the observer's eyes, changing their perspective to that of the patient or a healthcare professional. As a result, the location of the camera can have a significant impact on the simulation's educational value, so it's important to think carefully about the situation's viewpoint and the elements that are most instructive. By positioning the camera at eye level, for instance, instructors may be able to provide trainees with a comprehensive understanding of the patient's perspective, which will increase an appreciation for humanistic skills and improve patient-centered care.

Also noteworthy is the idea of utilising camera placement to create the illusion of a change in perspective. By strategically relocating the camera from one person's position to another, one can simulate a shift in viewpoint without the actual movement of individuals within the simulation. This approach could prove valuable in training scenarios where understanding multiple perspectives is important. I attempted a multi perspective shift technique for a resus observation film, to explore how the same scenario might look through the eyes and positioning of different roles in that event. This proved to be a useful exercise in offering 'too much information in too short a duration" where participants felt they were unable to fully process the entire 360 video sphere of activity from one perspective before jumping to the next before the scenario was finished. I believe this was an important example to understand the 360-medium and managing cognitive load. One learnt important strategy from this is to simplify the visual and auditory information wherever possible. This can be achieved through longer duration shots and periods of relative inaction. By stretching out the duration of shots, participants are given more time to explore the environment, acclimatise to the perspective, and process the unfolding events. This reduces the need for rapid shifts of attention and the associated cognitive strain. Interludes of inactivity or lulls between significant or crucial events in the situation fulfil a comparable function. They offer a mental break, enabling viewers to relax and reflect on what they have just encountered before proceeding to the next important occurrence. The gaps also reflect the fluctuation of actual clinical settings, with quieter periods typically preceding and following moments of crisis. Furthermore, these periods of inaction can serve as opportunities for contemplation, enabling participants to process their experiences, emotions, and reactions. This is especially beneficial in a training setting, as it provides an opportunity for viewers to reinforce their knowledge and apply it to upcoming situations.

360-degree cameras are most effective when there is minimal movement and ample time is provided in the shot for viewers to fully explore the surroundings. When placing the 360-degree camera on a manikin or patient's head, stability is crucial. Excessive camera movement during filming, due to manikin or patient movements, can lead to a disorienting and uncomfortable viewing experience in a VR headset. Ensuring the stability of the camera during filming is a critical technical aspect. Different tactics can be utilised for this purpose. Stabilising equipment or mounts can be utilised to minimise camera movement, such as a neck brace worn by the patient actor, with a camera rig attached to their head. The simulation scenario could be orchestrated to restrict the movements of the manikin or patient, thus avoiding sudden camera movements.

Figure 15 A pre-dedicated 360-degree camera rig on the manikin's head for perspective simulation scenario filming

The immersive quality of VR enables viewers to actively engage with content when the camera is positioned at the correct height. However, if the participant is significantly too low or high compared to their natural eye-level perspective, there can be a quick disconnect unless clear context is provided, such as being in a patient bed, or taking on the perspective of a child. The notion of agency, even if limited is crucial in the VR experience, allowing the viewer to choose where to direct their attention in the 360-degree environment. If the camera moves unpredictably while filming, it disrupts the feeling of control. The viewer may experience a sensation of being compelled to look in specific directions, potentially leading to motion sickness and diminishing the immersive quality of the experience. It is essential to find a balance when integrating a 360-degree camera into a medical simulation scenario. Positioning the camera to offer an immersive perspective is important, but maintaining its stability is equally vital for a pleasant and captivating VR experience. This equilibrium necessitates careful preparation, proper utilisation of stabilising tools, and potentially some post-production modifications.

Despite the fact that 360-degree video presents viewers with novel opportunities for agency that are distinct from those offered by traditional cinema, it does not completely separate itself from the foundations of established film theory. A nuanced understanding of the conventions and techniques of the medium could be beneficial to its application. This would not mean completely disregarding the established rules of filmmaking; rather, it would mean adapting and expanding upon some of those principles. On the other hand, there is also a significant amount of value in approaching 360-degree video in a manner that is more akin to a theatrical production. This approach brings an entirely different set of strategies and considerations to the table. Creators of 360-degree content, much like directors of theatre productions, are required to take into account the entirety of the environment and figure out how to direct the attention of the viewer within it. This is an exercise in composition, which involves coordinating multiple elements in order to direct the gaze of the viewer without overtly dictating it. In theatre, the audience's focus is directed using lighting, sound, and actors' movements. Similarly, in 360-degree video, viewer control can be subtly influenced by these principles. Sound can subtly guide attention to a particular direction within the immersive space. Actor blocking and movement are important in 360-video because they can direct the viewer's attention to significant moments. In essence, viewer agency in 360-degree video is significant, but it is not absolute. The viewer's focus can still be subtly steered and guided by the "conjuror's hand"[32]. Therein lies the delicate balance of this

[32] In the context of creating immersive 360-degree videos, the term "conjuror's hand" refers to the invisible guiding force that a content creator exerts to direct the viewer's focus and attention. It's reminiscent of how a magician uses sleight of hand to control the audience's gaze during a magic trick. In the immersive video setting, this "hand" may not be literal but is instead a combination of narrative cues, visual techniques, and even sound design elements that subtly steer the viewer's attention. This concept of the "conjuror's hand" is an area I'm particularly interested in exploring further, especially in identifying

new medium: providing freedom of exploration while maintaining a coherent narrative experience. This form of guided agency is more closely related to the interactive nature of theatre than traditional film, presenting new challenges and opportunities for VR creators.

That said, neither the filmic nor theatrical analogy perfectly encapsulates the unique affordances and challenges of 360-degree video. In essence, it's a hybrid medium that demands a fresh set of literacies and practices. It requires us to combine, adapt, and extend established conventions to effectively navigate its uncharted narrative and experiential terrain. My experiences creating 360-degree videos in simulation and healthcare were both rewarding and challenging, resulting in a wealth of valuable insights. The insights had the potential to provide guidance for individuals starting their own immersive content creation endeavours, especially within the broader simulation community. My recognition coincided with my position as a national advisor to Health Education England. I was responsible for creating national guidance documents on producing VR360 films in different scenarios. This initiative aimed to scaffold and streamline the process of creating immersive content in the healthcare education sector by sharing insights and best practices gained through first-hand experience. The guidance documents were made public in order to provide a comprehensive roadmap for those interested in pursuing this emerging medium[33].

While there was no rulebook for the medium of 360-degree video at the start, the complexities and nuances of healthcare education necessitated a set of guidelines for navigating its unique challenges and opportunities. Through my practical work, I was able to help create such a guide. By gathering and consolidating these key learnings, I hoped to not only improve the efficiency

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and effectively using attention triggers within immersive content for healthcare simulations and education.

[33] These VR content creation guides can be accessed via the following link: https://www.hee.nhs.uk/our-work/technology-enhanced-learning/simulation-immersive-technologies and additionally provided in the appendix.

and effectiveness of 360-degree video production, but also to foster a culture of knowledge sharing and collaborative learning in the field. The project's practical aspects led to tangible outcomes that went beyond the immediate immersive experiences. The guidance documents, based on real-world applications and experiences, demonstrate the importance and influence of hands-on, experiential learning. They act as a living archive of the iterative learning process that defines the dynamic field of VR360 film production in healthcare education.

4.3 Language, Content, and Simulation: Bridging Human Factors and Humanities

The terminology used to describe specific skills and behaviours in the healthcare industry holds great importance. Language influences perception and understanding, playing a role in establishing the framework for recognising, valuing, and developing skills in medical education and practice. This impact is clearly demonstrated in current discussions regarding the terminology related to empathy, compassion, and proficient communication abilities. Terms like "soft skills," "humanistic skills," and "human factors" frequently come up in these conversations, each with unique implications, particularly in the field of medical education and practice, such as medical simulation. In my research and observations, participants and facilitators frequently struggled to describe their reactions to the immersive content they were watching and their experiences. Frequently, they would resort to well-known phrases like "soft skills," "human factors," and sometimes " non-technical skills". Though they captured some aspects of these competencies, none of these terms seemed to be able to adequately capture the rich complexity that these competencies possessed.

It is possible that the phrase "soft skills," which is frequently used, has the potential to diminish the significance of these fundamental competencies, possibly portraying them as supplementary or incidental to "hard" or technical skills. When discussing the healthcare industry, the term "human factors" is typically used to refer to aspects of teamwork and communication, particularly in relation to the management of errors and the improvement of processes. On the other hand, its widespread application may result in a reduction in the emphasis placed on empathy and compassion in particular because it paints these qualities in a general sense rather than capturing the subtleties of these qualities.

Promoting the application of "humanistic skills" in medical simulation and healthcare education helps tackle these challenges. The term "humanistic" emphasises the importance of human values and concerns, highlighting the central role of empathy, compassion, and effective communication in healthcare. It emphasises that these items are essential components of medical practice, not just accessories. Furthermore, it provides a comprehensive perspective on healthcare that recognises the essential importance of interpersonal skills in patient care.

At the start of this section, I will give a concise comparative overview of the definitions to highlight the similarities and differences in language use, especially when presenting alternatives to clinical terminology. This chapter focuses on differentiating between "soft skills," "human factors," and "humanistic skills" in order to address the challenges associated with understanding the subtle differences and implications of their application in healthcare education and practice.

Soft Skills**:** According to Schulz (2008), the term "soft skills" refers to non-technical skills, which are typically interpersonal in nature, that are used to supplement technical skills and expertise in professional settings. Among the many abilities that fall under the category of "soft skills" are communication, empathy, teamwork, and problem-solving. Patient interactions, collaboration across disciplines, and the delivery of general healthcare are all areas in which these are extremely important in the healthcare industry.

Problematic Aspect: The word "soft" might give rise to the false impression that these abilities are less important, secondary, or simpler to learn than "hard" technical abilities. This is particularly problematic when considering the healthcare industry (Rao, 2019). It is imperative to refute this notion, since soft skills are essential to the smooth operation of any healthcare system.

Human Factors: To define the link that exists between human beings and the systems in which they work, the phrase "human factors" is utilised in the field of healthcare (Carayon et al., 2006). This term has its roots in the fields of ergonomics and system safety. It entails having an awareness of how the design of functions and procedures affects human performance and, consequently, the safety of patients.

Problematic Aspect: Because of its widespread application in system design and patient safety, the word "human factors" has the potential to dilute the specialised focus on empathy, compassion, and nuanced interpersonal communication (Catchpole, 2013). This is despite the fact that the term emphasises the significance of teamwork and communication. Within the context of healthcare delivery, this word has the potential to accidentally divert focus away from the relationships between individual carers and patients as well as the significance of emotional intelligence.

Humanistic Skills*:* According to Lee Roze des Ordons et al (2015), the phrase "humanistic values" refers to the personal traits and interpersonal abilities that healthcare practitioners need to possess in order to deliver treatment that is compassionate and respectful at all times. Having compassion and concern for the patient, talking with them, and respecting their autonomy are all necessary components of this process. Given that the term "skills" is being used in a variety of educational and training materials for the healthcare industry, I propose the use of the phrase "humanistic skills" as a phrase to connect the two concepts in this context.

Problematic Aspect: There may be a discrepancy between the term "humanistic skills" and its actual application in medical education, which raises questions about its philosophical foundations (Hojat et al., 2002). It's important to prevent the possibility that these abilities may be mistaken for philosophical or abstract, which they are not, and divert attention from the practical, hands-on skills in healthcare.

Though there is some overlap, each phrase emphasises its own specific focus, implications, and possible problems. Therefore, while discussing the incorporation of these abilities into medical education and healthcare practice, it is imperative to utilise language with clarity and consideration.

4.3.1 Soft Skills vs Humanistic Skills

Although "soft skills" and "human factors" are useful in characterising some aspects of human behaviour and interactions in healthcare environments, they fall short of encapsulating the essence of successful communication, empathy, and compassion—all of which are essential for delivering patient-centered care. The phrase "soft skills" has also been contested frequently, at least in my experience speaking with the workforce of Allied Health Professionals (AHPs), Midwifes and Nurses, where the general consensus is that these are anything but "soft" skills and that the term itself minimises the unique capacity of compassion. The phrase first appeared in the corporate field, where it describes a collection of non-technical skills that support problem-solving, teamwork, and interpersonal communication (Laker & Powell, 2011)[34]. Soft skills have been used to characterise traits like empathy, compassion, and communication in the context of healthcare.

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[34] Laker, D. R., & Powell, J. L. (2011) in their paper "The Differences Between Hard and Soft Skills and Their Relative Impact on Training Transfer", explore the distinction between 'hard' and 'soft' skills. 'Hard' skills pertain to technical knowledge and abilities that are specific to a job or sector, such as computer programming or financial analysis. In contrast, 'soft' skills relate to interpersonal skills that are universally beneficial across various jobs and industries, such as communication, teamwork, and problem-solving. Their research examines the impact of these skills on the transfer of training in the business context, highlighting the essential role that 'soft' skills play in overall job performance and success.

It is difficult to refer to compassion, empathy, and effective communication as "soft skills" in the context of healthcare for a number of reasons. First of all, it maintains the notion that clinical expertise and technical proficiency somehow supersede these abilities (Roter et al., 2002). This view establishes a hierarchy where "hard skills" are given priority, which could result in the neglect of crucial humanistic patient care components.

Second, to reiterate what I said before, calling these abilities "soft" implies that they are intrinsic, that they cannot be learned or developed, and that they might not be as crucial to the general efficacy of healthcare practitioners (Drigas & Papoutsi, 2016). This idea undercuts attempts to teach humanistic skills in medical school, which results in a lack of support for programmes meant to increase empathy and compassion among healthcare workers. The phrase "soft skills" fails to capture the importance of these attributes in patient care and fails to acknowledge how they may be enhanced by training and education. On the other hand, the phrase "humanistic skills" describes compassion, empathy, and successful communication in the healthcare field in a way that is more accurate and appropriate. By characterising these abilities as humanistic, we highlight how crucial they are to promoting a patient-centered approach and admit that training and education can help to develop and enhance them (Doukas et al., 2013).

In academic medical humanities programmes, the terms "soft skills" and "humanistic values" are frequently used interchangeably to refer to the traits of empathy, compassion, and effective communication. However, these terms are rarely applied outside of the restricted exposure that trainee doctors, for instance, receive during their post qualified education in hospital settings. Even with this environment gap, terminology matters because it shapes attitudes and perceptions about these skills and their value in medical practice and education. It can also, inadvertently, play a small role in ensuring that the humanities are consistently included in medical education.

On the other hand, I believe the phrase "humanistic skills"[35] acknowledges the significance of these attributes and is consistent with the increasing focus on incorporating medical humanities into healthcare practice and education. Its name alone may allude to a return to traditional medicine with an emphasis on human dignity and art. Examples include Arthur Kleinman, who has stressed the significance of embracing cultural, social, and personal perspectives in comprehending patients' experiences of sickness, and Howard Brody, who has investigated the role of literature and narrative in creating compassionate care. These academics, along with many others, have added to the ongoing discussion regarding the value of humanistic abilities in healthcare by stating that delivering high-quality, patient-centered care requires a focus on empathy, compassion, and effective communication. Furthermore, using the phrase "humanistic skills" is consistent with the increasing acknowledgement of the value of medical humanities in further medical education. Empathy, self-awareness, and reflective practice have all been demonstrated to be enhanced by medical humanities, which integrate literature, history, philosophy, and the arts (Shapiro et al., 2006). By using the phrase "humanistic skills," it recognises the important roles that these fields have played in helping healthcare practitioners become kind and understanding individuals. Acknowledging the significance of integrating humanistic competencies into medical simulation and healthcare education fulfils part of what was suggested as an outcome need in the Francis Report (2013), and indeed a distinctive chance to hone these abilities in a secure and regulated setting is provided by medical simulation. We may make sure that simulation scenarios are created to increase not just technical competency but also compassionate and empathic interactions with patients by giving humanistic skills top

[35] The term itself can be traced back to the influence of humanism, a philosophical and ethical perspective that emphasises the inherent value and potential of human beings, as well as the importance of empathy, compassion, and understanding in human relationships. Humanism has its roots in the intellectual traditions of ancient Greece and Rome and was further developed during the Renaissance.

priority during the planning, execution, and assessment stages of simulation-based training (Garden, 2015).

4.3.2 Human Factors into Humanistic Skills

There are various ways in which the ideas of human factors and humanistic skills overlap in the context of healthcare; nevertheless, each of these concepts addresses a different facet of patient care and professional growth. In the course of our discussion of their various objectives and ramifications, it is of importance to recognise the interaction that exists between these two domains, as well as the requirement for a well-rounded approach to the teaching and practice of healthcare.

The significance of comprehending and optimising the interactions between people, systems, tools, and surroundings is emphasised by human factors. This multidisciplinary area focuses on the physical, cognitive, and social facets of human-system interactions in an effort to enhance patient safety, effectiveness, and quality of treatment. Although human factors takes into account several issues such as ergonomics, cognitive workload, decision-making, team dynamics, and human error, their main objective is to maximise the design and performance of systems.

These characteristics do not specifically target the development and promotion of humanistic skills, even if they may have an indirect impact on empathy, compassion, and communication in healthcare settings. Examining the potential overlaps (and the reasons why human factors can be misinterpreted in the context of this field of study) reveals that although human factors do not directly impart compassion and empathy, they do so indirectly by placing a strong emphasis on teamwork, effective communication, and emotional health. The main goal of human factors is to optimise systems and procedures in order to raise healthcare workers' productivity, lower medical errors, and increase patient safety. On the other hand, some parts of human factors can be considered as secondary to the development of empathy and compassion.

For example, good communication—a crucial aspect of human factors—can promote compassion and understanding between medical staff and patients. Human factors training can help healthcare providers better connect with their patients and meet their emotional needs by promoting open communication, emotional intelligence, and active listening. In a same vein, cooperation and teamwork—two key components of human factors—can foster the growth of empathy and compassion. Nevertheless, system optimisation and performance enhancement continue to be the major goals of human factors, not the overt instruction of compassion and empathy. Additional training and terminology related to this, such as in medical humanities or humanistic skills focus, may be required to augment human factors training in simulation in order to successfully teach and develop these humanistic abilities.

Conversely, humanistic skills focus on the intrapersonal and interpersonal abilities that support effective communication, empathy, and compassion in healthcare environments. These abilities acknowledge the importance of empathy, understanding, and support from others when delivering patient-centered care. In addition to encouraging self-awareness, reflective practice, and sympathetic relationships between healthcare providers and patients, humanistic skills aim to develop a deeper understanding of the human experience.

It becomes clear that these two domains are critical to providing patients with high-quality treatment and producing healthcare workers who are well-rounded. Humanistic skills provide a strong emphasis on empathy, compassion, and communication—all of which are essential for building rapport and trust with patients—while human factors concentrate on eliminating errors and maximising system performance. Naturally, as both serve different goals, so this exercise is not necessarily advocating for one over the other in this comparison. Again, it's adding a term to more fully and accurately define an area that has frequently been absorbed into these other adjectives. Thus, a balanced approach to healthcare education and practice that incorporates both human factors and humanistic skills would be advised as a course of action. Healthcare

facilities can be structured to minimise errors and maximise efficiency while encouraging cooperation and teamwork among healthcare staff by applying human factors principles.
So, by adopting the term "humanistic skills" and incorporating it into medical simulation and training as a first step, it begins to foster an adoption of terminology within a practical training environment, from which new trainees are required to complete as part of their training, giving language important exposure in the development of healthcare professionals who are not only technically competent but also compassionate and empathetic in their interactions with patients.
In the context of this research, incorporating humanities terminology and influence is being delivered through a 'technical' already established modality of video playback, but viewed and used instead with an underpinning from film theory. Bringing this knowledge into simulation training can offer unique opportunities for reflection on human emotion and foster the development of humanistic skills among trainee doctors and other simulation participants (Peres et al., 2019).

The recognition of Humanistic Skills in healthcare simulation is an essential step for utilising and confirming first-person accounts and storytelling as key components of healthcare delivery and education. Exploring patient perspectives requires looking into personal narratives and lived experiences. The personal accounts, derived from actual patient experiences, provide powerful insights that can greatly impact healthcare practices and cater to specific patient requirements. Yet, repeating the concern previous mentioned, the subjective nature of these experiences has frequently been criticised for being too personal and lacking public verifiability. This criticism resonates especially in a clinical setting where the foundation of medical practice is heavily reliant on empirically verified data. Patient narratives' intensely emotional and personal content doesn't easily fit within the traditional parameters of clinical evidence, which leans towards objectivity. Despite these criticisms, storytelling is gradually gaining traction in global healthcare systems, including the NHS. This is supported by a growing body of scholarly research emphasising the importance of patient narratives as a form of evidence to supplement traditional data. These narratives, based on patients' lived experiences, can provide valuable insights that can be used to improve individual care, shape institutional policies, and guide public health strategies on a societal scale. Notably, Charon (2006) has long advocated for the use of narrative medicine as a tool for understanding and interpreting patient narratives. Charon contends that healthcare professionals can use narrative competence to empathetically listen, interpret, and respond to patients' dilemmas. This shift away from system-centered approaches and towards more person-centered care emphasises the importance of incorporating humanistic skills into the structure of healthcare. It implies that, while system-level improvements are still necessary, they must be accompanied by an empathic, compassionate, and humanistic approach to patient care. This is incredibly revelent in the current landscape of the NHS, as organisations begin to transition to electronic patient records (EPR) in a large system level rollout of technological infrastructure. The narrative turn in healthcare, including the growing recognition of patient perspectives and experiences, makes a compelling case for this integrated approach, reflecting the need for a more nuanced understanding of healthcare that values both 'human factors' and 'humanistic skills' and how these values might be recognised and recorded in systems.

4.4 Blueprint for Clinicians as Content Creators

In this concluding part of the chapter, I integrate the film theory, discourse analysis, humanistic skills, and the transformative capabilities of 360-video technology that we have previously explored. I develop a blueprint for clinicians to use their clinical expertise and newly acquired knowledge of imagery in medical simulation. Here is an outline of the factors discussed in my previous research, as clinicians are taught to create content.

The technological advancements in recent years have widened the potential for exploration and expression in healthcare. As a result, more and more clinicians are turning towards the use of technology as a means to document, scrutinise, and enhance their professional practice. In response to this evolving landscape, it's crucial that healthcare professionals have the necessary skills, balanced awareness, and knowledge to navigate these new territories (Topol Review, 2019). This involves not only the practical skills for content creation but more importantly (and the practise supports a route toward) the theoretical underpinnings that allow for a more profound interpretation and usage of these filmic materials, leading to more insightful debriefing sessions.

The comprehension of the language of film and imagery is fundamental to this undertaking. By studying film theory, medical professionals can arm themselves with a thorough framework for producing and analysing moving image documentation. When combined with a foundation in discourse analysis, clinicians are able to look past the obvious and uncover meanings and nuances that would otherwise go missed in these visual narratives. Additionally, learning from a variety of engaging films from across the cinematic spectrum is an essential part of the toolkit. Clinicians can benefit from the thoughtful depictions of empathy and compassion in these works, which offer real-world examples and perspectives. Clinicians can gain a comprehensive understanding of the visual and narrative ways in which empathy and compassion can be communicated by analysing such films during workshops. In addition to inspiring clinicians, these cinematic works offer a valuable opportunity to apply and refine the skills being developed. By critically dissecting these films, clinicians can apply the principles of film theory and discourse analysis to better understand the visual narratives and how they evoke emotional responses. This analytical practice can enhance a clinician's understanding of how these elements work in combination to generate empathy and compassion in the viewer.

Humanistic skills are emphasised in this transformative journey. Clinicians must effectively communicate and demonstrate empathy and compassion as they transition into content creation roles. The strategic utilisation of film and immersive 360-degree video technologies offers a powerful tool to showcase these skills, generating an emotional impact to complement the technical aspect in medical simulation. Integrating patient perspectives into this method provides clinicians with a more profound comprehension of the patient's experience and willingness to consider first-person narratives, promoting a more narrative and human-centered approach. Clinicians gain unparalleled insight into the patient experience by creating immersive experiences and incorporating first-person narratives, which enhances healthcare education and practice. By instilling these skills in clinicians, it is hoped that a pathway for them to produce content that is not only impactful and meaningful but also transcends the technical, thereby embodying a humanistic approach to healthcare. Therefore, this blueprint for clinicians as content creators is aimed to be a catalyst for the continued evolution of medical simulation. It is going to steer it towards an approach that fully combines technical skills, humanistic skills, and patient perspectives in the context of healthcare education and practice. Educating clinicians on how to create imagery is important because it allows them to acquire a more profound comprehension of how to interpret it, which is an essential ability in this day and age of visual technology. For the purpose of gaining a better understanding of the workshops' function as an adaptable and evolutionary blueprint, the workshops can be broken down into key themes;

4.4.1 Visual Literacy

Building visual literacy is a vital step as clinicians transition into the role of creators of audio-visual content. This involves acquiring a deep understanding of the underlying theories that govern moving images, an understanding that extends beyond the mechanics of film production. A number of these were highlighted in chapter two as important for content makers, however as

the practise of this research progressed, the idea of the 'imperfect image' is one of the fundamental ideas of film theory that became particularly pertinent. As was previously mentioned, this phrase describes images that are purposefully left unclear or incomplete in order to encourage the viewer to actively interact with the image and fill in the blanks. If clinicians used this method of filmmaking to create their content, it might promote a more involved and active learning process in medical simulation scenarios. Clinicians may find value in utilising extended, almost uncomfortably long scenes, a technique borrowed from film theory. The extended scenes portray medical situations as they happen, encouraging viewers to watch and predict, replicating the tempo and flow of real clinical environments. This can improve the authenticity and immersive nature of the simulations, increasing their effectiveness as educational tools.
Filmmakers utilise focus and depth of field to direct the viewer's focus. In traditional film, the director has the ability to selectively focus on a specific subject by blurring the background or foreground to subtly highlight where the viewer's attention should be directed or what they should deem significant. Depth of field is the distance range in a scene that appears sharp. It can help direct viewer focus and create a sense of depth and dimension in a scene. The application of focus and depth of field in 360-degree videos is inherently different because of the medium's unique nature. The entire scene is in focus in a 360 video, allowing the viewer to freely explore it. Creators can direct the viewer's focus by strategically placing action or captivating elements. Strategic staging and choreography in the scene can attract attention and establish a focal point in the spherical video environment, however the apparatus to view this content (like experienced with the CardboardVR) may in itself create imperfections of the image, which is an important element to consider.

Close-up shots in 360-degree video present a challenge because traditional zoom features are not available, making it difficult to focus on detailed expressions and establish emotional connections with subjects. Alternatively, moving the camera closer to the subject or bringing the action nearer to the camera can produce a comparable outcome. Viewers can choose to examine the content more closely by physically moving closer to the screen while wearing a VR headset. Understanding the visual tools in 360-degree video allows clinicians to improve their skills in reading, interpreting, and creating more impactful, immersive, and instructive medical simulation scenarios. From the perspective of technological philosophy, there is opportunity to investigate the influence that the medium itself has on the information that is being delivered. In the context of 360-degree video, for example, the technology enables a more immersive and comprehensive experience. It provides the viewer with a more comprehensive grasp of the environment and the interactions that occur within it, as well as a broader context in which to observe it. On the other side, material engagement theory[36] investigates how humans engage with material culture, like films, to interact with and comprehend the world. Clinicians may guarantee that their content is actively engaged with rather than merely passively consumed by identifying this interaction, which will encourage deeper learning.

4.4.2 A Curated Film Library: A Tool for Expanding Visual Literacy and Empathy

I have started including a carefully selected film library into the workshop model, acknowledging the significant ability of films to convey intricate emotional experiences and promote sympathetic comprehension. This was influenced by very early interest in this research into cinematherapy[37], a concept of using well curated films to engage as therapeutic tools for

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[36] Material Engagement Theory refers to an approach within cognitive archaeology that seeks to understand the cognitive and social changes in human evolution through the lens of the human interaction with the material world. It was initially proposed by Lambros Malafouris in 2013. This approach highlights the reciprocal interaction between people and things, where both entities mutually affect each other. Applying MET in medical simulation encourages an understanding of the complex dynamics of 'human-material' relationships within the simulation environment. It recognises that these interactions are not merely instrumental but play a significant role in shaping cognitive processes and influencing learning outcomes. It underlines the importance of considering the design, configuration, and usability of simulation equipment and environments to optimise the learning experience.

[37] Dr Amanda O'Bryan, a mental health coach, describes the use of film in this context as a means to explore deep reflections of our culture and our inner lives as human beings.

addressing medical, mental health, and life management concerns. It is a type of self-help that promotes emotional healing and personal development.

This library has a wide range of carefully chosen films from the film industry, each showcasing a distinct narrative that effectively captures empathy, compassion, and first-person viewpoints in hospital settings. This collection is intended to serve as a resource and a guide for clinicians as they embark on their journey of content production. Its purpose is to assist clinicians develop and understand that cinema is more than just a medium for narrative. Some of the films that provide a framework of inspiration include "The Diving Bell and the Butterfly" (2007), "Wit" (2001), "Patch Adams" (1998), "Amour" (2012), "Still Alice" (2014), and "One Flew Over the Cuckoo's Nest" (1975), amongst others. These films demonstrate how empathy and compassion can be illustrated on screen, and are influenced by the theory offered through the cinematherapy movement. These films have since been made available through our Trust Library for viewing. These films' narratives are not only fascinating, but also sophisticated in structure, making them excellent for creating a greater knowledge of how empathy and compassion can be effectively integrated into a clinician's practice. An additional resource that is available to clinicians who are interested in interacting with the film arts is the bibliography that was compiled by my co-author, Dr. Jacqui Knight, and included in the TAaCT[38] paper that we produced in 2018. The purpose of this annotated list is to present a comprehensive collection of films and books that are centred on the investigation and evaluation of empathy and compassion. The purpose of this initiative is to provide clinicians with a comprehensive grasp of these humanistic abilities, which will be informed by a range of narratives and points of view. A more profound comprehension of empathy and compassion can be attained by clinicians through their participation in this bibliography, which can be accomplished by either watching the videos or reading the selected texts. It is possible for individuals to be stimulated to engage in

[38] The TAaCT publication can be found in the appendix of this document.

reflective thought about their own habits and attitudes by various depictions and discussions of these feelings.

4.4.3 Understanding the Medium

The process of creating content requires a thorough understanding of the selected media, be it 360-degree films, virtual reality (VR), or regular video. Every one of these media has unique technological requirements, opportunities, and difficulties that must be effectively resolved. Mastering the technical aspects is an important first step. This entails having a working knowledge of the machinery, the software, and content editing. In the case of 360-degree films, for example, one must become proficient with the 360-degree camera, understand how to "stitch" together various video feeds to produce a smooth spherical image, and navigate the post-production workflow. Additional skills, like an understanding of interactive elements or even basic coding knowledge for specific platforms, might be required for VR. However, simply mastering the technology is not enough. Clinicians (or any new audience to film for that matter) need also understand the unique attributes of their chosen medium. This includes the immersive nature of 360-degree films and VR, which allows the viewer to be 'inside' the scene, looking in any direction they choose. This radically different perspective has the power to shift the viewer's perception and create a highly engaging, emotionally resonant experience. But it also requires careful consideration of what is in the frame at all times and how this might impact the viewer. Another crucial component is the ability to be interactive. For example, viewers may be able to interact with the environment when using VR, creating completely new opportunities for training and simulation. To guarantee that it fulfils the learning objectives and doesn't become a distraction, this interactivity also requires careful design. Additionally, the comfort of the audience is of importance. When watching virtual reality or 360-degree video, it is possible to experience disorientation or even motion sickness due to rapid movements, quick cuts, or inappropriate use of perspective. Having an understanding of how to design and film in a way that maximises the comfort of the audience is therefore essential.

While engaging in content creation, I frequently promote 'filmmaking instruction' on-site, directly during the content creation process. During the filming of a simulation or learning scenario, I would explain the process to the participants, converting a potentially passive experience into a participatory activity. When setting up a 360-degree camera, I will detail the rationale behind selecting the camera's location, its ability to capture the action, and the importance of being aware of it during the scenario.

Figure 16 A content creation workshop, supporting clinical staff create 360-degree video in a clinical area.

I also extend an invitation to the clinical staff to take part, even if it's just in small ways like camera placement or monitoring the video feed screen. This encourages a sense of creative engagement in addition to giving them a practical understanding of the medium. This interaction turns into a useful feature in and of itself, making people feel involved in the process and fostering a deeper comprehension of the medium. The collaborative process and ensuing innovative conversation provide a priceless learning environment that improves the team's capacity to collaborate with these rapidly advancing technologies. An essential first step in bringing ideas to life is content creation. From idea to final product, this process starts with a well-defined goal and a clear grasp of the selected medium. Before starting any project, I want to emphasise this: what is the experience or learning objective you want your audience to have? Every choice you make regarding the film's content, structure, and final presentation becomes simpler when you keep this question in mind.

The use of storyboarding as a tool during the planning stage is extremely effective. The flow of the content can be visualised more easily, which provides a blueprint for the production of digital content or the filming of the content. On the other hand, conventional storyboarding techniques will need to be modified in order to accommodate 360-degree filming. As a result of the spherical view that a 360-degree camera provides, the entire environment is captured in the image. Therefore, it is necessary to take into account the scene as a whole as well as the placement of the action within the entirety of the 360-degree video sphere. I frequently instruct my coworkers to approach the camera space as if it were a bullseye, with bands of activity emanating from all directions around it.

After the planning stage is finished, the next step is to start the content creation process. When viewed through the lens of a 360-degree camera or within the context of a virtual reality environment, this is the point at which the medical scenario comes to life. During this stage, the most important things to think about are the positioning and movement of the camera, the efficient utilisation of lighting and sound, and the management of the actions to ensure that they are captured in the way that was intended.

The last stage involves editing, which is how the unfinished digital content or raw video is transformed into the final product. It entails putting the video in order, honing the transitions, and adjusting the audio. During this stage, additional text, graphics, or special effects could be added. At this point, a critical examination of the video makes sure it is in line with the original learning goals. To make this entire process accessible and manageable, pre covid-19, I set up a digital lab where clinicians can access the necessary equipment, support, and training. Offering one-to-one training, either with me or a member of the digital team, we were able to provide comprehensive guidance through each stage and address any challenges that may arise.
In addition to practical guidance, various resources are accessible, including VR360 guides created for Health Education England (HEE), online tutorials, and collaborative platforms like HEE's technology enhanced learning (TEL) network. The goal is to provide clinicians with the essential tools and knowledge to effectively generate content and overcome any obstacles they may face.

4.4.4 Reflection, Discussion, Debrief and Engaging with Broader Discussions

The process of becoming a content creator in healthcare extends beyond the physical creation of audio-visual materials. As creators, clinicians also step into a broader, dynamic discourse about the use and implications of visualisation technologies in healthcare settings. They become contributors to and participants in discussions around patient-clinician empathy, the transformation of clinical practice, and the evolution of professional identity in the face of these technological advancements. Participating in these conversations encourages clinicians to consider the significance of their work in a critical manner. Their digital content—360-degree films, virtual reality simulations, or other immersive media—has the power to profoundly affect how empathy is expressed and felt in healthcare settings. These works of art have the power to transform the dynamics of the relationship between doctors and patients, promoting a greater capacity for empathy and understanding. By taking part in these discussions, clinicians can keep improving the ways in which they create content to better accomplish their goals. Engaging in this wider discussion also sheds light on the ways in which the creative work of clinicians integrates with other aspects of healthcare, providing a deeper comprehension of how visualisation technologies can improve clinical practise. Most significantly, it encourages clinicians to reconsider their place in medical education, particularly in the context of simulation-based learning environments.

Enhancing non-technical skills training is one of the key areas of intersection where the humanistic aspects of healthcare—empathy, compassion, effective communication, and understanding the patient's perspective—are just as important as the technical skills. A distinctive platform for highlighting these humanistic skills is provided by digital content, especially 360-degree films and VR simulations. But more importantly, how can participant language and learning be extracted from these experiences?

These immersive mediums offer a unique chance to replicate patient experiences and feelings that traditional simulations might not be able to match. 360-degree films and virtual reality, for instance, can depict the unease a patient might feel during an MRI scan or the bewilderment an elderly person might feel while navigating a busy hospital. These re-enacted scenarios provide a potent and poignant teaching aid, inspiring medical professionals to look beyond their technical duties and take the humanistic facets of their work into consideration. This visual material also functions as an effective debriefing tool. Similar to how a debrief might analyse a clinician's technical actions or decision-making process during a simulation, these immersive visual materials can help spark conversations about the humanistic, non-technical aspects of the work. Was the medical professional empathetic? In what manner did they speak with the patient? Could the care given have been more considerate of the patient's viewpoint or better understood? These discussions can facilitate more thorough, compassionate, and efficient healthcare practitioners by bridging the gap between technical proficiency and humanistic care. Clinicians can improve the value of simulation-based learning environments by investigating these creative uses for their digital content. This will help to foster the development of these essential humanistic skills in addition to technical skill training. Essentially, participating in these more extensive conversations is an essential aspect of the path that clinicians take as content creators; it broadens their knowledge and amplifies the influence of their work in the complex field of healthcare.

In this chapter, I have explored how the arts and humanities can enhance the technology, content, and language of a human-centric approach to simulation, looking at a variety of aspects related to the integration and augmentation of simulation through film. Through an analysis of these fields and the provision of a blueprint model for their combination and implementation, this field establishes itself within the recurring patterns and constraints of simulation. But theoretical domains are not the only places where this multidisciplinary approach can be understood and applied. As discovered in the next chapter, these ideas have significant real-world application. Here, I will explain how the ideas and methods of the humanities and film theory came to play a crucial role in our Trust's ability to provide vital training to people in the midst of the Covid-19 pandemic's unprecedented challenges. More than that, this method helped my team's viewpoints on simulation fidelity to fundamentally change. We've begun exploring the idea of minimal viable solutions, which was made clear by the experience. This idea and its useful applications highlight the fact that fidelity isn't always the most important factor. It also provides an unusual but useful perspective on how we should approach and carry out medical simulation.

Chapter 5: The Innovation of the Debrief

In order to improve the humanistic skills learning process, I have examined a variety of aspects of medical simulation in this thesis thus far, including the function of the camera, the impact of introducing a more established theory of film and narrative for imagery, and the significance of perspective and innovation. Additionally, I have provided context towards the challenges associated with high-fidelity simulation and the impact that has as an experienced example on technological innovation on healthcare training. This research has led me to recognise the necessity for a more balanced, accessible, and human-centred approach to simulation, one that focuses on achieving meaningful learning outcomes without over-reliance on expensive, high-tech solutions. However, what happened next, effecting both global health systems and the NHS from which I was actively working within would create a challenging but accelerated environment for innovation and specifically the rapid affordances of digital technologies, including how to make things work previously untested. The global health crisis brought about by Covid-19 upended the established norms and expectations of healthcare delivery, pushing the boundaries of adaptation and innovation in every aspect of the field. Medical education and training, and more specifically, simulation-based learning, were not exceptions. In this demanding climate, it became more important than ever to train healthcare professionals swiftly and effectively, while maintaining the highest possible standards. Amid the chaos, one particular aspect of simulation-based learning assumed a greater significance: the debrief. The debriefing process serves as a reflective mirror[39] to the active phase of simulation. It facilitates the

[39] In his 2002 paper "Total Internal Reflection: An Essay on Paradigms," Roger Kneebone asserts that reflection is an indispensable process in experiential learning, particularly in the context of medical education. He states, "Reflection is a process that allows us to step back and think about the experience, analyse it, and learn from it." He further underlines its role in bridging the gap between theory and practice.

conversion of experience into learning, helping learners to dissect their actions, reactions, and decision-making processes. This transformation from experience to understanding is crucial for the application of learned skills and knowledge to real-life clinical practice. Rudolph et al. (2008) further emphasises the integral role of the debriefing process, asserting that it's not the simulation itself but the reflection and conversation afterwards that create the most profound learning experiences. This sentiment echoes the findings of Shinnick et al. (2011), whose research demonstrated that learners who underwent debriefing after a heart failure simulation significantly improved their understanding and knowledge, compared to those who did not. However, the potential of debriefing extends far beyond this reflective phase post-simulation. In this chapter, I will explore how debriefing, when considered an integral part of delivering simulation differently (part on account of Covid-19) such as through remote means or from filmed material, becomes a tool to shape the simulation itself. By aligning the debrief more closely with the simulation, it may be possible to make or package the learning process more accessible, repeatable, and affordable through these alternative ways of delivering simulation that were now being considered more widely as a response, such as through Immersive Media and technology (such as VR).

The significance of this alignment has been highlighted in large part by the Covid-19 experiences. The pandemic presented enormous obstacles, requiring quick adjustments to the way healthcare education was delivered. The need for effective and accessible simulation and the delivery of specific and very different scenarios related to the pandemic (such as respiratory failure with infection control, PPE, and management of exposure to COVID-19[40]) became critical as face-to-face training became more limited and the demands placed on healthcare professionals increased. In this shift, lower-fidelity and film-based learning were heavily

[40] An example of a 360-degree training resource for donning and doffing PPE is available in the appendix video library, which became part of the national resources supporting NHS staff during Covid-19.

emphasised and played a crucial role in providing 'minimum viable simulation,' a notion I elaborate on in this chapter. The pandemic also made clear how important debriefing is for promoting learning, fostering emotional health, and, frequently, for uniting teams to promote cohesiveness and experience-based learning in the midst of a crisis. The high-stress environment of the Covid-19 era brought to light the continued necessity of debriefing, necessitating a creative approach that could both adapt to the pandemic's constraints and take advantage of its unexpected opportunities.

This chapter will examine the development of debriefing in these difficult times, highlighting creative solutions and key takeaways. The debrief and the simulation itself have been shaped by prior experiences and the practice of creating and incorporating imagery when navigating the Covid-19 landscape. It explores resilience and adaptation in the face of adversity, in addition to innovation. This journey demonstrates the debriefs ongoing relevance in creating simulations that are more impactful, emotionally resonant, and effective in the face of constraints. It also highlights how innovation and the evolution of simulation don't have to be dependent on the idea of high fidelity. In order to examine the significance and changing environment of debriefing in medical simulation, especially in light of the Covid-19 pandemic, this chapter will be divided into three main sections;

i. The Significance of Debriefing in Medical Simulation:

This chapter's first section focuses on the critical function that debriefing performs in simulation-based medical education. Simulations can be turned into thought-provoking educational opportunities through the debriefing process. The foundation of experiential learning theory is this reflective process, which also serves as a catalyst for better performances in the future. Furthermore, debriefing is a technique to improve learners' cognitive abilities—though it frequently omits the emotional and humanistic skills side, which I also examine—rather than merely being a memory and feedback exercise. Debriefing, on the other hand, attempts to foster critical thinking and motivate students to question and consider their clinical actions by drawing them into conversations about clinical decision-making, effective communication, teamwork, and leadership throughout the session. However, debriefing's function in medical simulation isn't limited to cognitive growth. It also includes forming the professional identities, morals, and behaviours of students—aspects that are fundamental to medical professionalism. Using categories defined in Shinnick et al. (2011)'s paper "Debriefing: The Most Important Component in Simulation?", I will go into great detail in this section about how debriefing helps shape these intrinsic qualities, drawing from relevant literature. In addition to drawing on pertinent literature and theories for each heading and further connecting to my own work as a means of showing joining and entry of the arts and humanities to create a wider landscape, this paper is highly regarded in the simulation community as a mechanism to explain the processes and their concepts of debrief stages.

ii. The Impact of Covid-19 and Minimal Viable Simulation:

The Covid-19 pandemic led to a period of crisis and challenges, necessitating rapid adaptation in all aspects of healthcare, including medical education. Due to the difficulty of conducting in-person, high-fidelity simulation, there was a pressing demand for creative and easily accessible simulation training methods. This resulted in the emergence of 'minimal viable simulation', which aimed to enhance learning experiences by utilising efficient yet simplified resources. Utilising imagery and recorded 360-degree content as example served as a potential method for scenario-based teaching, in conjunction with alterations to the debrief process and simulation settings, all contributing to the concept of endorsing a minimalist approach. Images and videos are increasingly important for remote teaching platforms due to their capacity to communicate intricate situations with minimal textual information and are essential for scenario design and briefings. Integrating recorded 360-degree material from our experiences at Torbay improved the immersive quality and on demand access of the simulations, offering learners a realistic visual perspective in the absence of simulation labs and full teams. This section will explore into the concept of minimal viable simulation, analysing its components, explaining its integration within our Trust, and examining how it aided in sustaining training effectiveness during the challenges presented by the pandemic.

iii. Innovation of Debriefing Methods:

In the final section of the chapter, I will examine the creative debriefing techniques that emerged during the challenges of the pandemic. The Covid-19 pandemic required a transition from conventional debriefing techniques to approaches that could meet the intricate demands of a swiftly evolving healthcare environment. The significance of flexibility and adaptability in debriefing strategies has been highlighted, which may not have been as crucial in a pre-pandemic setting. Here, I will give examples of how technologies enabling remote debriefing facilitation emerged as advantageous during this period. I will use a practical example I created to show staff how effective communication, care, and compassion can be maintained in clinical environments under pressure, while wearing PPE during Covid-19. This section will also examine the integration of imagery and 360-degree content in these new debriefing approaches. How was the debriefing process enhanced? How did they promote more efficient learning experiences? This section of the chapter will discuss the advancements in debriefing techniques that resulted from the crisis at Torbay. It aims to outline their possible impact on future medical education within a post-pandemic simulation programme.

5.1 The Significance of Debriefing in Medical Simulation

A substantial amount of literature has been written about the function and significance of medical simulation, and a recurring theme in all of them is that the debrief is the most crucial component of the simulation process. In addition to offering a helpful starting point for dissecting some of the most important components of a debriefing session, the paper "Debriefing: The Most Important Component in Simulation?" by Shinnick et al. (2011) presents empirical evidence highlighting the significance of debriefing in medical simulation. The debriefing procedure, which is a crucial part of simulation-based learning and where the biggest knowledge gains were seen, is highlighted in this study above all others. It implies that learners' comprehension and abilities are improved more during the debriefing phase than during the hands-on portion of the simulation itself. This is because it enables learners to consider their actions, receive feedback, and relate theoretical knowledge to real-world situations. The study also highlights the importance of debriefing in group learning, as it allows students to benefit from one another's viewpoints and experiences. The study supports the idea that debriefing is a transformative process that enhances critical thinking, develops emotional intelligence, and motivates students to consider their clinical actions. This process also helps to explain why simulation-based medical education is so successful. The headings are those suggested in the aforementioned paper, and I begin each subsection with the summary from Shinnick et al. (2011) before connecting other pertinent literature and a proposition to my work. I use this paper and the key phases described in the makeup of debriefing, ones that are widely recognised in the community as a pathway forward to examine and explain both the current conditions of medical simulation debriefing, but also to illustrate links and opportunities where my practise and research theory extending beyond that of just simulation practise has valid entry into a currently accepted model.

Understanding and Reflection: In simulation-based learning, the debriefing procedure acts as a reflective mirror, giving students a chance to consider the choices and actions they made during the simulation. This reflective process entails a thorough examination of the reasoning behind each action, the decision-making process, and the results, rather than just a recollection of events. It enables students to evaluate their performance critically, comprehend the effects of their choices, and pinpoint areas in which they need to grow. This introspective and understanding process is essential because it promotes self-awareness and self-evaluation, which are essential elements of lifelong learning and career advancement in the medical industry. It was found that there were the most obvious knowledge gains during the debriefing portion of the simulation, as suggested by Shinnick et al. (2011).

Kneebone (2002) emphasises the value of reflexivity and reflection in learning in "Total Internal Reflection: An Essay on Paradigms". Reflection is the process of taking stock of past encounters, deeds, and choices in order to better understand and draw lessons from them. Conversely, reflexivity entails a more introspective process in which students critically assess their own participation in the learning process as well as their prejudices and presumptions. According to Kneebone, engaging in this process of self-examination can help one gain a better understanding of the complexities of their own practice as well as promote personal development and self-awareness, all of which are essential for advancement in the medical field. Kneebone (2016) makes additional arguments in favour of avoiding the conventional positivistic worldview that permeates medical education. This kind of thinking, which emphasises the objective outside world, may restrict the scope and depth of learning. Accepting different paradigms can help students develop a more thorough grasp of the intricate realities of medical practice. The process can also stimulate creativity and innovation because it pushes students to question the status quo and think creatively. Furthermore, according to Kneebone, the humanities can provide insightful opinions and new insights that enhance medical education. He contends that accessing the literature of the humanities necessitates more than just going to the library; it calls for extensive reading, learning how to use unfamiliar terminology, and comprehending different viewpoints. Because students are exposed to a variety of viewpoints and modes of thought, this process can result in a more comprehensive learning experience. Also, it can promote understanding and empathy, two qualities that are essential for providing patients with quality care. Kneebone advocates for a more accepting and inclusive approach to learning in medical education that takes into account different viewpoints and paradigms. He contends that using this strategy can result in learning that is both more efficient and profound. Acknowledging and appreciating a range of viewpoints helps students develop a deeper comprehension of the intricate realities of medical practice. Additionally, by promoting an atmosphere of openness and respect, this inclusive approach can help students feel heard and appreciated.

Kneebone's advocacy for an all-encompassing approach to learning aligns closely with the practical research methodology I have selected for this thesis. His argument supporting different paradigms and viewpoints influenced my choice to integrate arts and humanities into medical simulation. By combining these various fields of study, the research aims to do more than just enhance the educational process. It also aims to broaden the perspective from which medical practice is observed and understood. The interdisciplinary approach enhances comprehension of intricate clinical scenarios. It motivates students to go beyond the conventional limits of medical science by incorporating knowledge from disciplines like film theory. This results in improved learning outcomes, as learners are more capable of understanding and manoeuvring through the intricacies of medical practice. This inclusive learning environment fosters a culture of respect and openness, which are fundamental principles of this thesis.

Kneebone's learning approach supports the innovative, interdisciplinary foundation of the practical research in this thesis. Incorporating diverse ideas and viewpoints enriches the learning process and promotes a more comprehensive understanding of medical simulation and practice. Another important resource for reflection and understanding is the paper "Promoting

Excellence and Reflective Learning in Simulation (PEARLS): Development and Rationale for a Blended Approach to Health Care Simulation Debriefing" by Cheng et al. (2015). It describes four specific phases of the debriefing process, each essential for promoting reflection and learning.

The process commences with the 'reactions' phase, during which learners can share their initial thoughts and feelings about the simulation. This phase is significant as it enables learners to analyse their emotions and responses, which can serve as a vital initial stage in the reflection process. Learners can enhance their comprehension of how their emotions may have impacted their actions and decisions in the simulation by recognising and discussing their feelings. The 'description' phase follows the reactions phase. During this phase, learners are asked to summarise the main events of the simulation from their point of view. This process ensures that all participants share a common understanding of the events that took place during the simulation. It serves as a foundation for the following analysis stage, during which learners further explore their actions and decisions. The 'analysis' phase is central to the debriefing process. This is the place where genuine learning takes place. Learners are prompted to analyse their actions and decisions, reflecting on successes and areas for improvement. The PEARLS framework offers a blended debriefing approach in this phase, enabling educators to choose the most appropriate strategy for each performance aspect. This phase may include giving explicit performance feedback, encouraging learners to assess themselves, or leading a focused discussion. The debriefing process ends with the 'summary' phase. This phase offers a chance to solidify the acquired knowledge. Learners are required to identify their key takeaways and predict factors that may facilitate or hinder implementing change in their environment. Alternatively, the educator can summarise by giving a concise overview of the key take-home messages. This phase solidifies the learning and ensures that participants depart the debriefing session with a comprehensive grasp of what they have learned and how to apply it in future situations. The PEARLS framework emphasises the importance of reflection in learning. It achieves this by organising debriefing sessions to enhance learners' capacity for reflection, leading to a more profound and comprehensive grasp of the simulated experiences. This principle aligns closely with my utilisation of film and 360-degree patient perspective films. Presenting a recorded or a 360-degree patient perspective video provides learners with a distinctive view into the patient's experience. They perceive the emotional intricacies and subtleties essential to patient care, which might not be completely replicated in conventional high-fidelity simulations. The PEARLS framework is applicable for post-viewing film analysis and simulation scenarios to facilitate reflective discussions.

Feedback and Guidance: Debriefing serves as a platform for providing constructive feedback and guidance. Facilitators are crucial during this phase as they offer learners valuable feedback on their performance, highlighting both strengths and areas for improvement. This feedback fosters an interactive dialogue between the facilitator and the learner, enhancing comprehension of the correct actions and strategies. Feedback during debriefing corrects misconceptions, reinforces correct actions, and improves future performance. It is an essential stage in the learning journey, connecting theoretical knowledge with practical application. Shinnick et al. (2011) discovered a significant improvement in knowledge scores following debriefing, underscoring the critical role of this feedback mechanism.

The paper titled "The Relationship Between Facilitators' Questions and the Level of Reflection in Postsimulation Debriefing" by Husebø, Dieckmann et al. (2013) provides valuable insights into the role of feedback and guidance in simulation debriefing. The study explores the depth of reflection expressed in questions by facilitators and responses from nursing students during post simulation debriefings. The authors found that facilitators asked most evaluative and fewest emotional questions, whereas nursing students answered most evaluative and analytic responses and fewest emotional responses. The greatest difference between facilitators and nursing students was in the analytic stage. Only 20% of 117 questions asked by the facilitators were analytic, whereas 35% of 130 students' responses were rated as analytic. Interestingly, the facilitators' descriptive questions also elicited student responses in other stages, such as evaluative and analytic responses. The study concludes that post-simulation debriefings provide students with the opportunity to reflect on their simulation experience. However, if the debriefing is going to pave the way for student and trainee reflection, it is necessary to work further on structuring the debriefing to facilitate deeper reflection. It is therefore important that facilitators consider what kind of questions they ask to promote reflection, and indeed the material in which is presented in order to support this, thereby optimising the conditions for simulation-based learning. This paper underscores the importance of the facilitator's role in guiding the debriefing process and providing feedback that encourages reflection. The findings suggest that the type of questions asked by facilitators can significantly influence the level of reflection and learning that occurs during debriefing. Therefore, facilitators should carefully consider the types of questions they use to promote deeper reflection and learning. The findings of the authors reveal an important area of potential growth within simulation-based education, particularly as it pertains to the incorporation of more humanistic and emotionally-led content. The dominance of evaluative questions from facilitators, contrasted with the scarcity of emotional inquiries, suggests that there is a significant emphasis on clinical performance evaluation, while emotional experiences and responses may be relatively neglected. The paper highlights the pivotal role of facilitators in shaping the debriefing process within simulation-based education, a principle which I consider central to the direction of this thesis. Their study brings to light a gap in the current practice of debriefing: the limited exploration of emotional aspects, both in terms of the questions asked by facilitators and the responses given by students.

When considering my research focus on incorporating more humanistic skills training, it is evident that facilitators' capacity to gain insight into the emotional aspects of simulated scenarios could be vital. Medical simulation involves replicating clinical tasks and managing emotional responses that occur in real-life medical practice. By utilising filmed and 360-degree patient perspective videos, I aim to bridge this gap and find valuable guidance in this insight. The study suggests that the debriefing process should include both cognitive and affective learning to encourage a thorough and profound reflection. Within my thesis, this emphasises a chance to adjust facilitators' approach to encompass the humanistic aspects of healthcare more fully. Encouraging facilitators to ask emotionally focused questions can help create a learning environment that promotes technical proficiency and nurtures empathy, emotional resilience, and improved patient-centered care. Furthermore, by advocating for this well-rounded method, facilitators can assist learners in acknowledging and contemplating the emotional aspects of their practice, which are frequently overlooked but crucial in actual clinical environments. Facilitators can help learners connect their cognitive and affective aspects by evoking emotional reactions, leading to a more comprehensive understanding of healthcare.

Utilising filmed and 360-degree patient perspective videos in simulation scenarios can be vital in this effort to rebalance. Therefore, they provide a rich source for facilitators to utilise when posing emotionally driven questions during the debriefing stage, thereby enhancing the overall learning process. Engaging facilitators in content creation workshops and training them to use the new approach with filmed materials, such as 360-degree patient perspective videos, offers a valuable opportunity for a more balanced facilitation approach. Facilitators can gain direct experience of the emotional narratives and humanistic perspectives evoked by the filmed materials presented and outlined in the previous chapter in this workshop approach. This participation will improve their comprehension of the emotional and human aspects of patient care and provide them with the ability to lead learners through the intricate narratives presented in these materials.

Linking Theory to Practice: A debriefing acts as a link between theoretical understanding and real-world situations. Learners may become completely focused on the current task during the simulation, making snap decisions and actions. It's possible that they won't instantly understand how their actions relate to the underlying theoretical understanding. By making these connections clear, debriefing improves learners' comprehension and memory of the material. It strengthens learning and gets students ready for actual clinical situations by demonstrating how theoretical concepts are applied in real-world settings. This point is emphasised by Shinnick et al. (2011)'s study, which demonstrates that knowledge gains were only realised following debriefing.

The paper "Enhancing Healthcare Simulations and Beyond: Immersion Theory and Practice" provides a distinctive viewpoint on the application of role-playing game immersion to healthcare simulations in a more general context. The six categories of immersion that are examined by Bowman and Standiford (2017) are activity, game, environment, narrative, character, and community. Every category offers a unique perspective that helps us better comprehend and improve the educational experience in healthcare simulations. Immersion in the game is a concept that is especially pertinent to our conversation. In order to successfully finish the simulation, learners in this immersion mode solve problems. This might entail determining the medication's side effects or making a medical diagnosis for a patient. This kind of immersion gives students the chance to apply their theoretical knowledge in a problem-solving setting and offers a debriefing phase where they can receive advice and feedback. Facilitators can offer focused feedback as students discuss their choices and actions, assisting students in understanding what they did well and where they could improve. For students, this feedback—which is based on the framework of the game-like simulation—may have a greater meaning and impact. Furthermore, the debriefing process may be more successful due to the immersive nature of the game-like simulation. Because they are fully immersed in the simulation, students are probably more interested in the debriefing conversation. They have a personal interest in comprehending how they performed, which can increase the value of the advice and criticism given during the debriefing. The research on immersion theory provides a perceptive viewpoint that I can incorporate into my strategy to improve debriefing in medical simulation. Their theory offers a novel model that intersects with a number of the major themes I'm finding in my research. They explore the 'game' category of immersion, which particularly speaks to my ongoing efforts to encourage more thoughtful and nuanced debriefing sessions.

A deeper sense of immersion can be achieved by turning simulations into problem-solving exercises that closely resemble the difficulties encountered in actual medical scenarios. This allows learners to become more fully engaged with the material. A good environment for the introduction of recorded and 360-degree patient perspective videos is created by this kind of immersion. By encouraging students to consider the emotional and humanistic aspects of patient care in addition to the clinical and technical aspects of their actions, I can further improve the debriefing process with the help of these cutting-edge tools. Furthermore, the increased involvement that accompanies realistic, game-like simulations can improve the efficacy of the debriefing procedure. Due to their intense involvement in the scenarios, learners might be more engaged and willing to participate in debriefing sessions. During debriefing sessions, this increased investment can foster a richer dialogue and offer a platform for more productive reflection and learning. In light of Bowman and Standiford's (2024) findings, my research and practical work can investigate further ways in which this theory of immersion can be used to broaden the debriefing process's scope and promote a more comprehensive, immersive learning environment that goes beyond traditional medical education paradigms. These immersive learning opportunities have the potential to emphasise even more how important debriefing is to bridging theory and practice in medical simulation.

Emotional Processing: Simulations can be highly emotional experiences, particularly in medical education. They frequently require learners to make difficult decisions and can arouse intense emotions in them. Debriefing gives students a secure and encouraging environment in which to work through these feelings. It enables students to talk about how they're feeling, comprehend how emotions can affect performance and decision-making, and acquire techniques for effectively controlling emotions under pressure. As a crucial component of the learning process, this emotional processing helps students develop their emotional intelligence and resilience. Although emotional processing is not specifically addressed by Shinnick et al. (2011), the substantial knowledge gains that are seen following debriefing imply that emotional processing most certainly plays a part.

Building on this, West and Chowla's (2017) paper "Compassionate Leadership for Compasionate Health Care" offers more details on the debriefing's emotional processing component. (It is advantageous to introduce this through a route into simulation practice, as it is politically advantageous to link in this piece of work given the prominence of Michael West in leading the wider agenda on compassionate care and leadership in the NHS). The four elements of compassionate leadership—noticing or attending, comprehending, empathising, and assisting—are described by the writers. These elements have a strong emotional resonance with the debriefing process's emotional processing. To effectively manage learners' emotions, facilitators need to be aware of their emotional states, understand where these emotions come from, empathise with learners, and provide support or assistance. West and Chowla emphasise how important it is to create a secure and encouraging atmosphere in which people feel free to talk about and express their feelings. This fits in perfectly with the debriefing function, which is to provide learners with a safe, encouraging environment in which to work through their feelings after a simulation. Debriefing helps students and participants develop their emotional intelligence and resilience by creating a space where they can express their emotions, understand how emotions affect performance and decision-making, and learn how to control their emotions under pressure. The writers also stress the importance of leaders serving as compassionate role models, which includes acting compassionately towards oneself. This self-compassion can provide facilitators the tools and knowledge they need to show compassion to others, which is an essential part of the debriefing process. By exhibiting self-compassion, facilitators can better assist students in managing their feelings and create a caring and encouraging learning environment.

Essentially, the knowledge gained from West and Chowla's research can improve our comprehension of how emotional processing functions during debriefing. Facilitators can enhance the overall learning experience, foster emotional intelligence and resilience, and better support learners in processing their emotions by putting the principles of compassionate leadership into practice. The paper "Compassion in Practice: Evidencing the Impact" (2016) extends the conversation on compassionate leadership and emotional processing and offers more details that are especially pertinent to debriefing. The authors stress how crucial it is for employees to feel like change agents and to have a strong sense of local ownership when it comes to choosing actions and activities within programmes. An essential component of debriefing is encouraging learners to take ownership of their actions and decisions and participate in discussions about how to perform better in the future. The study also emphasises how important patient stories are for comprehending how procedures affect patient experiences. This is a useful tool for conducting debriefings. Learners can get a better understanding of how their choices and actions affect patient care by talking about and thinking back on patient experiences. This improves their understanding and increases their capacity for empathy and understanding. Essentially, this paper's findings highlight how important it is to train compassionate or humanistic skills for simulation and debriefing. It emphasises how important debriefing is for helping students feel more invested and in control of their education as well as for improving their comprehension and compassion for patients.

The ideas presented by West and Chowla (2017) provide a framework that can improve the debriefing process' emotional processing component, and they work in concert with the instruments and methods I have created—and am still developing—for this study, like patient perspective videos. They can encourage students to "observe or pay attention" to the emotional state of patients, "understand" the causes of these feelings, "feel" the patients' pain, and come up with ideas for "supporting" or "helping" them. As the four elements of compassionate leadership are discussed, this can help learners develop a deeper sense of emotional understanding, empathy, and compassion. Also, the debriefing process emphasises the value of emotional intelligence and resilience in the provision of healthcare by creating a space in which students can express their emotions and how those emotions might affect their clinical decision-making. These videos from the patient's point of view act as a potent stimulant to provoke these kinds of reflections, giving the simulations a more emotional and realistic quality. Regarding leadership, these patient perspective videos can be a useful tool for facilitators who practise self-compassion to guide conversations about emotional resilience and foster a more sympathetic and caring learning atmosphere.

Revisiting the NHS paper "Compassion in Practice: Evidencing the Impact (2016)" it emphasises how crucial it is to have a strong sense of local ownership in deciding what to do and how to do it, as well as how important it is to feel included as a change agent. These ideas mesh well with the content creation workshops I developed for my research, in which facilitators actively participate in creating simulation scenarios to encourage co-creation and a sense of ownership. Similarly, the incorporation of patient narratives and first-hand accounts into my video resources provides an invaluable resource for comprehending the immediate effects of healthcare procedures on individuals. By providing a framework for discussion, these recorded experiences help debriefing participants relate their actions and decision-making process to the viewpoint of the patient. It helps students develop a more sympathetic understanding, which improves their capacity to provide kind care.

As a result, the Compassion in Practice: Evidencing the Impact (2016) and the papers by West and Chowla (2017) offer perceptive frameworks that closely correspond with the video materials and the facilitation style that have initially been created and will continue to develop, supporting the debriefing sessions' efficacy in developing reflective and compassionate practitioners.

Collaborative Learning: Debriefing is a collaborative learning process rather than merely an individual one. It frequently entails conversations in groups, encouraging a shared learning environment. A richer and more varied learning experience can result from students learning from each other's experiences, viewpoints, and understandings. These conversations promote mutual respect and teamwork, two qualities that are necessary for productive cooperation in the healthcare industry. Additionally, they foster an environment of transparency and ongoing education where students are at ease expressing their ideas, posing queries, and picking up knowledge from one another. Shinnick et al. (2011) conducted a study that highlights the significance of debriefing as a group experience. The study was carried out in groups after all participants completed the simulation. The research "The Role of Debriefing in Simulation-Based Learning" by Fanning and Gaba (2007) offers a thorough examination of the dynamics of group discussions during debriefing, extending the idea of collaborative learning. The authors underscore the crucial function of educators in promoting these dialogues, making certain that their degree of participation is suitably aligned with the type of content and the cohort. This method discourages over-instruction and fosters a shared learning environment where students actively participate in their education. The study also explores different facilitator strategies that can direct or guide participants' reflection, including frontloading, funnelling, and framing. These methods not only encourage involvement but also mutual respect and teamwork, two qualities that are necessary for productive cooperation in the healthcare industry. The authors stress how crucial it is for facilitators to possess these skills in order to maximise the debriefing process's learning potential and effectively direct it. The study also presents the idea of collaboration scripts, which observers can utilise to improve their capacity to provide team members with performance reviews. This tool encourages even the so-called "passive" participants to participate in the debriefing process by transforming passive learning scenarios during observation phases into more focused and active experiences. This method creates a more varied learning experience by enhancing the collaborative learning environment even more. The authors also stress how crucial it is that facilitators possess thorough training when utilising these cooperation scripts. These scripts can be used skillfully by a facilitator to lead the debriefing process, promoting shared learning and active engagement from all participants. Fanning and Gaba's basically emphasise how crucial group learning is to the debriefing procedure. It emphasises how the instructor guides discussions, how to engage participants with various facilitator techniques, and how collaboration scripts can promote active participation. These revelations support the idea that debriefing is a cooperative learning process that fosters transparency and ongoing education. The study also highlights how crucial skilled facilitators are to maximising the debriefing process's learning potential. My research emphasises even more how important it is for facilitators to be competent and confident, especially when working with emotionally charged content like patient perspective videos and leading humanistic skills training. The debriefing sessions are centred around the support provided by these facilitators. Therefore, what counts is not only how comfortable they are with the material but also how well-versed they are in the theoretical underpinnings of the humanities and arts as well as the language of emotions. A firm grasp of the subject matter, in terms of both emotional nuance and content, enables facilitators to lead reflective conversations more skillfully. It becomes crucial for them to be able to "frontload," "frame," and "funnel" the discussion—words used by Fanning and Gaba to characterise crucial facilitation strategies—especially when dealing with emotionally charged content. In this case, the facilitator's job is comparable to that of an expert conductor conducting an orchestra; they must know when to draw attention to particular parts and when to create harmony between them.

But leading these kinds of thoughtful conversations—particularly ones that entail processing emotions—requires a sophisticated knowledge of the language of emotions, which is a skill that has its roots in the humanities and arts. Consequently, it becomes imperative to be conversant in the language of emotions, whether it is through identifying various emotional states, empathising with emotional experiences, or facilitating discussions about emotional intelligence. Moreover, Fanning and Gaba emphasise that the idea of collaborative learning can be greatly improved when facilitators are at ease with both emotional and humanistic dialogue in addition to having a solid understanding of the subject matter. Under such circumstances, debriefing sessions can become a secure and encouraging environment where students can express their feelings, comprehend the ramifications of those feelings, and develop effective coping mechanisms. An inclusive and deeper learning environment is produced when facilitators possess both emotional literacy and subject matter expertise. Fanning and Gaba's work essentially establishes the foundation for comprehension of the dynamics of debriefing in medical simulation. When combined with my research's goals of giving facilitators the skills and training they need to deal with emotionally charged content and leading humanistic skills training, it strengthens the strategy for developing a generation of healthcare professionals who are more emotionally intelligent and compassionate.

The chapter emphasises the significance of an inclusive and immersive learning approach by drawing on a wide range of theoretical perspectives, such as those of Kneebone (2002), Cheng et al. (2015), Husebø et al. (2013), Bowman and Standiford (2017), West and Chowla (2017), and Fanning and Gaba (2007). This method stimulates introspection and deeper understanding, as well as emotional processing and a sense of group learning. Through the use of immersive patient perspective videos, instructors can help students become more deeply involved in the content and see a stronger link between theory and practice. The addition of humanistic skills training, a major theme in the work of West and Chowla, where compassion becomes an essential component of leadership, further enhances this. The debriefing process is viewed critically thanks to Husebø et al.'s insights into the types of questions facilitators ask and the degree of reflection they elicit. It highlights the need for an organised debriefing that encourages more in-depth thought and highlights the facilitator's critical role in making this happen. Finally, Fanning and Gaba clarify that the value of collaborative learning not only improves the learning process but also motivates all students to take an active role and take ownership of their learning. Their observations, along with the knowledge that debriefing is a learning process, promote an atmosphere of ongoing development. Essentially, the debriefing procedure becomes a vital instrument in medical simulation. When used properly, it provides a dynamic platform where learning, reflecting, understanding, and evolving come together, accelerating the conversion of simulated experiences into illuminating learning opportunities.

5.2 The Impact of Covid-19 and Minimal Viable Simulation

The COVID-19 pandemic was a watershed moment in global health history, posing enormous challenges and causing profound social transformations. The world of education, particularly medical education, was in the midst of these challenges, necessitating quick and comprehensive responses to meet the crisis's demands. A significant portion of these responses included preparing the healthcare workforce for the unprecedented challenges posed by the pandemic. In-situ simulations emerged as critical tools in this preparation, providing an effective tool for training healthcare professionals to manage COVID-19 patients in specific clinical settings such as the Intensive Care Unit (ICU). In these high-stress, high-stakes environments, healthcare teams were required to provide specialist treatment and support to critically ill patients, many of whom they were not previously accustomed to handling. It was vital to learn from our European and international colleagues who had begun dealing with the pandemic before it reached the UK. For example, during the COVID-19 pandemic, a study conducted at a tertiary care academic centre in Lebanon[41] involved native teams of healthcare professionals participating in daily in-situ simulations, which provides valuable insights into the effectiveness of these simulations in preparing healthcare professionals for the unique challenges presented by the pandemic. The study's findings highlight the importance of leadership and clear role assignment in managing these high-stress, high-stakes situations. It was discovered that a flatter hierarchy discouraged participants from taking the initiative to lead, resulting in confusion about who was giving directions. The study also emphasised the importance of situational awareness. During most simulations, participants were found to be unaware of their surroundings, equipment location, and how to set up in a timely manner. This emphasises the importance of familiarising healthcare professionals with their surroundings and the equipment they will be using, especially in high-pressure situations like those found in the ICU. Their experiences provided valuable insights into the clinical presentation and management of COVID-19 patients, which helped shape our response plan.

However, the pandemic's sudden and complex nature necessitated an equally quick response. Time was of the essence when it came to providing training on new and revised procedures, processes, and protocols, such as the proper use of Personal Protective Equipment (PPE) and performing intubations under unusual circumstances. In this climate of extreme urgency and high risk, certain training scenarios that had previously relied on simulation methodologies had to be reconsidered and reinvented. Examples include orientation to new processes and physical environments, such as how to safely turn and move a patient in a bed, as well as proper donning and doffing of PPE.

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[41] This was a well referenced document at the time and helped influence the role that daily in-situ briefings could provide. Sharara-Chami R, Sabouneh R, Zeineddine R, Banat R, Fayad J, Lakissian Z. In Situ Simulation: An Essential Tool for Safe Preparedness for the COVID-19 Pandemic. Simul Healthc. 2020 Oct;15(5):303-309. doi: 10.1097/SIH.0000000000000504. PMID: 32910106.

The traditional simulation approaches, which frequently involved a manikin and a clinical team, had to be modified to account for the pandemic's unique circumstances and constraints, such as social distancing protocols and the need to limit the number of people involved. This also included how debriefing would be conducted and its relationship to the training itself, with the discussion and reflective elements becoming part of the simulation as it unfolded. The study "Development and implementation of an end-of-shift clinical debriefing method for emergency departments during COVID-19" by Servotte et al. (2020) provides an excellent example of innovative use of debriefing within the simulation process. In this study, the researchers took a novel approach, incorporating debriefing into the simulation itself, making it part of the end-of-shift routine in emergency departments. This approach resulted in immediate reflection and discussion of the events and decisions made during the shift, which helped shape how the next shift or action might take place, making the learning experience more relevant and immediate. The end-of-shift debriefings allowed for real-time reflection and feedback, allowing healthcare professionals to apply what they learned immediately in their next shift. It demonstrates debriefing's adaptability as a learning tool, as well as its ability to be integrated into the simulation process as it occurs, providing immediate and relevant feedback and learning opportunities.

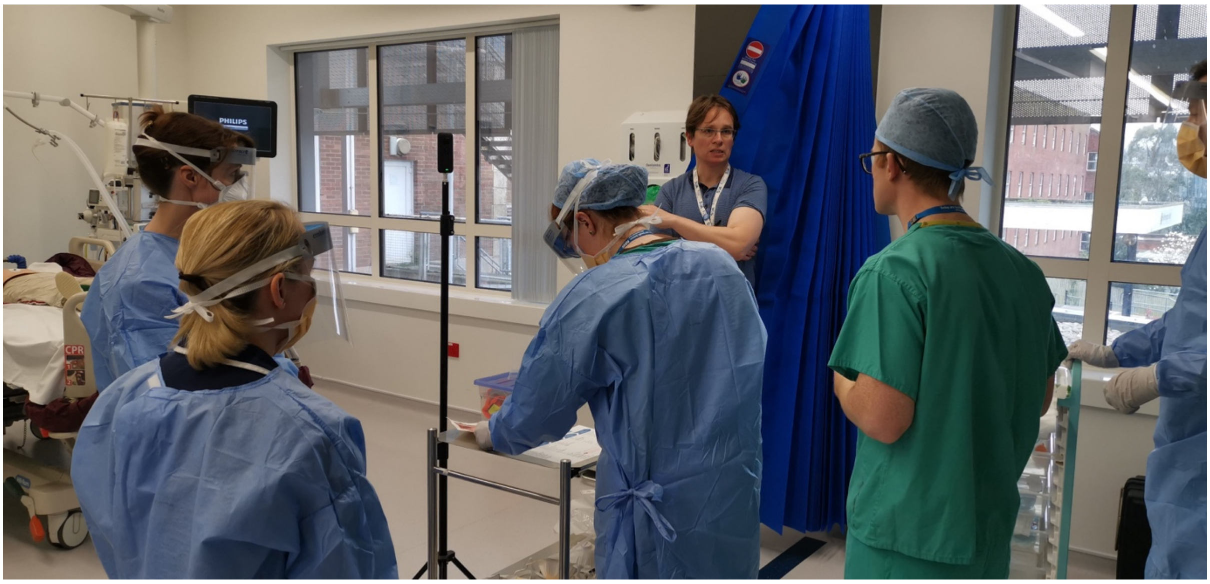

Figure 17 Recording an in-situ ICU simulation debriefing preparing for Covid-19. Copyright TSDFT 2020

This pandemic not only necessitated medical staff training, but also highlighted the importance of upskilling the entire healthcare workforce to operate effectively in a high-intensity, high-pressure environment such as the intensive care unit. This requirement extended beyond doctors and nurses to include other healthcare professionals and support staff who may not have previously worked in such environments. Additionally, the pandemic's physical restrictions, such as limited capacity, time constraints, and the need for social distancing, sparked innovation in simulation-based education delivery. The question became not only how to train effectively, but how to train effectively given these constraints. One of the unique challenges was ensuring that trainees could continue to receive effective medical simulation training despite the lack of traditional in-person scenarios. This necessitated a 'outside the box' rethinking of established practices, creative application of existing tools and techniques, and a willingness to embrace new methodologies and approaches. Indeed, the pandemic has accelerated the use of digital technologies in medical education, resulting in novel approaches to simulation and debriefing. The use of pre-recorded, view-at-anytime simulation scenarios and training tools, such as the

360-degree video version for donning and doffing that was developed at Torbay, is an excellent example of this. These digital resources became part of the Trust's larger educational materials, accessible through our online learning management system and shared as part of national training resources, demonstrating the growing potential of simulation training videos, particularly 360-degree ones, to improve learning on a larger scale.

The use of live video feeds from simulation labs allowed participants to join from home or off-site locations, effectively breaking down the barrier of in-person training (which was nearly impossible for trainees due to social distancing measures) and making training more accessible. While this approach appeared to be a logical step towards remote learning, it was not without its challenges. Simulation centres, particularly those that rely on audio-visual systems with ceiling-mounted cameras. These cameras, which were used to record the content and scenario for the remote debrief discussions, frequently failed to capture all of the necessary details because they were now relied on in a much more comprehensive and conclusive manner than before. This limitation presented a challenge for both facilitators and learners, as the often distant or incomplete footage limited the depth and effectiveness of the debrief discussions. This was a realisation that the video material, when used in a more complete and replacement form for in-person simulations, needed to do more, with the role of cameras in simulation being reconsidered. To be clear, the remote simulation scenarios were frequently run live with a smaller simulation faculty but with little or no in-person presence from trainees, medical students, or other staff who were unable to leave their clinical commitments. Despite these challenges, many people's decision to move simulation training online and remotely provided valuable lessons and a new perspective on the filmed material.

Drawing on my research, my colleague Timothy Mason and I decided to use 360-degree pre-recorded material instead. The study, titled "Remote 360 Virtual Simulation- Can You 'Do Sim' Completely Online?" investigated the feasibility of remote simulation training using 360° videos of simulated paediatric emergencies. We hypothesised that this approach would provide a more immersive experience because participants could look around the video sphere as an 'active observer' (in desktop mode, this meant remote learners could use their mouse and drag the video around). Technical challenges, like ensuring stable internet connections for all participants, were present. Successes were mainly attributed to the facilitator, Tim, who played an active and engaging role during the debriefing sessions. As video creators, we possessed a profound comprehension of the content, allowing us to effectively lead the learners through the debriefing process. This enabled us to emphasise important aspects and promote valuable discussions, improving the participants' learning experience. Moreover, the online platform, when functioning properly, provided distinctive benefits that we could utilise. For example, the capability to replay segments of the video enabled us to enhance awareness of subtle activities or actions within the 360° video sphere. This was especially advantageous during the reflection portions of the debrief, allowing us to stop and replay specific moments to enhance in-depth discussion. Learners' feedback suggested that the experience was captivating, immersive, and secure. They valued the realistic quality of the 360° videos and experienced reduced feelings of scrutiny in comparison to conventional simulation sessions. The remote debriefing sessions were accessible and convenient, allowing learners to participate from work or home using standard consumer technology. It was noted that remote debriefing sessions frequently prompted learners to recount clinical experiences, even if they were not directly involved in the simulation. This indicates that the remote debriefing sessions encouraged a high level of involvement and contemplation that went beyond the simulation. Our findings indicate that remote 360° simulation with debriefing is an excellent addition to standard simulation. We emphasised the affordability, favourable feedback, and safety of this approach, along with its ability to simulate emergency situations for individuals. The findings of this study have contributed to the development of optimal techniques for this advancing approach.

Digital technologies provide new opportunities but also bring new challenges and considerations. Ensuring efficient and fair learning results, sustaining involvement in a distance learning setting, and resolving technical problems are some key challenges to be addressed. The lessons learned from this period of rapid adaptation and innovation may influence the future of medical training, focusing more on digital technologies and remote learning.

Due to the specific challenges brought on by the pandemic and research insights gained through this study, a new concept in simulation training called 'Minimal Viable Simulation' (MVS) was developed. This concept embodies an efficient and flexible method for simulation training that can be successfully executed with limited resources and under strict constraints. The concept of 'Minimal Viable Simulation' emerged from the need to maintain efficient simulation training during the pandemic's difficulties. It incorporates the concept of cost-effective and easier-to-operate simulations, which were developed in response to the pandemic's working conditions and as a strategic method to optimise the effectiveness of simulation training with the resources at hand. The concept of 'Minimal Viable Simulation' involves achieving optimal results with minimal resources while maintaining high training standards. It entails identifying the crucial components of a simulation that have the greatest impact on learning results and allocating resources to these components. An example demonstrating the benefits of an MVS approach is discussed in the paper "The role of clinical simulation in preparing for a pandemic" by C. Shelton (2021). The paper examines various obstacles in implementing simulations amid the COVID-19 pandemic. One major challenge was the participants' high levels of anxiety, particularly when learning new skills, which necessitated the rapid upskilling of staff in unfamiliar environments. The escalating pandemic situation worsened this anxiety. An MVS approach could assist in this situation by concentrating on the crucial aspects of the simulation, thus lessening the cognitive burden on participants and potentially reducing their anxiety. For example, instead of utilising high-fidelity manikins that may necessitate participants to acquire extra technical skills and depend on additional simulation faculty, such as a simulation technician, a low-fidelity manikin or role-play scenario could be employed. This would enable participants to concentrate on the clinical skills and decision-making processes being taught, rather than on handling the technology. Streamlining the simulation process allows facilitators to allocate more time to observing participants and offering feedback, rather than focusing on technology management. This may result in increased emphasis on debriefing sessions, as facilitators will possess a more comprehensive comprehension of each participant's performance and the overall progression of activities.

The paper also mentions that facilitators had to recognise the existing uncertainties related to the continuously developing evidence base and modifications in clinical guidelines for Covid-19. Participants' observations and feedback may provide valuable insights into guidelines and processes that were likely still evolving during the initial phase of rapidly increasing case numbers. The summarised learning points were communicated to clinical leaders and hospital managers to enhance practical application. Considering our experiences at Torbay and this information, integrating the debriefing process into the simulation as it unfolds can utilise participant experiences, offer instant feedback, and enable adjustments in real-time. It is especially advantageous in a multidisciplinary team environment to prioritise communication, teamwork, compassion, reassurance, and care for colleagues and patients during difficult times.

The concept of Minimal Viable Simulation originates as a concept from the influence of 'Minimal Viable Product', commonly used in industries like automotive and technology to quickly introduce a product to the market with essential features to meet initial user needs, facilitating rapid prototyping, testing, and improvement. This method leads to a more streamlined and economical development process. A minimal viable method can be used in medical simulation by identifying essential elements to meet learning objectives and develop skills effectively without focusing too much on technology. This approach is particularly valuable during the pandemic when there is a need to cater to a larger demographic of the healthcare workforce. In product development and technology innovation, the MVS approach emphasises focusing on elements that provide value to users rather than aiming for perfection in every aspect. This concept is also related to the imperfect image and observational approach used in 360-degree films. This mindset promotes an agile and iterative approach that relies on user feedback and experiences for continuous improvement in medical simulation, incorporating feedback from both facilitator teams and participants. Developers can innovate and improve by focusing on crucial features and functions, while steering clear of over-engineering, technological redundancy, distraction, or excessive reliance on technology, except when necessary for remote simulations, and considering the limited capacity of technicians.

The minimal simulation approach was crucial in efficiently training healthcare professionals. The approach relied on using freely available open-access resources that could be easily customised to fit the specific needs of local organisations. A collaborative effort was made within the simulation community, involving hospital sites and national NHS teams, to create and share resources and guides in a central repository. I contributed to this initiative by sharing a hygiene protocol guide for using VR headsets[42] in simulation education activities and a guide on using webcams as virtual cameras in MS Teams[43]. The resources were designed to help other sites implement these methodologies. Simulation scenarios created by simulation centres were shared, covering topics such as personal protective equipment (PPE), common symptoms, team management, and interventions to support staff well-being. This collaborative method enhanced relationships within the simulation networks and helped integrate individuals with less expertise

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[42] This document can be found within the appendix as 'Virtual Reality (VR) Head Mounted Device (HMD) Infection Control v1.2

[43] I created a tutorial guide for both TSDFT and HEE on how to capture and send ceiling and room mounted camera feeds into MS Teams video conferencing software to try and support the sudden move to online and remote learning. A link to the video can be found on the film list in the appendix.

in the field. Simulation experienced increased participation from new members and a surge in interest. The collaborative effort facilitated rapid scenario development and modification to meet educational objectives promptly during the time-sensitive pandemic context. The simulation programmes achieved a more cost-effective and streamlined development process by maximising the use of existing resources and ensuring consistency in the types of scenarios offered. This approach greatly increased the availability of training opportunities to a wider variety of healthcare professionals.

'Walk-through' simulations were another application of the minimal simulation approach. The healthcare staff gained a practical and highly effective experience from these sessions, which were facilitated by a senior medic. The aim was to acquaint participants with the hardware, procedures, and physical surroundings that are pertinent to their positions. This included a thorough "deconstruction" or "breakdown" of the area to provide participants a thorough grasp of all of its details. Facilitators thoroughly examined both real and simulated environments during these walk-through simulations. It was preferred where possible to include these that took place in actual locations, like an ICU side room, as it gave participants a first-hand understanding of the difficulties and subtleties associated with providing care in those crucial environments. Furthermore, environments with restricted or limited access were replicated in the simulation labs. Our digital team oversaw the development of novel tools[44] at Torbay and assisted other healthcare trusts in producing their own interactive 360-degree films and virtual walkthroughs of crucial environments, such as the intensive care unit[45], in order to further improve the efficacy

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[44] Innovative to the NHS does not usually mean innovative in other industries. The use of virtual tours, as example, have been used in theme parks as an example for many years to provide a guide and orientation of park features to its audiences before arrival.

[45] The Virtual ICU workspace demonstration video created for Torbay can be found in the video library of the appendix.

and accessibility of these walkthrough simulations. Thanks to these technological developments, the simulations could be run repeatedly or remotely, providing more training opportunities and a more uniform experience. In addition, 360-degree video gained prominence, and the tools I had been using for several years before saw a rapid uptake. Participants were able to look around, learn about some of the procedures, and become acquainted with important tools and procedures thanks to these virtual resources. The walk-through simulations were extremely helpful in getting medical staff ready for emergency scenarios and frequently didn't call for the use of high-fidelity manikins or sophisticated technology. Through a thorough evaluation of staffing needs and necessary physical environment modifications, participants gained the abilities and knowledge needed to perform well under pressure. Additionally, the simulations offered a chance to create or improve organisation- and unit-specific protocols. To guarantee efficient workflows and reduce needless contact, for instance, small but essential elements like strategically placing doffing bins or equipment trolleys were identified and put into place. Improving patient safety and preparedness during the pandemic required that the simulation experience be in line with the operational realities of healthcare facilities. Additionally, it expanded the idea of simulation beyond the lab, and the idea of facilitators and heavy AV constraints were replaced with valued approaches that ranged in fidelity and process breakdowns.

Eventually, the need to adjust and meet the demands of the COVID-19 pandemic led to an increase in "homemade" and economical innovation, which became a significant feature of the simulation landscape. This revival was reminiscent of the groundbreaking work covered in Chapter One and harked back to the early days of simulation. Notable people like Angélique Marguerite Le Boursier du Coudray created cloth birthing simulators to instruct her surgeons and midwives. In a similar vein, medical professionals once again took matters into their own hands during the pandemic, creating tools and training aids to supplement the limited resources and pressing need for training. The pandemic's exceptional conditions prompted the development of innovative solutions that prioritised essential function replication over high-fidelity accuracy. Among the in-house innovations that surfaced were ventilator splitters, 3d printed face visors and simulated latex materials for practising needle activity on. These inventions, which were frequently created by the facilitators and staff members themselves, demonstrated the creativity and flexibility of healthcare workers by providing a complete circle for simulation. Manufacturers also got heavily involved in innovation in the broader and more serious context; Dyson, for example, started supporting the production of ventilators. In this context, it is important to emphasise that thorough usability testing is essential prior to implementing these technologies in clinical practice. The simulation programme prioritises safety and effectiveness. As such, it makes sure that these home-made innovations comply with industry best practises and enhance the overall simulation experience.

The healthcare community's tenacity and inventiveness were showcased by the push for frugal innovation, which also addressed the pandemic's immediate problems. Staff members and facilitators were instrumental in creating workable and realistic solutions that aided training initiatives under adversity by utilising their knowledge and inventiveness. This included producing their own video training materials. Using Torbay as an example once more, staff members were seen filming quick training videos and guides with cameras. This not only increased the variety of simulation resources available, but it also encouraged a sense of empowerment and ownership among medical professionals—a goal that the content creation workshop model truly aimed to achieve—even though it was never anticipated that a pandemic would make it happen. All things considered, the COVID-19 pandemic's rise in inexpensive and homemade innovation demonstrated the flexibility and ingenuity of medical professionals in the simulation community. This cooperative effort to create useful training tools and apparatus demonstrated a return to the fundamentals of simulation and underlined the significance of stringent testing and compliance with safety regulations. It became evident that by giving priority to necessary features and functions, a minimal viable simulation programme still has value—perhaps not as a substitute for the requirement for high fidelity, but at least as a legitimate methodology in the toolkit. This programme was created out of necessity to avoid the pitfalls associated with excessive technological reliance and over-engineering. With the foundations for creative ownership in place, this approach enables ongoing improvement based on user feedback and experiences from facilitator teams and participants. Through the integration of these perspectives, the programme guarantees that simulations stay in line with the changing requirements of healthcare practitioners, thereby augmenting the efficacy of training and optimising patient outcomes.

5.3 Innovation of Debriefing Methods

As I have touched upon in earlier sections, the COVID-19 pandemic required a change from conventional debriefing techniques to approaches that could meet the intricate demands of a quickly evolving healthcare environment. During this turbulent time, debriefing strategies needed to be flexible and adaptable—aspects that were maybe not as urgent in the days before the pandemic. The use of technologies that enabled the remote facilitation of debriefing was one of the major innovations during this period. These technologies emerged as a boon as face-to-face interactions became more difficult due to social distancing measures and the risk of infection. They made it possible for debriefing sessions to go on, guaranteeing that students would still gain from this essential step in the learning process even in the middle of a major international health emergency. But this change involved more than just going from real to virtual spaces; it also involved customising the format and subject matter of debriefing sessions to address the particular difficulties brought on by the pandemic. Debriefing sessions, for example, had to cover novel subjects like the application of personal protective equipment (PPE), modifications to clinical guidelines, and the psychological effects of providing care for COVID-19 patients. They also had to accommodate a larger group of medical professionals, such as those who were transferred to different areas of their regular practice. The pandemic made it clear how crucial it is for debriefing techniques to be adaptive and flexible. In order to accommodate learners' evolving needs, facilitators needed to be adaptable in their approach and modify their strategies accordingly. Adaptability was also essential; this might entail changing the simulation's level of difficulty, employing alternative debriefing methods, or modifying the debriefing schedule to account for changes in clinical responsibilities. New guidelines and information kept coming to light as the situation changed. It was necessary for facilitators to stay informed and apply this new knowledge to their debriefing sessions. They also needed to be flexible with how they used technology, experimenting with various tools and platforms for remote debriefing.

The legacy of conducting virtual simulations during the pandemic endures, although to a lesser degree of demand as face-to-face training returned, and there is ongoing discussion about how to conduct effective debriefings both in-person and virtually. Since the emphasis is now on cost-saving and scalability to accommodate more staff rather than training for and in a pandemic, the research findings were seen as transferable.

I go into greater detail on this subject in the upcoming chapter. But as we have already discussed in this chapter, a critical factor to take into account at this point is the date and location of the debriefing. Conventionally, the phrase "debriefing" refers to a post-event activity. But as the pandemic progressed, procedures changed to incorporate more talks at the simulation scenarios' own reflection and correction points. This adaptation was made in response to a number of issues that emerged during this extraordinary period, many of which have already been discussed in this chapter (e.g., social distancing measures and prohibitions on group gatherings made it difficult to implement traditional post-event debriefing sessions.) 'In-simulation' debriefing became more popular in response to the demand for a more realistic and immersive learning environment. Learners were able to reflect in real time on their decisions and actions by incorporating debriefing into the simulation scenarios, which closely mirrored the realities of the clinical setting.

A fascinating investigation into the placement of debriefing during simulations can be found by reviewing the paper "Comparison of Post simulation Debriefing Versus In-Simulation Debriefing in Medical Simulation" by Jon N. Van Heukelom et al. (2010). However, it's important to keep in mind that this paper was written prior to the experiences of a pandemic, and the unique challenges and constraints imposed by the pandemic require further adaptations to these debriefing strategies. The writers explore the idea of "in-simulation" debriefing, which involves pausing the simulation periodically to offer guidance and time for introspection. This method makes it possible for 360-degree videos to be stopped at important points, which naturally invites discussion and introspection. Additionally, by using this strategy, facilitators can draw learners' attention to minute details that might go unnoticed in a conventional debriefing session (Mason, T., & Peres, N., 2020). With the help of this technique, students and trainees can evaluate their choices and actions in real time, which helps them better comprehend the situation as it's happening. According to research conducted by Jon N. Van Heukelom et al. (2010), debriefing interruptions made during a simulation do not considerably change how realistic participants perceive the experience to be. This is a significant finding because it implies that these breaks for instruction and reflection do not interfere with the learning process. These brief stops actually give students important chances to review what they've learned, think back on what they've done, and get quick feedback. Interestingly, though, the authors also contend that, as opposed to clinical realism, letting students finish a simulation uninterrupted tends to result in a higher degree of emotional learning. The results of the writers show an interesting paradox. On the one hand, letting students finish a simulation without any interruptions can help them learn at a deeper emotional level because it gives them the chance to really get into the situation and feel all of the feelings that go along with it. When paired with patient perspective videos, this method can be especially successful because it enables students to actively participate in the personal stories and develop a deeper comprehension of the humanistic elements of healthcare. Conversely, the authors propose that providing a debriefing during the simulation can help reduce negative learning, which occurs when students remember errors without realising what to do. This strategy can result in a more precise and adaptable learning method, which is especially helpful when process flexibility is needed. But stopping the simulation to conduct a debriefing could break the emotional immersion and possibly impair emotional cognition. This paradox emphasises the need for a well-rounded approach to simulation training as well as additional knowledge about the appropriate resources being utilised. Facilitators may opt to prioritise emotional learning over clinical realism, depending on the learning objectives.

When considering this dichotomy, filmed simulations and patient perspective videos serve to enhance rather than obscure those simulations that are specifically designed for clinical learning. For example, in humanistic skill-improving simulations, it might be more advantageous to let the simulation run continuously to improve emotional learning; the content would then be viewed again after the first viewing and paused during that second viewing. On the other hand, frequent debriefing might be more successful in ensuring accurate learning and avoiding the retention of errors in simulations that centre on clinical skills. We discovered from our personal experiences at Torbay during COVID that both strategies have advantages and can be applied successfully in certain situations. The secret is to comprehend each simulation's learning objectives and modify the debriefing technique accordingly. Among the many things we learned during the pandemic was how to debrief in a flexible way. We still use this lesson in our simulation training procedures.

During the pandemic's peak, I created a special 360-degree video scenario in an attempt to better comprehend and address these issues. This immersive video, "What does Covid-19 look and feel like[46]," included paused reflection points for a facilitator to lead a discussion while offering a patient's perspective of their experience in the hospital during these turbulent times. The video emphasised the drastic changes brought about by the pandemic, such as the frightening sight of medical personnel in full protective gear (PPE) and the difficulties this created for interpersonal relationships and efficient communication. While essential for safety, the protective gear also posed a physical barrier that might hinder the nonverbal communication that is so important in healthcare settings. When medical personnel wore full protective equipment (PPE), masks and visors covered their faces. Patients found it challenging to read their facial expressions, which is an important part of nonverbal communication.

Figure 18 What does Covid-19 look and feel like? A screenshot from a patient perspective film. Peres, N 2020.

[46]The 360-degree video is available to view as a link within the video library list in the front as well as the appendix of the thesis.

Reassurance-giving smiles vanished, as did the nuanced facial expressions of empathy and understanding. Patients who were already vulnerable because of their illness may experience feelings of anxiety and isolation as a result of this. Furthermore, PPE muffled voices, which complicated verbal communication. It was more difficult to discern the consoling tone of a healthcare worker's voice and possible to overlook important information. This made an already difficult situation even more complicated. It made us think about how we could change the way we behaved so that, even in the face of the physical barriers put in place by PPE, our care remained patient-centered and compassionate. Could we, for example, figure out how to express our feelings even when our faces were hidden by using our body language and eyes? Could we improve the way we projected our voices to make sure our spoken words were understood?

These were a few of the queries the film posed, emphasising how crucial it is to preserve the humanistic components of care even in the face of unheard-of difficulties. A simple recognition of the increased value of hand gestures was incorporated within hand over activities for clinical teams in the covid areas as a result of the video. The 360-degree film was offered as more than just a stand-alone resource. It was incorporated into an online session that was facilitated by one of our knowledgeable simulation tutors, who led the participants through the course material. In order to get participants to interact with the material, the facilitator was essential in getting them to think critically about what they were seeing and to express their opinions. In prior years, our cooperating simulation tutors had contributed to the creation of 360-degree films and other film materials. At significant moments for reflection, the tutor would pause the film during the online sessions. Following that, they would ask participants to share their observations, feelings, and thoughts in order to facilitate a discussion centred around these points. Participants' comprehension of the subject matter was deepened, and a collaborative learning atmosphere was promoted, thanks to their active engagement with it. In addition to leading the conversation, the tutor's job description included establishing a secure and encouraging environment for introspection and learning. They urged attendees to ask questions, be frank in their thoughts, and grow from one another. In order for participants to interact with the material and get the most out of the debriefing sessions, a supportive environment was essential.

Ultimately, the COVID-19 pandemic has led to significant changes in medical education and simulation training, despite the difficulties it presented. It is essential to apply these lessons to develop an improved, enduring, and efficient strategy for simulation training in a post-pandemic era. The transition from conventional post-event debriefing to versatile and adjustable strategies, such as 'in-simulation' debriefing, has been a significant innovation. The shift was influenced by the distinct challenges posed by the pandemic, such as the requirement for social distancing and the swift development of clinical guidelines. Yet, it has also emphasised the potential advantages of these novel methods, like offering immediate feedback and customising the debriefing procedure to suit the learners' individual requirements. Utilising technologies for remote debriefing has been a significant advancement. These technologies have allowed simulation teams and educators to conduct debriefing sessions despite physical distancing measures, while also presenting new opportunities and inquiries for improving the debriefing process. While still in its early theoretical stages compared to face-to-face debriefing, foundational principles outlined by Shinnick et al. (2011) and related theories, which I have referenced, drawn from fields beyond simulation and into the arts and humanities, could guide the development of standards that encompass emotional and human behaviours. The timing of debriefing in simulations can impact the learning experience by influencing the perceived realism of the simulation and the depth of emotional learning. To achieve balance, one must have a detailed comprehension of the learning goals and the particular context of each simulation. I have aimed to investigate these challenges in my own research and production. The development of the 360-degree video scenario titled 'What does Covid-19 look and feel like' is a recent example of preserving humanistic skills during a challenging period. The concept of 'Minimal Viable Simulation' (MVS) has shown the potential for efficient training that maintains quality standards, created out of necessity. The quick uptake and incorporation of digital technologies have increased the accessibility and efficiency of simulation training, stripping conventional obstacles and creating opportunities for remote learning.

As we anticipate a future after the pandemic, these lessons and experiences offer a valuable basis for the ongoing development of simulation training in the NHS. As a Trust service, we have looked on solidifying these achievements, improving the methods, and incorporating these strategies into a lasting framework for delivering accessible simulation. The healthcare community's collaborative spirit and resourcefulness displayed during the pandemic should be utilised further. The healthcare workforce's resilience during this challenging time has been bolstered by resource sharing, collaborative problem-solving, and a commitment to frugal innovation. The post-pandemic blueprint for simulation training should include these elements to promote a culture of continuous learning, improvement, and mutual support.

The events of the last two years have highlighted the significance of flexibility and adaptability in debriefing strategies. As I progress into the next chapter, aiming to incorporate all the elements discussed in the thesis and provide a plan for a sustainable framework in a post-pandemic NHS, the lessons learned during this unique period will shape an enhanced simulation training approach.

Chapter 6: Reflections at the Human Machine Interface

In earlier sections, I have discussed various complex aspects of medical simulation, such as the importance of debriefing, immersive learning, emotional processing, and collaborative learning. The COVID-19 pandemic has required innovative changes in medical education, such as the adoption of Minimal Viable Simulation (MVS) and principles of compassionate care, which are considered crucial for its evolution. As we move into this chapter, I aim to explore into the advancements that these basic elements support, particularly in addressing the uncanny valley in medical simulation through debriefing. We will examine how the events during Covid-19 highlighted the importance of maintaining consistency in detail between debriefing and simulation scenarios, and the practical use of minimal viable solutions for training clinicians effectively, with a focus on nurturing humanistic skills such as professional empathy. The uncanny valley concept poses a notable obstacle in medical simulation, as simulations that are close to reality but not entirely accurate can cause discomfort, distraction, or disengagement in learners. In previous chapters, I discussed the industry's direction, manufacturer trends, and the confusion in the market. This chapter will focus on the post-COVID-19 landscape and the changing direction, based on my recent participation and presentations at the ASPiH conference 2023[47].

This chapter will investigate how a multidisciplinary approach, supported by participative collaboration, can help navigate through this valley. By emphasising emotional connection and utilising the combined expertise of multiple professionals to introduce new viewpoints, simulations can be developed that serve as effective educational tools while avoiding the unsettling impact of near-realism.

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[47] The recently released ASPiH standards discuss a recalibration of technical requirements and the assurance of learning outcomes related to EDI qualities, such as compassion and empathy. For more information, visit https://aspih.org.uk/standards-2/

Furthermore, combining immersive learning and emotional processing helps us comprehend how strategic debriefing can address and lessen the impact of the uncanny valley. The idea that we may learn more effectively through emotional connections rather than technological realism is now being observed at the ASPiH executive level and in recent publications[48]. By engaging in reflective discussions during debriefings, learners can connect their experiential gap, turning potentially unsettling simulation experiences into valuable learning opportunities. The idea of debriefing is not new. Incorporating reflective elements within a scenario can help fill gaps in the technological interface or its redundancies. This method highlights the significance of debriefing as an essential and unifying element of the simulation learning process, rather than just a routine follow-up task.

Additionally, the focus on collaborative learning and compassionate care principles in prior conversations highlights the importance of maintaining a consistent level of detail and realism, known as granularity, in both simulations and debriefings. Consistency in the educational journey allows learners to connect theoretical knowledge with practical applications and revisit or re-experience the practical aspect of this research, similar to watching recorded video perspectives. These experiences show that debriefing sessions should cover both technical and emotional aspects of simulations. It is important to have a consistent design and execution strategy that matches the level of detail in simulations with that in debriefing processes. The creative solutions

[48] The allure of high-quality graphics alone falls short of fully immersing individuals in VR environments. What truly captivates and engages users is the formation of a strong emotional connection with the virtual world. This insight, as highlighted in a study by the University of Bath, underscores that the essence of engagement in VR extends beyond mere visual fidelity to the deeper realms of emotional resonance (https://www.bath.ac.uk/announcements/vr-users-need-an-emotional-connection-to-virtual-worlds-not-better-graphics-study-finds/). This principle holds profound implications for the field of simulation, suggesting that the pursuit of high fidelity in educational and training simulations transcends technological advancements. It echoes earlier chapters in the understanding that the effectiveness of simulations is not solely determined by their technological sophistication but by their ability to evoke meaningful emotional responses.

to the difficulties brought by the COVID-19 pandemic, especially using the Minimal Viable Simulation (MVS) concept, highlight the effectiveness of simplified, cost-effective simulation methods in producing valuable educational results. This approach emphasises the importance of key simulation elements and thorough debriefing techniques in effectively training participants, drawing from discussions on emotional intelligence and compassionate care. This approach prioritises sustainability in cost models and equitable access, focusing on educational effectiveness rather than technological extravagance. It also aims to rebalance the development of professional humanistic skills as part of the agenda. In the broader context of technical procurement activities within the NHS, the experiences and outcomes observed in simulations may also be relevant in determining the expectations and requirements for technological solutions.

This chapter aims to provide a detailed framework for improving simulation-based education that can be applied in various contexts. It draws on insights from emotional and collaborative learning, the use of MVS, and strategic debriefing to address challenges related to the uncanny valley. Advocating for a comprehensive approach to clinician training involves addressing technical and logistical challenges in medical simulation and emphasising the importance of professional empathy development at a systemic level and in the design process. Titled "Reflections at the Human-Machine Interface," this chapter looks into the post-COVID landscape and the balance between utilising technological advancements and maintaining the human element crucial for medical education.

6.1 Overcoming the Uncanny Valley

I have previously touched on the concept of the Uncanny Valley, which has been a persistent concern in simulation technology, especially in medical simulation where a high level of realism is considered important. The term originates from robotics and describes the unease people feel when an artificial representation, such as a robot or simulation, closely resembles human appearance or behaviour[49] but is not perfect. This can lead to cognitive dissonance, as the observer struggles to perceive the representation as both human and non-human, resulting in feelings of unease or discomfort. In medical simulation, this issue is significant when using medical manikins. My practical work involved capturing patient perspectives to address this challenge. Essentially, we can view the uncanny valley in simulation as follows:

When a medical simulation closely resembles reality but is not flawless, it can be unsettling and diminish the training's efficacy. If the simulation deviates too much from reality, it may lack the required level of detail to offer an effective training experience.

During the COVID-19 pandemic, a significant advancement was made by conducting simulations in-situ with a broader range of staff members. Debriefing sessions were held in the same location and frequently right after the simulation training. This ensured a high level of consistency in the simulation and debriefing process, as opposed to a standardised approach.

To explore deeper into the balance between realism and distraction, I will refer to Johnston et al.'s (2020) paper "Into the uncanny valley: Simulation versus simulacrum?" which analyses the uncanny valley in medical simulations by comparing Baudrillard's concept of simulacra with the practical aspects of simulation-based learning. It emphasises the equilibrium between developing authentic educational scenarios and the possible discord experienced in simulations that are

[49] There are a number of sources that describe the uncanny valley in various forms relating to robotics and the advent of physical AI agents, but it was Japanese roboticist Masahiro Mori who first proposed the "uncanny valley" hypothesis, which predicted a nonlinear relation between robots' perceived human likeness and their likability.

nearly human but not entirely. The pursuit of hyperrealism[50] ,referred to as 'heightened fidelity,' in this thesis can occasionally result in an unproductive educational outcome.

The paper acts as a current resource, emphasising the subtle difficulty of developing simulations that are authentic without being unsettling. This section aims to explain the significance of maintaining a balanced approach in simulation design by exploring the concepts of simulacra and the uncanny valley. The goal is to promote learning and engagement while avoiding the unsettling realism that may distance learners. The authors discuss the concept of third-level simulacra in simulation education, where the simulation not only influences learning but also embodies it, addressing the hyperreal or the illusion of high fidelity. The simulation in this context not only aids learning but also establishes it. Learners do not just practise in a simulated scenario; their entire learning process, including how they diagnose, make decisions, and take action, is strongly influenced by the simulated environment they are in. Learners must interact with extremely realistic computer-generated models, environments, and avatars that mimic clinical scenarios so accurately that the simulation environment starts to blur the line between simulated and real medical experiences. These advancements provide a sophisticated and immersive learning experience that accurately reflects the complexities of healthcare practice with the necessary level of accuracy. Nevertheless, this change also initiates a crucial evaluation of the equilibrium between technological advancement and the retention of the essential human aspects inherent to healthcare. Some intangible aspects of healthcare, like the intuitive grasp of a patient's requirements, the cultivation of interpersonal skills, and the ethical dilemmas encountered in practical scenarios, may not be entirely represented.

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[50] Perhaps slightly ironically, the term hyperrealism is characterised by the extremely detailed and precise representation of its subjects, creating artwork that often resembles high-resolution photographs. This may go to show again the need for clarity of terminology in medical simulation, or more interestingly that simulation touches on art at a very fundamental and originating level – language that has deep applicability to film.

In this thesis, I have previously pointed out that the focus on technical accuracy in full-scale simulation may obscure the nuanced aspects of human behaviour. This degree of simulation is so far removed from genuine communication and interaction that it runs the risk of becoming completely detached from the authentic and imperfect practice of medicine. The authors propose that high-tech simulation environments, which lack the messiness and unpredictability of real clinical settings, may create an educational context that is hyperreal. This environment may overshadow the clinical humanity, complexity, and uncertainty with the technological aspects of the simulation.
Johnston et al. suggest various strategies to prevent simulation from straying into third-level simulacra and losing touch with the genuine essence of medical practice.

Emphasising the importance of enhancing workplace learning and assessment by combining simulation with a stronger pedagogical focus, to better connect simulation-based education with real clinical settings.

Contextualising Simulation: Using in situ simulation to enhance the authenticity of simulation training. This method utilises real working environments as the educational setting, integrating the intricacies and unpredictability of these environments into the learning process.

Utilising sociomaterial theories, such as complexity theory, to inform the design of simulations and highlight crucial dynamics that are frequently overlooked in simulation-based education. This method seeks to improve the genuineness and variability of simulations, making them more closely resemble the intricacies of actual clinical scenarios.

Promoting Criticality and Reflexivity: Encouraging critical thinking and self-awareness in simulation education to challenge the emphasis on efficiency and accountability. The authors recommend considering sociocultural context, emotions, and agendas when creating and implementing simulated scenarios to take a critical approach to using simulation in education.

Torbay and South Devon’s simulation team are working towards a multi-disciplinary approach to enhance simulation blueprinting through staff diversity and participant inclusion, a theme also highlighted in Johnston et al.'s discussions. By critically analysing simulation education, they emphasise the importance of integrating a variety of viewpoints and skills to improve the realism and educational impact of simulations. My belief is that involving a diverse group of individuals, including healthcare professionals, educators, service users, technology experts, as well as individuals from fields like arts and humanities, is essential for creating simulations that go beyond high fidelity to promote authentic narrative-driven experiences. The authors emphasise the importance of designing simulations carefully and aligning them with broader educational goals to prevent them from losing connection with real-life applications. This aligns with the collaborative design processes advocated in the previous chapter.

Despite occurring spontaneously in response to service demands during the Covid-19 pandemic, a more organised initiative focusing on co-development started with the content creation workshops as just one interactive activity. Running workshops for creating 360-degree content allowed for practical exploration of collaborative planning and design among various staff groups. This included activities like storyboarding and production, demonstrating how collaboration in designing simulation scenarios can be effective. It also highlighted the importance of film-based content as a valuable medium for simulation delivery. Bringing clinical groups together to create a creative experience aligns to the design, running, and debriefing process used in medical simulation.

Johnston et al.'s study on third-level simulacra emphasises the significance of preserving a connection to the genuine essence of medical practice to prevent simulations from becoming completely detached from real-life communication and clinical interaction. Input from various stakeholders helps ensure that simulations are relevant to real clinical environments. Due to an increase in in-situ simulations during the Covid-19 pandemic, the team is now continuing a programme of in-situ delivery. This is accompanied by a redesign of the simulation lab spaces to better resemble specific environments in the hospital. The paper suggests that using in situ simulation and sociomaterial theories can enhance the context authenticity of simulations, aligning closely with the participative collaboration model. This method, which seeks to mimic the uncertainty and complexity of real-world situations in simulation training, strengthens my belief in the importance of working together to create simulations that truly capture the intricacies of clinical practice.

In 2019, my colleague Jacqui Knight and I co-developed a project titled "Rethinking Causality: Recovering the Complexity of the Patient's Reality in A&E Assessment," which presented a reflective case study. The interactive seminar was created to redirect the focus of simulation from a purely technological pursuit to one that is strongly connected to the stories of patient experiences in Accident and Emergency departments. We aimed to challenge traditional simulation design paradigms by prioritising narrative and collaborative input over technological accuracy. The project used story cards as interactive prompts in the simulation to involve participants in the scenario's development. Participants were encouraged to engage with the simulation as unfolding stories that demanded interpretation and response, rather than just completing tasks. This design aspect was essential because it placed participants in a unique position where they were both impartial observers and active participants. Having two viewpoints promoted a more profound involvement with the simulation, leading to a more sophisticated comprehension of clinical decision-making and patient interaction. Yet, the project also highlighted the intrinsic constraints of depending exclusively on technology to replicate physiological reactions. Although animatronic manikins could imitate specific clinical signs like palpable pulse rates or breathing sounds, they were not effective in helping to develop the interpretative and soft skills necessary for comprehensive patient care. Our simulation focused on emphasising the narrative aspect to fill this gap by presenting symptoms in a context that required empathy, ethical judgement, and effective communication rather than just a technical response. This methodology is in line with sociomaterial theories, recognising that learning in simulations is influenced by both the social interactions among participants and the material elements of the simulation environment. Healthcare professionals' involvement guarantees the clinical accuracy and authenticity of the content, thus improving the simulation's realism. Educators provide their pedagogical knowledge to create simulations with well-defined learning goals and productive debriefing sessions to encourage reflection and enhance learning. Professionals from various fields, such as technology and media, introduce creative methods to simulation design, utilising tools like story cards to stimulate critical thinking and decision-making. The seminar emphasised the difficulties in creating authentic medical simulations. Striving for extreme realism and accuracy can sometimes distract from the crucial interpersonal skills needed in clinical practice. We aimed to show how media theory and knowledge of visual intelligence could enhance simulation design by going beyond the usual emphasis on high-fidelity environments.

The project ended with a debriefing session held in the same environment. Participants, who had experienced the simulation from two different perspectives, were asked to reflect critically on their experiences while being able to identify and discuss elements in the environment. The event allowed for criticism of current trends in medical simulation, particularly the emphasis on high-fidelity technology and the oversimplified method of teaching psychological and interpersonal skills. This detailed comprehension reveals a deficiency in the discussion put forth by Johnston et al., specifically regarding the development of a technical framework or terminology that encompasses a simulation approach focused less on fidelity and more on enhancing the value of non-technical skills. The concept of Minimal Viable Simulation (MVS) is seen as an important addition to the discussion. Although emphasising the importance of prioritising humanistic skills over technological approaches, the research introduces the MVS idea by integrating technological terminology and frameworks into the discussion. It provides a framework and system for creating simulations that are technologically basic but high in educational value. This method is in line with the educational principles discussed by Johnston et al. and connects educational theory with practical technological implementation in simulation design. By incorporating simulations into the MVS terminology and paradigm, it supports the framework that technological progress improves the authenticity and educational value of medical simulations, appealing to a broader audience involved in advancing medical education.

On that note, the historical uncertainty regarding the terminology used in marketing simulation manikins by industry manufacturers highlights the importance of involving the industry as a key audience to influence the future direction of simulation in medical education. Using accurate and universally understandable terminology is essential for various reasons. It helps to clarify the technological aspects of simulation for those who are not well-versed in the pedagogical theories supporting their use. Industry stakeholders, especially manufacturers familiar with terms like "high fidelity" in simulation technology, find the MVS concept prioritises educational outcomes over technological complexity, offering a clear framework. This clarity is crucial for directing the development and marketing of simulation tools that are fully in line with the requirements of medical educators and learners. Simulation technicians play a crucial role in choosing, preparing, and using simulation equipment. The MVS terminology provides a useful framework for evaluating and incorporating simulation technologies and within that giving importance and placement to the role of the simulation technician, which is often overlooked and underappreciated. Comprehending MVS allows technicians to make informed decisions regarding the utilisation and customisation of simulation tools, ensuring that these technologies are used effectively to support learning objectives. Using MVS as terminology and a guiding principle helps make a strong business case for simulation investments, highlighting educational effectiveness and fiscal efficiency. This approach is in line with the priorities of budget managers and fund allocators, providing a simulation-based education model that delivers substantial educational advantages without corresponding cost increases. Using MVS-specific terminology can help funders and commissioners better understand the value proposition of simulation initiatives during discussions. It enables a detailed discussion on how focused investments in simulation can result in significant educational achievements and also support the sustainability of simulation services in the long run. Implementing MVS improves the educational quality and cost-effectiveness of simulation programmes, ensuring their viability in a time of heightened financial oversight.

6.2 A Minimal Viable Simulation checklist

After discussing the use of filmic interface and immersive video technology in medical simulation alongside the configuration of fidelity, the following recommendations can be proposed as a manifesto for video-enabled simulation:

1. Patient-Centricity: Simulation design should prioritise a patient-centered approach, focusing on their experiences, emotions, and viewpoints. This can be accomplished by utilising narrative-driven materials, such as immersive video techniques, to capture, communicate, and reflect on the perspective of patients or service users.

2. Strategic utilisation of Technology: Instead of prioritising the impressive nature of advanced technology, the focus should be on how technology can improve learning results. The technology utilised should align with the learning objectives, rather than the learning objectives being adapted to fit the technology.

3. Realism in the simulation should not be attributed only to the technology or equipment utilised. Examine the physical setting and storyline of the situation and how these elements will be reflected in the debriefing. This should encompass the emotional and psychological components of a healthcare situation. This can be accomplished by depicting real-life situations with all their intricacies through diverse scenarios, interpreted from a broader stakeholder and collaborative perspective.

4. Solutions that are easy to obtain and affordable: Make sure the technology utilised in medical simulation aligns with the theme of the scenarios. Is advanced technology necessary for practicing clinical or humanistic skills? Do you take into account accessibility and cost-effectiveness when conducting the simulation? This enables a broader range of institutions to implement these technologies and expands the accessibility of simulation-based learning to participants on the fringes with lower levels of technology literacy.

5. Foster interdisciplinary collaboration by engaging diverse teams, such as clinicians, educators, filmmakers, and technologists, in the creation of medical simulation. This can improve the authenticity, storytelling, and efficiency of the simulation.

6. Utilise the adaptability of video-enabled simulation to cater to learners' needs by assessing whether the video presents a distinctive or undervalued viewpoint. Where utilising full 360-degree video, ensure the camera is positioned to capture parts of the space which might otherwise have gone unseen. This feature should allow users to pause, review, and discuss specific moments in the video to emphasise key points related to communication, compassionate care, and humanistic behaviour.

7. Research and Evaluation: Engage participants and users in providing feedback and evaluating the MVS methodology. This includes both quantitative evaluation and qualitative input from students and teachers, guaranteeing an ongoing process of enhancement.

8. Ethics and Consent: Ensure ethical standards are upheld when incorporating elements like filming real-life scenarios for simulations or structuring debrief discussions around patient narratives and participants' emotional and cognitive reactions.

6.3 The Uncanny Valley and Minimal Viable Simulation: Relating Other influences.

"All too often it is the surface realism of the simulation that occupies the ingenuity of those who develop it, eclipsing key issues of teaching and learning," as noted by Roger Kneebone, speaks volumes in the context of the ongoing conversation about the uncanny valley and methods for overcoming it through teamwork and the Minimal Viable Simulation methodology. This quotation draws attention to a

crucial issue with medical simulations: the obsession with reaching technological realism and sophistication can occasionally obscure the core educational goals that simulations are meant to fulfil. Kneebone's observation highlights the need to shift our attention back to the primary educational goals of simulations in light of the uncanny valley, where learners may become uneasy due to simulations' hyper-realistic portrayal. The uncanny valley presents a pedagogical opportunity to reconsider what makes simulations effective teaching tools in addition to a technological challenge. Kneebone's concern is directly addressed by the MVS methodology, which promotes the development of simulations that are pedagogically sound and customised to meet particular learning objectives rather than focusing on surface realism. MVS advocates for developers—stakeholders from the clinical, educational, technological, and service user domains—to eliminate superfluous technological intricacies that fail to augment learning, opting instead to concentrate on components that authentically augment educational worth. The criticism of concentrating too much on the surface realism of simulations, as brought out by Roger Kneebone, is complemented by Edgerton's claim that the "shock" of technology frequently originates from the old rather than the new. Similar to Edgerton's observations that societies frequently overemphasise novel technologies at the expense of comprehending the value and utility of existing ones, this obsession can eclipse the fundamental goals of teaching and learning. Regarding medical simulation and the uncanny valley, Edgerton's observations in The Shock of the Old offer a helpful shift in perspective. It makes sense to use current technologies in creative ways to meet educational goals rather than aiming for ever-higher degrees of technological fidelity. This strategy is consistent with the MVS methodology, which promotes the development of simulations that meet particular learning objectives with the required fidelity—rather than the highest fidelity feasible.

Our discussion on the challenges of medical simulation, the uncanny valley, and the pursuit of authenticity through collaborative methodologies and the Minimal Viable Simulation (MVS) approach comes to a poignant close with my colleague and ENT consultant, David Alderson, reflecting on his article, "The Uncanny Valley of Simulation Fidelity," which explores the limitations of simulation in capturing the full spectrum of clinical practice. Alderson warns against the delusion of authenticity in high-fidelity simulations, emphasising that technology cannot fully replicate the essence of clinical care, which includes not only technical skills but also the subtle "sixth sense" of insight, ethical judgement, and emotional intelligence. This alert reinforces the need for a balanced strategy that puts educational goals ahead of technological perfection by serving as a crucial reminder of the inherent limitations of simulation technology. It emphasises how crucial it is to remember that the ultimate objective of medical education is to equip students for the intricate, frequently unpredictable human interactions that characterise the practice of medicine, in addition to the technical aspects of clinical care. Alderson's observations round out the conversations about creating and executing simulations using the MVS methodology and collaborative approaches. We are reminded of the importance of integrating reflective learning, debriefing, and an emphasis on the less obvious facets of clinical practice into simulation-based education by recognising the gaps that remain in even the most sophisticated simulations. These components are essential for developing a more comprehensive, holistic understanding of clinical care that extends beyond what is perceptible, palpable, or quantifiable. Our discussion comes full circle when Alderson emphasises the importance of "humility in our approach to simulation design and implementation."

6.4 Unlocking in the Debriefing

Overcoming challenges related to the uncanny valley in medical simulations heavily relies on the structure and implementation of the debriefing process. The debrief's role and methodology have evolved significantly, influenced by various factors, including the demands resulting from

the COVID-19 pandemic, as discussed in the previous chapter. During this time, changes were required in how training was provided, often taking place directly in clinical environments, which changed the usual setting for debriefing sessions. The pandemic caused significant burnout and emotional exhaustion among healthcare workers, but they remained dedicated to delivering excellent care to patients and supporting each other. These circumstances inevitably influenced the debriefing sessions, whether they occurred after simulation exercises or when reflecting on real clinical experiences. These sessions went beyond just evaluating technical skills to include discussions about emotions, goals, mental health, and the effectiveness of practice. This change highlighted the significance of meeting the comprehensive needs of healthcare professionals by making sure that debriefing sessions serve not only as a means to improve technical skills but also as a platform for emotional support and contemplation. The situation prompted a wider variety of clinical teams to participate in simulations to map out patient care pathways.
This diversification introduced a range of viewpoints to the debriefing sessions, moving beyond the conventional emphasis on doctors and medical students who have traditionally been the main participants in simulation training. Having various clinical roles included in the reflection process enriched it by ensuring a diverse range of experiences and viewpoints were taken into account when evaluating and learning from the simulations. The change in approach at Torbay and South Devon led to a lasting interest in maintaining a more balanced strategy beyond the initial pandemic crisis. The goal was to continue using a simulation methodology that emphasises humanistic skills as well as technical competencies. This commitment aimed to ensure that simulation practice remains accessible and relevant, without being limited by geographical or technological obstacles. The understanding that some simulations require high-fidelity manikins due to medical school standards, while others can benefit from Minimal Viable Simulation principles, has influenced a nuanced approach in simulation design. This difference highlights the need for adaptability in medical education to effectively address various training requirements.

The structure of the debriefing was identified as the crucial factor in connecting various types of simulations amid technological advancements. The debriefing process is effective in preventing technology from overshadowing the learning objectives by ensuring that the simulation scenarios and reflective discussions are closely aligned in thematic content. Consistency in debriefing sessions ensures that regardless of the simulation's complexity, the focus remains on extracting meaningful insights and reflections that directly relate to the scenarios' themes.

By combining knowledge from previous conversations on reflective learning, the impact of arts and humanities on language, the use of immersive patient perspective videos, and the technical aspects covered by the Minimal Viable Simulation (MVS) method, we can create a plan for guided conversations and discussions during debriefing sessions. This template aims to balance technical skill development and exploration of humanistic values in the simulation. It integrates these aspects into the learning experience while providing detailed scenarios through verbal context and additional materials, such as patient perspective videos or setting elements, for debriefing. Here is a structured plan for a debriefing session that includes different components:

1. Facilitating Reflective Practice:

Schön's idea of reflective practice supports the debriefing process, promoting a reflective conversation where learners explain their actions, thoughts, and the reasoning behind their clinical decisions (Schön, D. A., 1992). Reflective practice is essential in debriefing sessions as it enables learners to analyse their cognitive processes and address any discomfort or dissonance arising from the uncanny valley.

Questions for Facilitating Reflective Practice:

"Can you walk us through your decision-making process during [specific scenario]?"

"What alternative approaches could you have considered, and why?"

2. Bridging Theory and Practice:

Billett's workplace learning theory highlights the significance of combining theoretical knowledge with practical application (Billett, S., 1996). Debriefing sessions should address discrepancies between simulation realism and actual practice to enhance learning outcomes and the application of theoretical knowledge in real-world scenarios.

Questions for Bridging Theory and Practice:

"How does your theoretical understanding of [condition/treatment] compare with the simulated application?"

"What were the limitations of the simulation in representing the complexity of real-life patient care?"

3. Addressing Emotional and Ethical Considerations:

Bandura's theory of moral disengagement emphasises the significance of ethical contemplation in professional conduct (Bandura, A., 1999). Debriefing should cover the emotional and ethical aspects of healthcare, which are frequently neglected in high-fidelity simulations but are crucial for professional skills and patient well-being.

Questions for Emotional and Ethical Considerations:

"How did the simulation make you feel, especially when faced with ethical dilemmas?"

"Discuss a moment in the simulation where you had to make an ethical decision. How did you approach it?"

4. Enhancing Social and Material Interactions:

Sociomaterial theories, as outlined in Johnston et al., 2020 and explored in our Rethinking Causality seminar, suggest that learning results from the interaction between social engagements and material circumstances (Fenwick, T., Edwards, R., & Sawchuk, P., 2011). The debriefing should analyse how the physical components of the simulation (such as manikins and software) and the interpersonal interactions (like team communication and leadership) impacted the learning process.

Questions for Sociomaterial Interactions:

"How did the physical setup and technology of the simulation impact your learning?"
"In what ways did team dynamics and humanistic skills influence the outcomes of the simulation?"

5. Narrative Medicine and Reflective Storytelling:
Through the application of reflective storytelling during debriefings, the field of narrative medicine—which highlights the significance of narrative competence in healthcare—can help close the gap between clinical practice and the human experience. Charon, R. (2006). By using this method, students can interact with the intricacies of patient care that go beyond the clinical symptoms, which promotes empathy and a stronger bond with the experiences of the patients. This reflective material is provided as part of the debriefing process by using patient perspective videos, such as those from the PatientVR project.

How do elements such as the sounds, lighting, and uniforms contribute to the realism and authenticity of the clinical scenario?" (Braudy, L., & Cohen, M., 2004)
"In what ways do the narratives encountered in the simulation and patient videos challenge your preconceptions about patient care?"

"In reflection, what ways do you define humanistic skills in patient and clinical care?"

6. Understanding MVS and Technological Application:

This section examines the function and effectiveness of technology in the simulation framework, based on the Minimal Viable Simulation (MVS) principles. MVS is in favour of a strategy where technology supports learning objectives without superseding it with needless intricacy.

"Consider the technology used in this simulation. How effectively did it replicate clinical realities, and where could it be simplified to better focus on essential learning outcomes?"

The template offers a method for incorporating technology into healthcare that emphasises technology use, reflective practice, and the ideas of minimal viable simulation (MVS). Its goal is to carefully evaluate and apply technology. By promoting reflective discourse, tying theory to practice, and taking into account the sociomaterial dynamics in clinical and training settings along with emotional and ethical considerations, it may also serve as a model for broader contexts of digital and technological integration in NHS contexts, including digital therapeutics. By focusing on patient needs, ethical integrity, and educational value, this approach aims to make sure that technology—such as digital therapeutics—is used in a way that supports healthcare professionals in carefully integrating digital solutions to enhance patient care and outcomes.

6.5 Wider Applications for MVS & Co-Design of Digital Literacy

The 2023 NHS Long Term Workforce Plan[51], which outlines the focus on digital transformation and workforce upskilling in the post-COVID NHS landscape, provides a vision for a healthcare system that embraces technological advancements and cutting-edge teaching strategies. This plan puts immersive technologies at the centre of future learning environments and argues that simulation and digital platforms play a crucial role in revolutionising healthcare education and patient care. The strategic use of virtual wards and digital connectivity for remote patient monitoring is highlighted by the NHS's goal to develop a workforce that is innovation-ready and digitally literate. It emphasises the importance of simulation in training, especially in light of programmes like the expansion of the Virtual Hybrid Learning Faculty and Simulation Faculty, which seek to increase the efficacy and reach of simulation-based learning. This focus aims to close the knowledge gap between theory and practice in a healthcare setting that is moving more and more towards digital solutions. The Long-Term Workforce Plan presents a long-term vision rather than a roadmap with concrete, doable steps in the near future, even though it lays out an ambitious trajectory towards a digital-first NHS by incorporating improved simulation techniques and digital tools into professional education and patient care. Significant progress towards novel training models has been made with the encouragement of Higher Education Institutions (HEIs) to adopt new guidelines for practice learning through simulation and the realisation of immersive technologies' potential. The plan's broad overview of the digital

[51] In my national role as XR and Simulation Advisor within the NHS England TEL team, we contributed a vision to the report that positioned simulation as a crucial training modality. This vision extended beyond clinical skill development, encompassing skills mastery, process mapping, and the fostering of multidisciplinary team building. Our contribution aimed to highlight the significance of simulation across various care settings, including primary, secondary, and community care, demonstrating its versatility and comprehensive application in enhancing healthcare training and delivery.

transformation journey, however, draws attention to a lack of precise instructions or well-defined routes for the industry to take.

This overarching goal, which aims to enhance patient outcomes and operational efficiency, lays the foundation for a technologically advanced NHS. However, the story also foreshadows a period of change, where the idea for a future in tech-enabled healthcare is obvious, but the specifics of how it will be implemented are still lacking. The difficulty is in turning this long-term vision into concrete actions that can direct the workforce of the NHS towards accomplishing these technological and educational breakthroughs. For example, in the clinical context, topics like pain control, anxiety reduction, and limb rehabilitation are not only being researched at the university level and in collaboration with some NHS organisations, like Torbay and South Devon[52],but are also being incorporated into care pathways, albeit with varying degrees of success because these areas require localised expertise and experience rather than national guidelines in areas like upskilling for staff facilitation. These initiatives do, however, highlight a shift from the pre-pandemic state of limited acceptance towards now the investigation and incorporation of digital therapeutics into patient care, all while the NHS is undergoing significant change because of the late or already implemented adoption of Electronic Patient Record (EPR) systems by NHS organisations, such as Torbay and South Devon. The goal of this change is to improve the coherence and effectiveness of patient data management by streamlining the recording, retrieval, and transfer of healthcare records. Most importantly, it is designed to encourage a more patient-centric approach by empowering patients and service users to actively interact with their healthcare data, from adding entries to making healthcare appointment requests, and hopefully beyond. Although the idea of switching to EPR systems for businesses

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[52] Digital Futures, as mentioned in previous chapters, is the evolution of the VR Lab, based at Torbay but sponsored at national level for the exploration and evaluation of XR technologies in the NHS. The Digital Futures strap line reads as human centred digital innovation, which while not perfect, does frame the approach of needs before technology https://immersive.tsdft.uk

offers integrated healthcare delivery, it also presents a significant challenge: making sure that the workforce are comfortable using technology and have the necessary digital literacy[53].

In order to tailor the system's initial stages to particular care pathways, clinical teams, patient representatives, and technology designers must work together to improve the system's user interfaces and functionalities. This scenario reflects larger issues that have historically been present in medical simulation technology, especially the possibility of adding needless complexity and navigational difficulties that compromise usability and accessibility. It poses important questions about how to steer clear of the technological redundancy traps of the past and concentrate on features that actually improve user experience and care delivery. The most intriguing thing about this transition, though, is how it offers a special chance to reconsider how humanistic values and skills are acknowledged and integrated into digital healthcare systems. Is it possible for the EPR system to be created in a way that recognises and records the intrinsic worth of the time that carers and clinicians invest in giving patients consolation, understanding, and support? This strategy has the potential to change the paradigm by enabling clinical interventions and digital interfaces to both recognise and value the core components of humanistic care.

A forward-thinking positioning paper (A Co-Design Solution to Digital Literacy in Health Provision, 2023) has been developed by the Transtechnology Research Group in partnership with our Trust digital team, specifically for the purpose of improving digital literacy at Torbay. This work falls under my organisational remit. This paper places the integration of humanistic values in healthcare technology in context by outlining the roles of participants and service users,

[53] This is a challenge I am now acutely aware of, being involved in leading the digital literacy strategy for our 6,500 staff at TSDFT.

maps what is available for literacy diagnostics, and describes a strategy for addressing the urgent issues related to digital literacy in the lack of strong frameworks for co-design in NHS innovation. The document suggests a number of creative avenues and useful interventions intended to improve digital literacy among TSDFT staff members by utilising co-design methodologies. One noteworthy development from the Digital Futures Hub is the introduction of a mobile digital lab that resembles a well-accepted (and welcomed) model of the tea trolley and aims to give patients first-hand experience with emerging technologies in a clinical setting. This initiative highlights the importance of speculative design and co-design in igniting interest in digital technologies in comfortable settings, like break out areas and staff rooms. The technology is presented alongside a cup of tea and during any brief breaks that employees may have during their regular workdays.

Deep dive sessions arranged by the Digital Futures team further enhance the strategy. The purpose of these sessions is to investigate how particular digital technologies, like virtual reality, might be applied to current healthcare procedures. These seminars seek to demystify digital innovations and promote a deeper understanding of their potential to revolutionise patient care by providing an immersive learning environment. The strategy also emphasises setting up a virtual simulation room where employees can use educational frameworks and role-play to work through the complexities of digital transformation. The purpose of this simulated environment is to improve the practical interaction with digital tools by providing a hands-on method for comprehending and utilising technology in healthcare settings. The addition of a glossary on digital technologies to the Trust's learning management system (LMS)[54] enhances these interventions and is essential in helping to explain digital terminologies. This platform describes technological definitions and framing but within a health or everyday comparative context,

[54] The glossary of technical terms makes up one recognised work package from the Digital Literacy project between Transtechnology Research and TSDFT, the full presentation of which can be found in the appendix.

making digital literacy more accessible to healthcare professionals. It does this by connecting to national frameworks and guidelines in an approachable and playful manner.

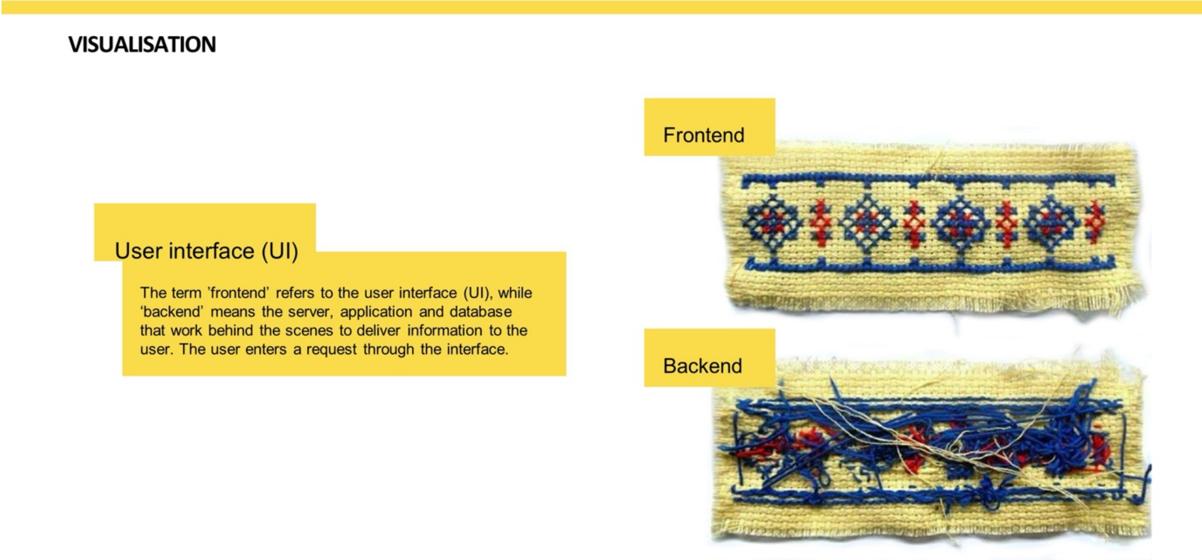

Figure 19 A contextual glossary of technical terms. Digital Literacy pt.2 Research Design Presentation. Knight, J et al 2022.

The fundamental tenet of this strategy is the dedication to ensuring that TSDFT's digital transformation is consistent with the fundamental humanistic values of healthcare. In order to make sure that technological advancements improve rather than exacerbate patient care and clinical operations, the strategy prioritises simplicity, usability, and clinical relevance when implementing a minimal viable approach to technology integration.

The minimal viable simulation (MVS) approach provides significant advantages in situations where budget and time limitations influence the organisation and delivery of services. Staff have concerns and hesitations about how these changes will affect their daily duties, highlighting the necessity for systems that provide essential benefits without unnecessary features. This era of digital advancement prompts a re-evaluation of how EPR systems can capture and appreciate the empathetic, non-directive interactions that are central to healthcare. The difficulty is in creating systems that recognise the value of humanistic care provided by nurses, midwives, and allied health professionals, who play a crucial role in improving patient care, while also ensuring that technology complements rather than diminishes the personal aspect of healthcare.

6.6 The status and development of medical simulation

The industry is undergoing a significant change, similar to the initial stages of simulation, where small companies and individual 'homebrew' projects are emerging to address gaps that larger organisations may have missed. These efforts, such as Dr. Giovanni Antonio Galli's birthing simulator from 1911 or Martha Jenkins Chase's "Mrs. Chase" doll, represent a shift back to fundamental principles, emphasising aesthetics and tactile experience over technical accuracy. This method seeks to create a realistic experience for users, which can sometimes evoke reactions similar to the uncanny valley effect. The industry is divided between computerised manikins and those aiming for lifelike appearances, with some using film industry expertise for manikin design. This raises questions about the definition of realism in medical simulation. Does the pursuit of visual and tactile authenticity in healthcare training truly enhance learning, or does it detract from the fundamental non-technical elements? This advancement in medical simulation prompts us to reconsider the most effective way to educate healthcare professionals, weighing the appeal of high fidelity against the essential requirement for valuable, skills-oriented learning opportunities. In November 2023, the Association for Simulated Practice in Healthcare (ASPiH) introduced a new strategy that signifies a significant change in direction and tackles urgent requirements for inclusion. This approach, designed to assist UK organisations in using simulations, has shifted from a focus on technology to include more human-centered and user-friendly aspects. It emphasises that decisions about simulation type, realism, and activity design should be based on the desired learning goals. This approach recognises that although simulation can be resource-intensive, requiring substantial investment in time, money, staff, and equipment, effectiveness in simulation does not necessarily require high costs. The Standards emphasise that low-fidelity, low-cost simulations can effectively meet curricular goals. It is important to adjust the fidelity and approach of simulation activities to align with specific learning objectives, rather than opting for high-fidelity options that may not provide extra learning benefits. The strategy's cautious approach recognises the importance of partnerships in industry, academia, and healthcare sectors, leading to a noticeable change in how technology is viewed and used in the simulation field. This reassessment indicates a developing agreement that the future of simulation in healthcare education depends not on the complexity of the technology but on its ability to enhance learning, replicate real-world challenges, and integrate the humanistic principles essential to patient care. I had the privilege to contribute to a strategic direction that aligns with the changing landscape of medical simulation, promoting a more inclusive, diverse, and educationally focused approach to simulation practice.

Final Discussion and Further Research

This thesis examined a pragmatic method for providing educational resources in a medical simulation programme at Torbay and South Devon NHS Foundation Trust. It sought to initially improve the comprehension and advancement of non-technical skills in junior and student doctors in years 5 and 6, but due to evolving circumstances found application and use with a wider workforce. This research suggests that a straightforward intervention could greatly improve training outcomes, inspired by the Francis Report's revelations about the Mid Staffordshire NHS Foundation Trust in 2013. Using my experience in filmmaking and role as a simulation technician, I recommend changing the approach to using video content in simulations. This involved moving beyond just observing environments through ceiling mounted cameras to showcasing patient perspectives through immersive, 360-degree scenarios. This activity, seeing environments, interactions and the scenarios from this perspective enhanced an understanding and involvement with the concepts of compassion and empathy in healthcare education, in response to a crucial requirement highlighted after the Francis Report's discoveries.

Two major concerns were brought to light during the practical investigation of this project. The vocabulary used in medical simulation and medical technology in general can be ambiguous and is frequently influenced by an industry that promotes expensive technologies. This scenario impacts the accessibility and perceived worth of simulation training, highlighting the necessity for more precise terminology to articulate crucial attributes like care, compassion, and empathy. The term "soft skills" does not fully capture the importance of these attributes, often placing them at a lower priority compared to technical skills. Similarly, the term "human factors" is often used too broadly, which detracts from its specific emphasis on ergonomics. This thesis proposes the term "Humanistic Skills" as a more appropriate designation for these essential healthcare attributes. The term "Humanistic Skills" has received positive feedback within my organisation and nationally in the form of staring a special interest group as part of ASPiH, suggesting its relevance and potential acceptance as the search for the ideal term continues. This has prompted additional research into a specialised focus on human-centered simulation, resulting in this initiative aims to share with a community an interest in integrating humanistic values more thoroughly into medical simulation by proposing a novel approach that enhances empathetic and compassionate patient care in training programmes.

Secondly, it is essential to possess the skill of interpreting film and imagery effectively to maximise the learning experience. This was primarily an afterthought resulting from feedback received from colleagues. As a filmmaker, I had taken for granted the significance of the language of film and the creative aspect of framing shots, which can help in comprehending what is captured within the frame. By moving the camera from the ceiling to eye level within the environment, the traditional camera usage was altered to align more closely with cinematic conventions and film theories like semiotics, mise-en-scene, and phantom perspectives. This transformation is discussed in chapter two, "Resistance to the Camera." Mapping the timeline of camera technology in medicine and healthcare revealed that cameras were strategically positioned to capture as much information as possible from the ceiling, resulting in the absence of facial expressions, gestures, and overlooked details. The desire to capture this need for more I tried to use a new technology involving 360-degree video capture and virtual reality device playback. This technology allowed both participants and viewers to control where they wanted to look within the sphere.

The desire to analyse the language of film and interpret imagery inspired the development of workshops for clinicians and content creators. These workshops aimed to foster creativity and encourage the filming and capturing of diverse narratives by individuals with unique experiences in their respective fields. Despite being shortened by time constraints and the emergence of the pandemic, the workshops provided participants with valuable and pleasant experiences. This has resulted in the organisation planning a film festival to showcase films made by Trust staff.

7.1 Discussion of the Implications

Embarking on this thesis presented an opportunity to investigate into the intricate relationship between medical simulation training and the development of non-technical skills, particularly within the context of Torbay and South Devon NHS Foundation Trust. Guided by the profound insights from the Francis Report, which cast a spotlight on the lapses in basic care and compassion within the NHS, this research aimed to explore and enrich the current understanding and practices in medical education, particularly focusing on empathy and compassion among junior and student doctors. Some of the key implications from the work present as the following;

Introduction to Humanistic Skills in Medical Simulation

The incorporation of "Humanistic Skills" into medical simulation is a deliberate attempt to better capture the intangible attributes required for providing compassionate patient care. This initiative was born out of the realisation that the terms that are currently in use, like "soft skills" or "human factors," fall short of accurately describing the breadth and importance of these competencies in the delivery of healthcare. The project proposes "Humanistic Skills," implying that these qualities are just as fundamental to healthcare as clinical knowledge and technical proficiency, in an effort to recognise and elevate the important role that empathy, care, and compassion play in medical practice. The selection of this terminology serves as an invitation to the medical education community to participate in a thoughtful, inclusive discussion about how we define and rank the principles that underpin patient care. It acknowledges that the language we use affects how we understand and impart medical knowledge, thereby affecting how aspiring medical professionals view and incorporate these fundamentally humanistic traits into their work. Thus, the term "Humanistic Skills" is presented as a discussion starter rather than a final solution, emphasising the necessity of a team effort to more successfully incorporate these qualities into medical education. The knowledge that the development of such skills is intricate and multifaceted emphasises this investigation into the language and incorporation of humanistic skills in medical simulation. It touches on deeper facets of human interaction, ethical practice, and the emotional intelligence needed to handle the complexities of patient care. It goes beyond simple behavioural mimicry or procedural knowledge. As a result, integrating humanistic skills into simulation training necessitates creative solutions that go beyond established practices, encouraging educators to think of simulations that promote empathy, moral judgement, and clear communication as essential elements of medical competency.

Engagement with Language and Terminology:

More generally, the project revealed how industry terminology greatly affects the comprehension and application of medical simulation techniques. It proposed using a more sophisticated vocabulary in order to better express the spirit of patient-centered care. This proposal is only the beginning of what is acknowledged as a larger, essential discussion regarding the language employed in medical education. The proposed vocabulary aims to provide a more nuanced way of describing and teaching empathy, care, and compassion, acknowledging the complexity of healthcare interactions and their critical importance. This shift to more precise language is considered a small step towards a much larger conversation that needs to include many different stakeholders from different areas of medical education, however by demonstrating testing of these concepts to a clinical audience within this thesis and linking this activity to national groups, this work has provided a foundation. In this context, language and terminology are used to foster a deeper understanding and appreciation of the values that underpin effective patient care, rather than merely for semantic purposes. In the spirit of cooperation, the project proposes a more sophisticated vocabulary and invites educators, clinicians and service users to consider how language can influence the attitudes and actions of healthcare providers.

Innovating through the Practise:

This exploration of language and terminology within medical simulation is an acknowledgment of the power of language to influence educational outcomes and patient care practices. By proposing adjustments to the vocabulary used, the project seeks to spark a conversation that goes beyond the confines of medical simulation, aiming to affect the broader field of medical education.

The project started an inventive investigation into the use of immersive 360-degree technologies and film as instruments to record and transmit patient experiences in medical simulations. This creative initiative became an innovation and sought to bring a fresh viewpoint to simulation training, increasing the learners' ability to relate to and benefit from these learning experiences. Through the use of immersive technologies and films, the project aimed to examine a pathway of innovation into conventional medical education approaches, exploring if this could be done while being grounded in creative and humanisties influences rather from the technologically prioritised and praised factor, an approach that could enhance the simulation environment without the associated marketed dominance that had hindered some of its past.

Nonetheless, this investigation into the application of visual media in medical education is offered as a first step, realising the enormous room for expansion and the chance to incorporate these methods more thoroughly throughout medical education. By utilising immersive technologies and film, the project is demonstrating its dedication to improving the educational value of simulations by making them more realistic and empathetic to actual patient experiences.

The project also revealed how crucial visual literacy is to maximising the educational advantages of filmic materials. This realisation resulted from comments and contemplations regarding the use of visual media in simulations, and it underscores a major chance for medical education to integrate film theory and visual interpretation abilities into the curriculum. Improving students' comprehension of and interaction with cinematic material may provide a more profound and complex comprehension of patient care situations, which could improve learning objectives and promote a more compassionate attitude towards medicine.

The concept of Minimal Viable Simulation (MVS)

This thesis' introduction to Minimal Viable Simulation offers a thoughtful investigation into streamlining medical simulation, emphasising the importance of more closely adjusting these encounters to educational requirements than to technological advancements. This methodology advocates for a measured approach that puts educational value over complexity. It was born out of a desire to close the gap between high-fidelity simulations and the essential learning outcomes of medical training. The concept of MVS puts forth a place to start for discussion and growth within the larger educational community, acknowledging that more development and wider agreement will be needed to fully realise its potential. Before setting out on the MVS journey, the project aimed to investigate the widespread use of cutting-edge technology in simulation training. MVS encourages a re-evaluation of simulation design and implementation by suggesting a leaner, more focused use of technology that is in line with particular educational goals. This investigation conducted within the Torbay and South Devon NHS Foundation Trust aims to refute the idea that increased technology inherently improves educational outcomes by demonstrating that meaningful learning experiences can be attained through simplicity and clarity. The trust's practical use of MVS during Covid and sustaining this approach after has shown off its potential to increase accessibility to simulation training, particularly in environments where resources may be scarce. According to early feedback, concentrating on each simulation's main goals without getting sidetracked by superfluous technology elements can encourage a deeper connection with the subject matter. This strategy is, however, respectfully offered as a trial run into what may eventually become a more generally recognised procedure. The project's experiences highlight the value of constant communication, teamwork, and empirical analysis in order to improve the MVS methodology and comprehend its implications for medical education.

Beyond simulation and into domains where programmes like virtual wards and digital social prescribing—which were first introduced during COVID-19—exist as permanent digital components, an MVS framework for how technology may be conceived, executed, and funded with the end user and co-development methodologies in mind offers its space for additional investigation and analysis.

7.2 Opening the field for further research opportunities

In this research, many interesting directions were highlighted and perceived problems were addressed, all the while trying to situate the project within the larger context of medical simulation. This method occasionally forced generalisations over minute details, especially in areas that benefited from more in-depth investigation. For example, the discourse surrounding terms like "human factors" was noticeably succinct; it lacked a more thorough comparison and an in-depth derivation of "humanistic skills" from the more general notion of human factors. This restriction highlights an opening for more thorough investigation that may enhance the conversation about incorporating humanistic abilities into medical simulation. The thesis was created as an activity playbook with the goal of summarising the practice in a way that NHS colleagues could understand. Although the goal of this design decision was to make the document easier to understand and apply, it proved difficult to translate and maintain certain terms and descriptors consistently throughout. Although the thesis acknowledged the value of exact language, it occasionally relied on well-known themes and fields of study to explain its points, which might have limited the discussions' impact and clarity. It’s objective status as a guide creates a foundation for further research and practical evidence for encouraging innovative activity, and although this is valuable, this does open more structured approaches that incorporates psychological assessments and pertinent scales to measure outcomes effectively would be beneficial for future research in this area, especially studies aimed at improving empathy and compassionate training. Furthermore, the thesis's investigation of empathy—a complicated and multidimensional concept—may not have been as clear-cut in terms of its goals or direction when it came to compassion. The research could be strengthened by providing a more precise explanation of how these interventions relate to the larger objectives of enhancing empathy in medical education, even though the main focus of the research was on film theory and practice as tools for promoting compassionate and empathetic reflection.

Despite its limited intervention, this research has produced important and long-lasting insights that go beyond reliance on technology. I am continuously tasked with critically evaluating and carefully implementing emerging technologies in my role as digital lead for the NHS. My investigation of technology's potential in medical education is influenced by my professional role, which demands that the delicate balance between innovation and usefulness be maintained. More thorough, data-driven studies that go deeper into the subtleties of humanistic skills within medical simulation could be the focus of future research, using structured methodologies to validate and build upon the preliminary findings reported in this research.

The most beneficial result is probably the investigation of sustainable simulation and technology practices, especially as it relates to MVS (Minimum Viable Simulation), which promotes co-design and collaboration in environments. The idea that MVS can lead to inclusive and collaborative design processes is significant because it holds potential benefits for the medical simulation industry. Seeing simulation design as an interdisciplinary and community-engaged endeavour in the future points to a move towards more inclusive, pertinent, and adaptable teaching resources. A progressive approach to medical education is embodied in the idea of creating a toolkit to support co-design and collaborative efforts involving a wide range of stakeholders, such as patients, artists, carers, and beyond. In order to ensure that simulation scenarios are based on the realities of patient care and community needs, this initiative recognises the richness that diverse perspectives bring to the process of developing simulation scenarios. An important step towards institutionalising this focus within the professional community is the formation of a Humanistic Simulation Special Interest Group by the Association for Simulated Practice in Healthcare (ASPiH) in 2024. In addition, I will be orchestrating a peripheral 'Fringe' track event at the forthcoming conference, designed to foster a platform of exploration into creative activities, inspirations, and predilections through a narrative-centric examination of medical simulation. Reflecting upon this initiative, it's pertinent to ponder whether such an undertaking would have garnered the same level of acceptance and enthusiasm a decade ago, particularly during a period when my professional identity was primarily defined by my role as a filmmaker within the NHS. This contemplation not only underscores the evolution of interdisciplinary approaches within healthcare education but also highlights a broader cultural shift towards recognising and integrating artistic and creative methodologies and roles in enhancing medical simulation and training. This evolution reflects a significant departure from traditional paradigms, suggesting a growing appreciation for the intricate ways in which art and science can combine to enrich both the delivery and the understanding of healthcare practices.

7.3 Executive Summary

Presented here are summaries of chapters and the key findings to support NHS colleagues with a succinct overview in the support of business cases for their own developmental programmes;

Chapter 1 provided an overview of the historical and current landscape of medical simulation within the NHS, with a specific focus on the experiences and practices at TSDFT at the beginning of the project. The analysis traced the development from basic task trainers to advanced computerised manikins and virtual reality environments, emphasising the crucial importance of debriefing in improving the learning of non-technical skills. The chapter emphasised the drawbacks of high-fidelity simulations, which have typically focused on acquiring technical skills rather than fostering humanistic qualities like empathy and compassion. The chapter advocated for a change in the approach to medical simulation by integrating training in humanistic skills, referencing important reports such as the Francis and Berwick Reports. This study highlighted the importance of incorporating arts and humanities into medical simulation to enhance the learning experience for healthcare professionals. In 2015, the growing interest in new technologies such as 360-degree cameras and VR in healthcare marked the beginning of their resurgence and influenced the development of medical simulation. The impressive moments linked to these technologies led to a thorough evaluation of their actual impact on improving empathy, compassion, and human connection in healthcare education. This exploration of medical simulation at TSDFT aims to emphasise the significance of maintaining a balance between the appeal of technology and the core objectives of patient care.

Chapter 2 explored into the connection between film theory and medical simulation, proposing a unique method to improve empathy and comprehension in healthcare training by providing insights on how to interpret the imagery accurately. The chapter discussed the initial reluctance to incorporate cameras in medical simulations due to their association with diagnostic purposes and the transition to a more surveillance-focused perspective. The resistance was exacerbated by the technical configuration of ceiling-mounted cameras, creating a feeling of constant surveillance akin to Foucault's Panopticon theory, which could have a detrimental effect on the learning environment. The argument was made to reintegrate the camera's function in capturing patient experiences to enhance emotional connection and understanding among healthcare professionals. Pioneers such as Dr. Hugh Welch Diamond and Dr. Jean-Martin Charcot utilised photography to document patient experiences and emotions, providing evidence supporting this approach. Further research in film theory within medical simulation aimed to tackle these obstacles by examining the Direct Cinema and Cinéma Vérité movements. It emphasised how film has been utilised to connect clinical practice with compassionate patient care. This suggests that learners can develop a more detailed understanding of patient viewpoints through the use of cinematography. Workshops were held to teach healthcare professionals how to use film techniques to create educational content that captures narrative, emotions, and care. These workshops aimed to support clinicians as content creators.

Chapter 3 expands on the previous research by emphasising the practical implementation of this PhD. It deals with the reluctance to use cameras in medical simulations because of privacy concerns, perceived intrusion, and the intimidating aspect of technology. This chapter presents film-based interventions designed to challenge traditional perspectives and promote greater empathy and engagement among medical professionals by redefining the role of the camera. The interventions implemented involve a range of film styles and techniques, including observational documentaries offering an unaltered perspective of medical situations and immersive 360-degree videos that immerse viewers in the patients' experiences. The chapter discusses the creation of simulated patient story videos to connect traditional classroom settings with immersive simulation environments, improving the realism and educational effectiveness of simulations. The stories were designed to make the patient manikins more relatable by addressing the 'plastic shell syndrome', where participants were overly focused on the appearance and texture of the manikin. The goal was to create material that would make simulation experiences more engaging and relatable for trainees. The chapter explores into the technical aspects of filming and editing simulation scenarios, emphasising how cinematic techniques can improve the educational quality of these materials. The article also presents the idea of patient perspective films, which provide a first-person view of the healthcare journey, aiming to enhance comprehension and empathy towards the patient experience.

A substantial part of the chapter focuses on addressing the difficulties and educational advantages of utilising 360-degree filming and virtual reality (VR) in medical simulation. Although facing technical challenges like stitch lines and ghosting, 360-degree videos were discovered to offer a comprehensive view of the simulation environment, providing an innovative method to engage learners. This process was implemented to inspire others to generate their own materials, with a significant portion of the knowledge acquired during this process now incorporated into the NHSE guidance documents (How to Develop a VR 360-degree video parts 1 & 2).

Upon reviewing *Chapter 4,* it is clear that there is a symbiotic relationship between the arts and humanities and medical simulation training, introducing new methods for healthcare education. The chapter mainly discussed using moving images as a means of communication and expression in medical simulations, highlighting its considerable potential. The integration of moving images, particularly through 360-degree patient perspective films and virtual reality, has greatly improved medical simulations. This has enhanced comprehension of patient viewpoints and highlighted the nuances of patient care. The chapter emphasises a significant challenge related to the language and terminology used by the multidisciplinary teams. Developing a shared language that effectively connects clinical and artistic elements, as well as technical and humanistic aspects, became a vital requirement. The common language is intended to improve communication, comprehension, and cooperation. The chapter examined the appeal of new technologies compared to their educational benefits. The project aimed to comprehend participants' acceptance and emotional reactions to innovative mediums using feedback mechanisms and questionnaires.

A substantial part of the chapter focused on reframing components typically grouped under 'human factors' in healthcare into a broader framework of 'humanistic skills'. This new definition highlights the strong link between the humanities and healthcare, promoting a more compassionate and efficient method for discussing and describing non-technical or soft skills in medical simulation training. Studying 360-degree and patient perspective films provides a practical demonstration of this method. The chapter presented the idea of clinicians as content creators, providing a new plan for incorporating film theory and the humanities into healthcare education. Healthcare professionals are urged to interpret and create narratives in clinician-attended workshops. They are also encouraged to apply these insights to improve simulated educational experiences. The goal is to equip clinicians with the tools to comprehend and utilise visual language effectively.

In *Chapter 5*, it is clear that the Covid-19 global health crisis required a thorough reassessment of conventional methods for medical simulation and training. The pandemic highlighted the need for creating innovative, flexible, and user-friendly simulation methods to efficiently train healthcare workers, without depending on advanced or costly technologies. This chapter looks into how the crisis prompted a transition towards adopting minimal viable simulation concepts, emphasising the crucial role of debriefing in improving learning results and promoting emotional resilience in healthcare teams. The importance of debriefing in simulation-based learning was newly recognised as the pandemic changed healthcare delivery. Debriefing, typically occurring after a simulation, has been recognised as a crucial method for turning experiences into practical learning. The process allowed for a more profound self-examination of actions, emotions, decisions, and their consequences, enhancing the educational experience's significance. The chapter emphasises the crucial importance of debriefing in enhancing deep learning experiences, extending beyond the simulation activity, based on studies by Rudolph et al. (2008) and Shinnick et al. (2011). Moreover, it highlights the importance of adapting debriefing to the pandemic's limitations and possibilities, which was essential in promoting learning and enhancing the emotional health of healthcare workers. The idea of minimal viable simulation was developed in response to the pandemic's limitations, focusing on creating efficient, accessible, and impactful learning experiences with simplified resources. The chapter demonstrates how low-quality and film-based learning, combined with the strategic use of imagery and recorded material, played a key role in providing essential training. The methods were highly effective in conveying intricate scenarios and aiding remote learning, highlighting the adaptability needed to address the crisis. The chapter describes experiences such as adjusting to new protocols and utilising innovative debriefing methods, showcasing a shift towards practical, timely, and contextually appropriate simulation techniques.

Chapter 6 is the final discussion in the examination of the changing medical simulation field, especially after the COVID-19 pandemic. The text explores the intricate difficulties and possibilities arising from the requirement for simulation experiences that are both realistic and impactful while remaining accessible. The central focus of this discussion is the idea of surpassing the uncanny valley, which refers to a phenomenon where simulations that are almost realistic but not quite can make learners feel uneasy. The chapter advocates for a well-rounded approach to simulation, emphasising emotional engagement and the cultivation of humanistic abilities like professional empathy, rather than focusing solely on technological accuracy. The chapter discusses the transition to Minimal Viable Simulation (MVS) in response to the limitations caused by the pandemic. MVS prioritises fundamental simulation components and incorporates thorough debriefing to emphasise the importance of simplicity, user-friendliness, and educational impact rather than technological complexity. This method supports the chapter's recommendation for a simulation design that upholds a uniform level of detail and realism, known as granularity, in both simulations and debriefings. Consistency ensures that learners can effectively connect theoretical knowledge with practical applications, improving the overall learning experience. The chapter emphasises the significance of collaborative participation in addressing the challenges of medical simulation. Utilising a diverse team's combined knowledge, simulations can surpass the disconcerting impacts of near-realism, providing more efficient educational resources. The chapter emphasises the strategic importance of debriefing in reducing the effects of the uncanny valley. Learners can turn unsettling simulation experiences into valuable learning opportunities by engaging in reflective discussions, which cover both the technical and emotional aspects of healthcare. The pandemic has been recognised for speeding up innovation in medical simulation, particularly in the adoption of MVS and the principles of compassionate care. The basic components are crucial for the continuous development of medical education, emphasising the need for training methods that are both technologically relevant and grounded in the humanistic aspects of healthcare.

7.4 Final Conclusion

This thesis has advanced medical simulation by shedding light on the value of the fusion of technology, humanistic skills, and education. This work has opened new avenues for exploration and collaboration by bridging film theory, the humanities, and healthcare, inviting educators, researchers, and practitioners to reimagine empathy, compassion, and human connection in healthcare education and practice.

This research produced the concept of PatientVR and "minimal viable simulation" (MVS), two innovative practical outputs. PatientVR, a virtual reality and 360-degree video patient perspective experience, shows how immersive media can improve human qualities in medical simulation such as empathy and compassion. PatientVR humanises healthcare education and training by putting learners in the patient's shoes, deepening their comprehension of the patient experience. This study's ethnographic and observational approach to VR and filmic material in education and debriefing has illuminated how immersive media affects learners' engagement and emotional response. These findings strengthen the case for immersive technologies in healthcare education and emphasise the relevance of affective learning in simulation design.

PatientVR was developed in close collaboration with healthcare professionals and educators at Torbay and South Devon NHS Foundation Trust to ensure authenticity, relevance, and alignment with simulation curriculum learning objectives. This collaborative approach also shows how interdisciplinary alliances can improve healthcare education and innovation. Outside of TSDFT, the NHS Innovation Accelerator initiative named PatientVR a national innovation. This distinction highlights the potential for this research to affect NHS healthcare teaching and practice.

As a response to the COVID-19 epidemic, MVS redefines simulation design by prioritising accessibility, adaptability, and basic learning objectives over technological complexity (Peres, 2023). By distilling simulation down to its essential elements, MVS has provided a more sustainable and humanistic approach to simulation-based education, demonstrating its potential to enhance the accessibility and effectiveness of simulation-based education in resource-constrained settings. The concept of MVS was designed responsively to align with the NHS Long Term Plan's ambition to deliver 'digitally enabled care' (NHS, 2019) and supports TSDFT's objective to provide integrated services that are compassionate, accessible, and allow people to tell their story once (TSDFT, 2020). The path and the pressing necessity to adapt simulation-based education to pandemic restrictions allowed responsive research and this also shaped MVS. TSDFT workshops and pilot projects evaluated and developed the concept, showing it might improve simulation-based education in resource-constrained contexts. MVS offers a viable approach to high-quality simulation-based education in settings with limited access to modern technologies and specialised facilities by stressing accessibility, adaptability, and fundamental learning objectives. These findings offer simulation-based teaching during crises and healthcare education in resource-limited contexts for example in less economically privileged settings.

Interdisciplinary collaboration and linking the arts, humanities, and healthcare have also been stressed in the studies. Using aspects of film theory and wider humanities research have improved medical simulation design and delivery, allowing for new aesthetic and emotional learning experiences (Charon, 2001; Stam, 2000). This interdisciplinary approach supports the Trust's digital strategy, which promotes digitally enabled innovation, experimentation, and implementation (TSDFT, 2021). This work has shown that practitioner-led research may impact on healthcare education and practice by actively interacting with the TSDFT simulation community and co-creating solutions to the identified difficulties. Film theory and contextualist simulation analysis have improved our understanding of how aesthetic and emotional variables affect learners' engagement and learning outcomes. This approach has shown the importance of considering simulation and simulation technologies social, cultural, and historical contexts and how learners' prior experiences and expectations may affect their responses to simulation-based education. These findings show that simulation experience design and evaluation may need a more holistic and contextualised approach to effectively capture the complexity of learning in simulation-based contexts.

This research also has impact on NHS digital transformation and healthcare education technology. Aspects of film theory and the innovation of MVS can inform approaches to digital literacy and creative professional integration in healthcare. The NHS Long Term Workforce Plan (NHS, 2023) emphasises the need for an innovative, digitally literate workforce. Applying the insights into immersive media and the humanities from this research can contribute to the strategies for healthcare workforce upskilling and a more holistic and humane approach to digital transformation. Creative practitioners such as filmmakers, designers, and digital media specialists can add fresh perspectives and talents to simulation-based education and other digital health projects in healthcare. Taking lessons from MVS these specialists can help create immersive learning experiences and user-centred design techniques that prioritise patient and healthcare professional needs.

The success of PatientVR and the collaborative approach used in this research reveals how interdisciplinary alliances may drive innovation and improve healthcare education and practice.

MVS with its emphasis on accessibility, equitability, realism, and authenticity in simulation design may also help include harder-to-reach communities in healthcare education and patient-designed scenarios. MVS can produce bespoke simulation-based education that meets different community needs and allows patients and service users to co-create learning experiences by prioritising these considerations over technology complexity. This strategy is consistent with the Trust's and others' vision of empowering citizens with their health, care, and well-being (TSDFT, 2021) and the NHS's goal of eliminating health inequalities (NHS, 2019). Its virtue is that patients and healthcare consumers can assist develop and offer simulation-based education to ensure authentic, relevant, and real-world learning experiences. This strategy can also help create a more patient-centered and inclusive healthcare system that values and incorporates various community voices into care design and delivery. This research, especially on authenticity and patient viewpoints, can help create more inclusive and responsive simulation-based education and healthcare delivery.

The research also revealed crucial system design considerations, such as approaches for electronic patient records (EPR) . The thesis discusses the growing need to capture and value empathic, compassionate, and supportive patient care in digital healthcare systems. EPR systems let clinicians document these crucial aspects of the patient experience, improving care delivery and outcomes by better understanding the patient's path and requirements. This insight shows how digital health technology can enable a more holistic and patient-centered approach to healthcare, connecting with the research's themes of humanism and empathy.
Video ethnography has played a significant role in understanding the complexities of healthcare settings and the experiences of patients and healthcare professionals (Knoblauch & Tuma, 2011). While there is value in video ethnographical theory and approaches, this thesis builds upon the legacy of that important work by integrating film theory and humanities perspectives to create a more nuanced understanding of the role of aesthetics, emotion, and narrative in medical

simulation and healthcare education. The important addition of clinicians as content creator workshops to TSDFT's digital skills training programme is a major step towards integrating these new practises into healthcare education. As recognised in the thesis, Roger Kneebone believes simulation is most effective when integrated into the curriculum (Kneebone, 2016). The trust is encouraging healthcare professionals to acquire technical and humanistic abilities by incorporating these courses within the digital literacy initiative. The research shows how integration can increase workshop attendance and emphasises the necessity of these skills in the changing healthcare context. Clinicians can use storytelling to improve empathy, communication, and patient-centered care as they improve visual narrative creation and interpretation.

During my eight years at TSDFT, from simulation technician to director of digital innovation, I have gained valuable insights, developed innovative practical outputs, and reaffirmed the importance of humanistic perspectives in healthcare education and practice. Practitioner-led research may transform healthcare education and practice, as shown by PatientVR and MVS and the significance of interdisciplinary collaboration and patient involvement. This research provides potential insights and ideas for the NHS as it navigates digital transformation and changing healthcare workforce demands. Simulation-based education can continue to prepare healthcare professionals to provide compassionate, patient-centered care in a complex and technologically advanced healthcare landscape by prioritising accessibility, adaptability, core learning objectives, interdisciplinary collaboration, and patient involvement. This research also touched on other critical issues that contribute to the narrative of merging humanism and technology in healthcare education. Resistance to the use of cameras in medical simulation, the historical context of medical photography, and the potential impact of surveillance culture on learning environments illuminate the complex dynamics of introducing new technologies and perspectives into established practices. This research, and the innovation of MVS has created the framework for a more inclusive and adaptive simulation-based education by addressing these difficulties and suggesting solutions including smaller, less invasive cameras and collaborative learning. Visual literacy and insights from film theory help healthcare educators grasp and interpret visual storytelling, according to the research. This approach has helped clinicians and healthcare staff become more visually literate and emotionally responsive by teaching them how to assess and generate meaningful visual content. The clinicians as content creators workshops highlight the transformative power of arts and humanities ideas in healthcare education and practice.

Finally, this research's findings and methods may apply to healthcare delivery and patient care outside medical simulation. Empathy, compassion, patient-centeredness, interdisciplinary collaboration, and creative problem-solving can help create more humane and responsive healthcare systems that prioritise patient and community needs. This research's insights and innovations can guide healthcare education and practice through the complicated and ever-changing terrain of technology and humanism. By embracing collaboration, creativity, and compassion, we can push the limits of medical simulation and beyond, creating a more equitable, accessible, and responsive healthcare system for diverse communities.

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Appendix

1. *Film Materials List:* A comprehensive inventory of the films and visual materials that I have produced as a component of this thesis. The list includes an example of the content type of various simulations discussed in chapter 3. It also contains 360-degree video materials that showcase the experimental and innovative use of the medium in distinct environments, such as an ambulance, an operating theatre, and on-site locations during our multi-profession 'big simulation' events. The films are accessible through a private YouTube link, as the platform supports the 360-degree video format. They are also available as files on a DVD, which can only be viewed on a computer.

2. National Protocol for use of VR for education and training during Covid-19

3. *TAaCT: Technology, Affect and Clinical Training* - a publication outlining the outcomes for TAaCT a collaborative research project between Digital Horizons at Torbay and South Devon NHS Foundation Trust and Transtechnology Research that aimed to develop alternative and holistic approaches to medical care by reviewing the tools, methodologies and approaches in the teaching and training of healthcare professionals.

4. *A CO-DESIGN SOLUTION TO DIGITAL LITERACY IN HEALTH PROVISION* – This publication, a collaboration between Transtechnology Research and Torbay and South Devon NHS Foundation Trust, aims to provide guidance on effectively navigating the complex digital health landscape and implementing strategies to promote digital literacy within the organisation. This article demonstrates examples of how the practice of co-design, where community members are regarded as equal partners in the design process, can improve digital literacy in healthcare services provided within Torbay and South Devon NHS Foundation Trust.

5. *"Thoughts on a Ceiling Canvas" (2014)* is a publication in the Transtechnology Reader 2014 where I share my personal reflections as a patient. This experience influenced some of the inspiration behind the work.

6. *THE GROWING VALUE OF XR IN HEALTHCARE IN THE UNITED KINGDOM* – A national guidance whitepaper where our Trusts work looking at perspectives and VR populates the patient focused education chapter.

7. *How to Develop a Virtual Reality (VR) 360-Degree Video – Part 1* – an example national

guide that was an output from experience gained during the practice of this thesis.

8. TEREMA 100 VR Evaluation Breakdown – provides data breakdown of the questionnaire that accompanied the use of CardboardVR and Theatre 360-degree scenario to first 100 participants.

9. Ethics statement for an evaluation of PatientVR run at University of Plymouth Medical students as part of the CAMERA research group 2016-2017.

Film & Media Materials List

Simulations referenced from Chapter three: Practise and Innovation:

Patient Story account video 2014: https://youtu.be/qh3UFSWz9x8

Simulated Patient Story Example 1: Sally Brown https://youtu.be/unCJ_rjW7zM

Filmmaker Simulation Example: In-Situ SCBU https://youtu.be/CNWUelRr3Rg

PatientVR Patient Perspective Example: Chest Pain Scenario https://youtu.be/Z-iX84uKMI8

Film material referenced from Chapter Four: The Human Factors Question Insists on the Arts and Humanities

Tod reflections on self performance. ITV interview 2015. https://youtu.be/IuNlFHhV04E

TEREMA: Theatre distractions 360-degree film https://youtu.be/J1h-ogPzfS4

PatientVR classroom demo: Using CardboardVR https://youtu.be/nuUdW_HwsuY

Patient Perspective film "Chariot" for content creator workshops: https://youtu.be/0VWMT5Xycqc

Film material referenced in Chapter Five: The Innovation of the Debrief

Patient Perspective 360-video Covid-19: https://youtu.be/R1bzdVCze3Y

360-degree Minimal Viable Simulation example: Covid-19 ICU Prep https://youtu.be/jpEtAzLO3ig

Interactive 360-degree example: Virtual ICU for staff orientation. https://youtu.be/PHWoWnlPKFM

Covid national resource example: 360-degree video PPE Proning. https://youtu.be/VVKW9fNtamU

360-degree video simulation example: Trauma Burns simulation (supporting remote learning) https://youtu.be/cHsYbjZoyrU

Additional Materials as part of the research:

Patient Perspective short film "Chariot" https://youtu.be/0VWMT5Xycqc

Documentary film influenced Simulation Example: Operation ORCA https://youtu.be/Q-P8BaVsXVY

Patient Perspective in Simulation testing: Ceiling Spaces. https://youtu.be/Qkc3YZ4kE5M

360-degree 'big sim' testing: Joint exercise mass casualty simulation https://youtu.be/0Ou1fR3atbE

Virtual Reality (VR) Head Mounted Device (HMD) Infection Control	No. 3
Nick Peres	**22/9/2020**
The VR Lab	NHS Torbay and South Devon NHS Foundation Trust
Technical Skill Required (out of 5) ✗ ✗	
Also see	

How to Guide series

This is one of a selection of resources that describes how technology is being used to support simulation-based education (SBE) during the pandemic.

These will provide a range of technical solutions including, for example, ways to stream, capture, share and make remote sessions interactive and experiential.

The aim is not to endorse specific technology, hardware, or software over others but merely to offer some guidance about possible options to help support or enhance local delivery of SBE in the current COVID-19 era.

Introduction

Hygiene is important when using VR headsets, and particularly now it is vital that all precautions are taken (including consideration of alternative ways to deliver content) to ensure that VR HMD's do not become transmit the virus between users. This document presents protocol that is currently followed at the Torbay VR Lab.

VR HMD foam

Problem

VR HMD's have stock foam which is highly absorbent and collects sweat and aerosolised droplets. This foam cannot be wiped down easily. In addition, wiping this foam with sanitising wipes risks damaging the foam.

Solutions

1. Leather covers: We have replaced foam with leather covered variants from a third party company- VR Cover https://vrcover.com/. The foam leather covers can be wiped without damage. In addition to sanitising wipes, we aim to use cleaning products that can provide an improved wicking effect for moisture. Apart from

being an acceptable replacement for foam, leather covers also provide enhanced comfort for the user.

2. Disposable face masks: Each individual user can additionally receive a hygienically packed disposable face mask. The mask has a slit where the eyes are for the user to view the experience. As the mask provides a layer between skin and the device, no direct skin-to-headset contact occurs. Disposable face masks come with ear loops to ensure the mask fits snugly on the user's head.

Sanitisation of VR HMD

Problem

VR HMDs must be cleaned in between each use to ensure no viral transmission occurs.

Solution

The outer casings, eye-mask and head-straps of the VR HMD are wiped down thoroughly using 1000ppm chlorine wipes, however this level of medical grade wipes is not advisable for extended use on the lenses. Instead consider a softer grade alcohol-based lens wipes for the lenses, as this part of the headset should not be in regular contact with the user.

Additionally, the headset is placed in a UV sterilsing box. Two examples we use at the Lab are from Cleanbox and Uvisan. This method of cleaning uses an array of UV-C LED's that sterilise the inside of the headset. UV Cleanbox and Uvisan takes 1-minute to sterilise the HMD. More information on Cleanbox and Uvisan can be found here: https://www.cleanboxtech.com/ https://www.uvisan.com/pages/sales

Additionally, for patient-based VR interventions, consideration may be given to placing the headsets, after cleaning, in a period of quarantine between uses – particularly if site has several headsets they can rotate. As we own a few headsets at the VR Lab, we can allow 3-5 days of quarantine on the headset before its next use. This step might not always be possible and may be considered a 'very safe' step in educational use cases.

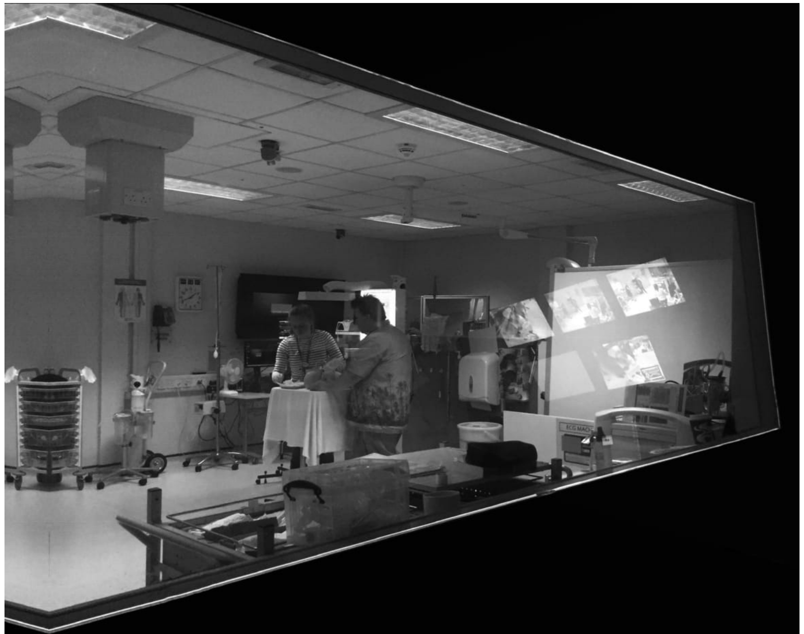
Step-by-step process for sanitisation of the VR HMD

1. VR HMD is modified with replacement face cover.
2. Technician wears Level 2 PPE to handle and wipe the HMD using 1000 ppm chlorine wipes (do not use on HMD lenses).
3. Upon cleaning, the headset is placed inside the UV box.
4. After 1-minute of sterilisation in the UV box, the headset is left there until required by next user.
5. User is offered additional disposable face cover and can continue to wear own face mask if comfortable throughout using VR hardware.
6. Cycle is repeated between every user. Facilitator changes PPE between every user.

7. Facilitator follows NHS guidelines for social distancing and hand washing.

*The above protocol example has been based on our use of VR experiences in the staff well-being room. This space can only be accessed by a limited, manageable number of users at a time to coincide with social distancing rules.

Consideration should always be given to manufacturers cleaning recommendations and any guidance from organisation infection control or health and safety teams



TAaCT: Technology, Affect and Clinical Training.

Jacqui Knight and Nicholas Peres.
Design: James Sweeting.
Cover Design: Hannah Drayson and Jacqui Knight.

Transtechnology Research at University of Plymouth.
www.trans-techresearch.net

TAaCT is a collaboration between Digital Horizons at Torbay and South Devon NHS Foundation Trust and Transtechnology Research at the University of Plymouth. We are grateful for the support of Dr Hannah Drayson, Dr Matt Halkes, Dr Mona Nasser, and Professor Michael Punt in the development of this project.

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TAaCT: Technology, Affect and Clinical Training.

TAaCT is a project that examines contemporary medical training by attending to the long history of devices that have been used to train medical practitioners, which include texts, atlases, models and a range of audio-visual apparatus. The object of TAaCT is to include reflective thinking about how technologies of representation are used to engage directly with human feeling, but which a prevailing focus on technological progress toward realistic simulation has tended to marginalise.

Authors

Jacqui Knight MA is a Marie Curie (ITN) PhD researcher with the Cognition Institute and Transtechnology Research at Plymouth University. As a practicing artist and doctoral researcher, her research retrofits an understanding of photography as a manifestation of human engagement with matter in order to address photography's changing ontology in technological photographic practices. She is currently lead researcher for TAaCT a collaborative research project between Digital Horizons at Torbay and South Devon NHS Foundation Trust and Transtechnology Research that aims to develop alternative and holistic approaches to medical care by reviewing the tools, methodologies and approaches in the teaching and training of healthcare professionals. Within this role she is also advising on the development and curation of the hospital arts program. She has previously held numerous lecturing posts in Critical Theory and Fine Art subjects across various institutions including Cardiff Metropolitan University, Plymouth University and University of Falmouth. As co-founder of artist film lab Cinestar based in Cornwall, she has been dedicated in supporting creative work with analogue film through experimental workshops, screening events and education. She has exhibited and curated numerous film screening events and group exhibitions internationally and has had a solo show at Nancy Victor Gallery, London.

Nick Peres is Head of Technologies Research and Development at Torbay Hospital and the founder of PatientVR, a Virtual Reality project within the NHS using immersive imagery to help teach humanities skills in medical education. Nick currently leads on multiple VR based initiatives within the NHS including The VR Lab sponsored by Health Education England and advocates a 'clinicians as content creators' approach to creativity in healthcare. Nick works and advises on various digital and emerging healthcare technologies panels at a national level, with a particular remit around immersive and simulation visual interfaces. Nick is also co-developing the arts program at Torbay hospital.

Nick earned a BA (Hons) in Documentary Film and is currently in his final year of a PhD within Transtechnology Research at Plymouth University, studying technological mediation and empathy in clinical training. Nick has a keen interest in the affect and portrayal of emotions within image, having spent over ten years as a film maker. He is most curious of the role and identity of the 'camera' in healthcare settings beyond being viewed as just a tool for medical diagnosis.

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Introduction

Technology, Affect and Clinical Training (TAaCT) is a funded collaboration between Transtechnology Research at the University of Plymouth and clinicians at Torbay Hospital Trust. The project investigates strategies for developing appropriate levels of professional empathy in clinical training. The collaboration includes multiple work streams which collectively aim to develop alternative and holistic approaches to medical care by reviewing the tools, methodologies and approaches in the teaching and training of healthcare professionals.

The project began by taking two approaches to the question of how to increase and improve training in non-technical skills concerning emotion and empathy. The first approach was to develop a methodology in medical simulation training that included consideration of the props and apparatus in the environment that provide cues to elicit empathetic responses. The second approach advances work already underway at Torbay in the use of Virtual Reality (VR) technology and involves critically examining the use of VR from arts and humanities perspectives. This intervention also looks at ways in which cost-effective, low fidelity approaches appear to produce higher capacity for reflection and empathy when used in clinical training,

which suggested a much wider adoption of VR technologies might be feasible across the healthcare workforce.

TAaCT is led from an arts and humanities perspective. It builds upon a systematic review undertaken by Nicholas Peres in Jan 2018 as part of a Doctoral Research study at the University of Plymouth, which proposes a transdisciplinary methodology for evaluating subjectivity, compassion and professional empathy in clinical training. Underpinned by an extensive literature review in the form of an open access annotated bibliography, an abridged version of which is included at the end of this publication, the research study analyses definitions of empathy and considers how apparatus, materials, technology, design and simulation methods elicit affective and empathetic responses in a professional context.

The initial collaboration opened multiple further possibilities for collaboration which are presented for the first time in this booklet, which introduces the context for the partnership and ten projects currently underway.

Still from *Elvis Scenario* (2012), a training video of a simulation scenario within the Special Care Baby Unit (SCUBU), which used techniques such as focus shifting to mimic the perspective of a relative.

The clinician film-maker's toolkit; clinicians as content creators

TAaCT addresses a recent trend in clinicians recording and editing audio-visual materials in the course of their clinical practice. It explores the value of using audio-visual materials to recover certain aspects of practice for a range of training and debriefing purposes. It considers technical and theoretical issues that arise from this activity and examines how and why audio-visual technologies bring to attention certain aspects of professional practice that are otherwise overlooked.

The project supports this developing practice by bringing filmmakers with backgrounds in documentary and experimental film into collaboration with clinicians in order to bring insights from arts media practice and visual culture to bear on the kinds of image-making practices underway in clinical settings. The ways that representation through visualisation technologies can distort identities is well researched in the arts, but less so in clinical settings. This transdisciplinary encounter aims to provide both guidance in the development of content and guidance for its interpretation. The intervention is timely as increasing use of visual technologies in healthcare without a wider training offer into the interpretation of media images which could have implications for patient-clinician empathy.

Transtechnology Research are therefore developing a series of workshops and a toolkit to provide a visual methodology for contemporary clinicians to both produce and interpret moving image documentation. The workshops and tool kit will develop skills and understanding for using audio-visual media as a tool that has value in the critical evaluation of events, interactions and procedures within clinical practice and will lead to more appropriate and informed judgements.

In this context the use of moving image documentation to evidence and challenge the boundaries of knowledge within the field and inform innovative and creative solutions to problems will offer new insights that are informed by critical evaluation of current research and professional practice. Drawing on film media theory, philosophy of technology, and material engagement theory the tool kit will offer a practical entry into how to interpret and evaluate the many facets of moving image content. It will also propose appropriate techniques, methods and editing strategies to create an awareness of the limitations and ambiguities of media representation and simulation.

The project aims to engage clinicians in building visual literacy of moving image material and generate informed discussion of film concepts to further enhance existing clinical skills and expertise.

Filming of reconstructive surgery in the Val De Grace Hospital, Paris, France. During WWI, surrealist artists Louis Aragon and André Breton were enlisted as physicians-in-training at the hospital.

Project C-T.I.M.: Interplanetary clinical trials

Researchers from Transtechnology Research and Cognovo at the University of Plymouth, Digital Horizons at Torbay Hospital, SEADS International Network, the University of the Philippines and independent researchers collaborated in order to speculate how clinical trials could look for future interplanetary missions. The project integrated a methodological thought experiment and two creative, interdisciplinary and interactive workshops. The first workshop was co-designed and hosted by Digital Horizons simulation team at Torbay Hospital and included a simulation of a space accident in microgravity along with an interactive discussion with consultants, clinicians, and scientists. The second workshop was run as part of the Edinburgh Cochrane Colloquium and focused on exploring a narrative scenario, engaging patient advocates and researchers. The project not only generated some suggestions for innovative methodological approaches for conducting clinical trials but also prompted a discussion on re-thinking the relation between patients and clinicians in the context of interplanetary missions.

Poster call for workshop participants for Project: C-T.I.M

The results of the project were presented at the International Astronautical Conference (IAC) in Bremen Germany on 2 Oct 2018. In their abstract for "Conceptualising the design of clinical trials and its associated support systems in interplanetary missions", the authors identify five key aspects for a conceptual framework to focus on patient commitment and motivation.

The project team and authors are Mona Nasser, Nicholas Peres, Jacqui Knight, Agatha Haines, Charlie Young, Julian Wright, Matthew Halkes, Diego Maranan, and Joanna Griffin.

Stills from workshop Project C-T.I.M.: Interplanetary clinical trials

Documenting Live Simulation: a documentary

Torbay Hospital is involved in a large-scale emergency simulation exercise involving multiple casualties, which will provide training for land, sea and air emergency response teams. Transtechnology Researchers will use the event to produce a short experimental documentary film aimed at revealing some of the values and challenges of simulation. Additionally, it will provide an opportunity to critique methods of production of simulation films and complement the tool kit workshops.

The documentary will act as a discursive tool in the critical evaluation of events, interactions and procedures needed to make appropriate and informed judgements in emergency situations.

Since the camera does not distinguish fiction from non-fiction, the documentary will raise questions about levels of authenticity, evidence and reassurance when using audio-visual material. Furthermore, it is intended to open discussion around mainstream film and television depictions of emergencies as well as training videos. The documentary will specifically address the way dramatic events and scenarios are typically represented in film training materials, often following mainstream structural, editing and narrative filmmaking techniques in a way that depicts heightened drama in every shot, but which does not necessarily correspond to lived experience. Mainstream film production techniques have largely conditioned viewers to expect a distilled version of events which in turn has had the effect of eroding agency, rendering viewers passive. This has implications for the way emergency response teams interpret events, make revisions to their future procedures and modify how emergency services collaborate. To address this issue, the project will look at experimental film making strategies and methods of narrative production that de-dramatize catastrophe by introducing perspectives taking place in other locations simultaneously. Experimental films can often be more effective in communicating a holistic understanding of events from multiple perspectives than literal depiction.

Film still from patient experience VR project

VR 'Perspective' immersive footage

The project addresses questions raised by the use of VR and immersive video documentation in medical simulation. Patient perspective films have been created at Torbay since 2015 in a variety of aspect ratios and formats as part of Peres' PatientVR project (Torbay and South Devon NHS Foundation Trust, 2015). The project was created in order to ascertain the learning value for clinical trainees of taking the patient perspective in immersive video. Aside from observing how VR participants respond to the technology —an enquiry which forms a significant part of Peres's Doctoral research— an element of this work identifies techniques that aid in the creation of content as well as the operation of the camera in hospital environments. One approach is to incorporate documentary film techniques and create a

style guide for shooting effective perspective-based content. Single camera 'one shot' VR techniques allow some of the more standard documentary production approaches to be utilised, but avoid problems associated with 360 VR such as lens distortion or the absence of the filmmaker. Another approach used is to work with an extended, but not 'fully immersive', image where a 180-degree angle or more (up to 270-degree capture) will achieve an extension of the periphery to include important elements of the environment, but still hide the presence and influence of camera operator from view. Other considerations raised by the use of VR in medical simulation include an assessment of the factors influencing adoption and acceptance of the technology by staff. For example, access to the apparatus, comfort for the users and visual integrity within movement pathways (that can have nauseating consequences for the viewer in virtual reality), all contribute to staff adoption of technology.

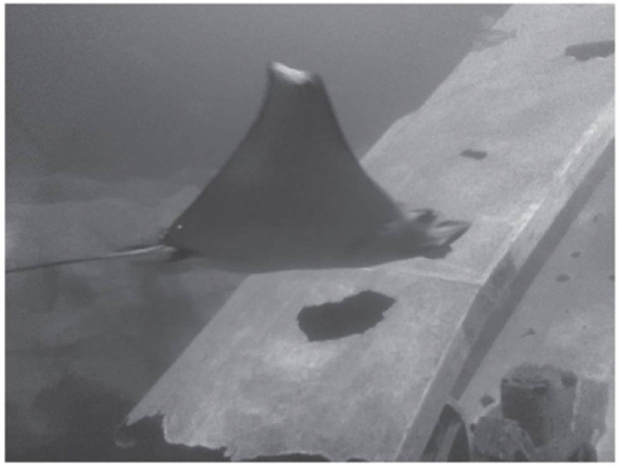
Within the TAaCT programme, the project is being revisited in order to further investigate the potential of accessible low-cost VR. Identifying the suitability of levels of resolution for an environment and its users, allows the widespread application of low resolution VR to be re-evaluated.

Film still from *Manual Handling: A Patients View*. 2016

Sound Communities: Connecting, Engaging & Inspiring through Radio and Music Production

HeArTs Gallery program

Artist filmmaker and Doctoral researcher from Transtechnology Research Jacqui Knight is providing curatorial and practical experience in the arts to assist Torbay Hospital Trust in developing The HeArTs (Health and the Arts at Torbay and South Devon) Gallery program. This project recognizes that creative activity has long been known to have tangible effects on health and quality of life and, well curated, can help make sense of the complexity of our human condition at times of stress. The arts, creativity, and the imagination can be agents of wellness that contribute to individual resilience, aid recovery and foster a flourishing society. The intention of the HeArTs program is to encourage active engagement with the community, people and practices around us. The gallery program aims to develop opportunities for both users and providers of healthcare—across Torbay and South Devon—to engage more fully with a wide range of arts and creative activity that can benefit health and wellbeing. The collaboration will assist in facilitating a range of art projects in a variety of health care and community settings for expressive, restorative, educational and therapeutic purposes. Some projects are intended to work preventively, some to enhance recovery, others to improve the quality of life for people with long-term or terminal conditions.



Film still from the Atlantic Ocean exhibit at the National Marine Aquarium, Plymouth

Slow TV in hospital waiting rooms

As an adjunct to the gallery program Transtechnology researchers are developing a slow TV project that brings live and recorded footage of local wildlife, marine life and conservation projects into hospital waiting rooms. There are many underutilised television monitors in waiting rooms that could potentially be used for appropriate screen-based artworks. The idea of slow TV came about in relation to a proposal by artist Jacqui Knight to situate a webcam within a beehive inside the hospital grounds. Slow television, or slow TV is a term used for a genre of 'marathon' television coverage of an ordinary event in its complete length (Puijk 2015). Its name is derived both from the long endurance of the broadcast as well as from the natural slow pace of the television program's progress. An early example of slow TV is Andy Warhol's 1963 film *Sleep*, which showed poet John Giorno sleeping for five hours and twenty minutes. The idea was more recently popularised by the Norwegian Broadcasting Corporation (NRK), beginning with the broadcast of a 7-hour train journey in 2009.

It is recognised that the toll of the hospital environment has a tiring effect and creates a fatigue or a longing for familiar and comforting surroundings (Koinis et al 2015). For this project we intend to frame static scenes, observed for a long period of time. The scene remains the same, but small changes happen over the recorded period in the style of *Cinema Vérité*. The potential of this medium for a kind of a meditative escapism could alleviate some of the anxiety experienced in communal environments and have wellbeing benefits for the viewer, whether patient, staff or visitor. This project has had considerable support both from hospital staff who recognise the benefits to health and wellbeing through the improved experience of the hospital environment, and from local wildlife conservation organisations eager for their resources to be utilised in meaningful ways.

Virtual Reality interventions for pain management and various distraction therapies

Additionally, the benefits of the Slow TV project for reducing anxiety and hospital fatigue are transferrable and are further developed and applied to Virtual Reality interventions for pain management and various distraction therapies. An immersive version of footage can be viewed using VR headsets to allow the user to look around the recorded environment and become virtually immersed into a new space. TAaCT researchers are currently working with The Deep Aquarium in Hull and leading researcher in the area of marine therapy Deborah Cracknell to develop and trial a VR aquarium intervention to reduce anxiety for patients and visitors at Torbay Hospital. To follow is a selected bibliography in relation to the use of VR in healthcare for distraction and pain relief therapy.

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Opriş D1, Pintea S, García-Palacios A, Botella C, Szamosközi Ş, David D. (2012). Virtual reality exposure therapy in anxiety disorders: a quantitative meta-analysis. Depress Anxiety. Feb; 29(2): 85–93. Published online 2011 Nov 7. doi: 10.1002/da.20910

A patient using 'Nature Treks VR' on the Oculus Go for pain management

Simulation Lab at Horizon Centre education and research facility based at Torbay Hospital

Recognising and reflecting on humanistic skill using immersive imagery within medical simulation

Medical simulation is a widely adopted approach and understood to be vital for safe practical skills training, as well as non-technical skills. However, from a media perspective, videos made to record and debrief simulations do not support non-technical, humanistic skills as well as they can. The default approach to camera angles of these training scenarios is often to position the camera for convenience on ceilings or at a distance. However, these distant almost CCTV images conceal details that could potentially aid in the recording and reflection on behaviours associated with non-technical skills such as facial expressions and gestures, or conversations taking place outside of the frame, all of which may be of value in the debrief.

Nicholas Peres' Doctoral research study explores the use of immersive imagery (primarily 360-degree video) to document medical simulations. The resulting films provide a novel aid for clinical staff to reflect on humanistic performance and human factors within a training debrief setting. This research suggests that 360-degree video, with the camera positioned unobtrusively within the simulation environment, allows the whole environment and activity to be played back and navigated as a joint, exploratory activity between facilitator and participant group. The interactive nature of the play-back activity, with 360 context viewed either on a computer and navigated with a mouse, or as a VR headset-based, but shared experience, brings an immersive dimension to a debrief that offers viewers an opportunity to recover, discuss, and critically reflect on the captured content. For example, trainers are able to evaluate critical communication within operating theatres, patient perspectives, review safety procedures, map patients' journeys through clinical spaces, evaluate patient transfer ambulance experience, and review footage captured from community and domestic settings. The 360 format makes visible environmental and contextual information such as the technical set up and dynamics in the environment which become useful reference points for discussion of human factors.

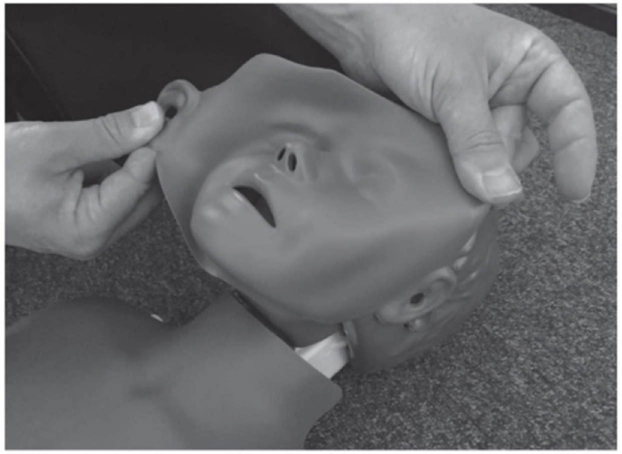
Within the TAaCT project, our particular focus is on collaborating with clinical simulation leads at Torbay Hospital to understand the value of this technology and how this immersive content can be utilised and effectively debriefed from.

Simulation Lab at Horizon Centre education and research facility based at Torbay Hospital

Comparative study of simulator technologies for clinical training

This final research strand aims to critically tackle a delivery problem in clinical training. It addresses the way in which an uncritical equivalence is drawn between the apparent visual realism of the medical manikin and human factors, such as empathy, that need to be developed in training. To date this has resulted in manikin technologies becoming increasingly expensive, as elaborate animatronic simulation functions become standard, without enhancing the necessary empathic skills of the clinicians. The resulting impact on the cost of simulation-based medical training is particularly problematic in the context of community healthcare applications. Moreover, technical complexity means that current manikins are heavy, immobile, require technical input and increasingly are designed to support specific pre-specified training scenarios at the expense of versatility. The increasing specialism also limits their application for important, culturally-dependent, features that might engage trainees and elicit professional empathy. Through a comparative study of manikins used in medical training simulations TAaCT will address concerns associated with fidelity and realism in simulation by comparing manikins, which are designed mainly to produce simulated physiological functions, with others that are conceptualised with visual and tactile concerns as the core principle. Building upon this activity the project will apply co-design principles to further two lines of investigation: a) proof of concept prototyping of low-cost locally configurable manikin simulators, and b) novel 360 filming and VR technologies that will flexibly support an expandable range of training scenarios as required. Underlying both is the goal of cultivating empathic skills in trainee clinicians without the restrictions of expensive animatronics.

This approach feeds into a project between clinical teams at Torbay Hospital and South Devon Foundation Trust and international partners in Kenya: GRASPIT (Global Recognition and Assessment of the Sick Patient and Initial Treatment) to deliver training in patient assessment and resuscitation. In this and other ODA contexts the need for cheap, effective simulation training is pressing.



Child resuscitation training mannikin used in training programme in conjunction with the National Resuscitation Council of Kenya (NRCK)

Cardboard low-cost VR Headset

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An abridged bibliography

The following bibliography, compiled by Jacqui Knight, is led from an arts and humanities perspective that analyses definitions of empathy and extends this into thinking about how apparatus, materials, technology, design and simulation methods can be used to elicit appropriate empathic responses in a professional context. This review builds upon a systematic review undertaken by Nicolas Peres in 2018 and proposes a transdisciplinary methodology for evaluating subjectivity, compassion and professional empathy in clinical training, and cognate bibliographies from the medical sciences. A full review of literature that takes the form of an open access annotated bibliography will be published in due course.

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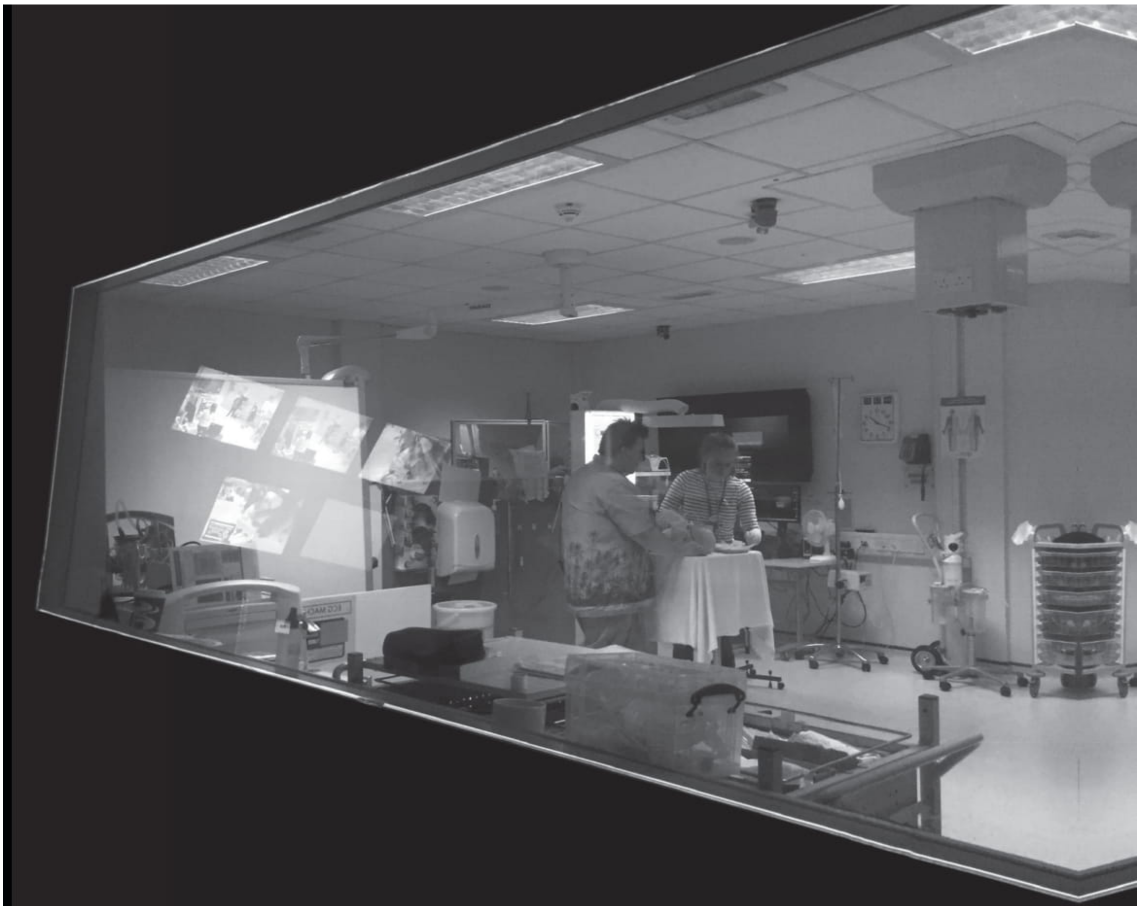
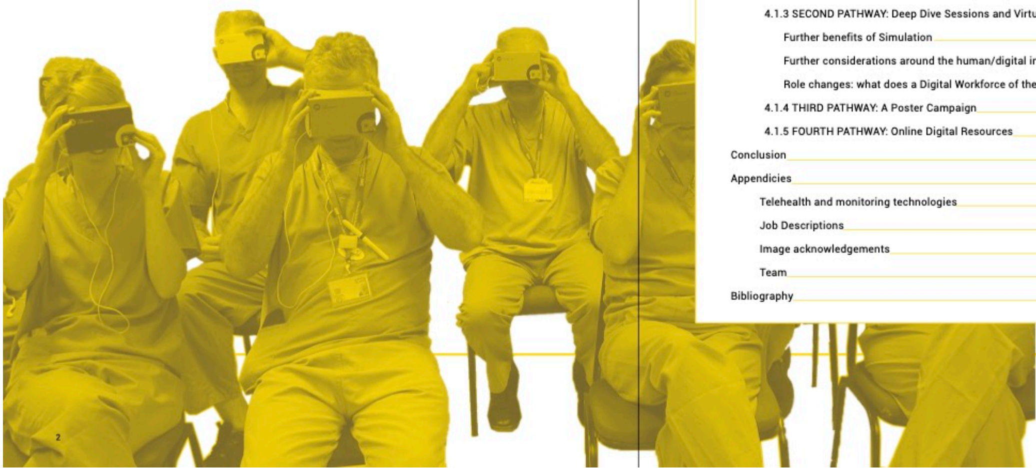


2018 Transtechnology Research
http://www.trans-techresearch.net/

A CO-DESIGN SOLUTION TO DIGITAL LITERACY IN HEALTH PROVISION

UNIVERSITY OF PLYMOUTH
NHS
Torbay and South Devon
NHS Foundation Trust
transtechnology research



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Introduction

The integration of digitalisation in the National Health Services (NHS) has been hastened by two main drivers: the "wide-ranging and funded programme to upgrade technology and digitally enabled care across the NHS" presented in the NHS Long Term Plan 2019 and the subsequent global pandemic which created a massive need to rapidly shift to new forms of interaction between the population and care givers.

The integration of digitalisation prepares for current and future healthcare challenges. It is occurring within a rich national landscape of frameworks and guidance that inspired the Torbay and South Devon NHS Foundation Trust to develop its own Digital Strategy in 2020. At the center of this strategy is the vision to "Transform Health and Care through the Digital" (Torbay and South Devon NHS Foundation Trust, 2020) centering the well-being of citizen, patients and carers. Their model of care calls for managing one own's health, at home and independently as much as possible, whilst being supported by the NHS workforce and a digital Integrated Care System.

Such a shift requires a workforce willing, confident and able to change its ways of working and engaging with the new capabilities the Integrated Care System affords. As for any change in the workplace, this process needs to be managed and created specifically for the culture and nature of the organisation. Technical and social issues (such as the challenges of interoperability and the risk of digital exclusion) and the needs of future populations must be carefully considered when designing a digital infrastructure.

Currently the demands of this transformation are being met by the work of Torbay and South Devon NHS Foundation Trust Digital Learning Group (comprising also of Digital Horizons and the Digital Futures Program) and People Promise and Plan Committee. This research project is intended to offer a contribution to their work by suggesting four pathways to meet the challenges, opportunities and roadblocks of digitalisation using co-design processes that might help with the uptake, accessibility and upskilling of the digital workforce of Torbay and South Devon NHS Foundation Trust.

To introduce our approach, this brochure presents the rich institutional landscape of NHS strategies and guidance documents to show the evolution of the digitalisation discourse at national level and for Torbay and South Devon NHS Foundation Trust. It will then highlight the shift in terminologies and direction since 2019 and consider how an adoption of technologies such as Extended Reality (XR) and Artificial Intelligence (AI) might have impact on the uptake, accessibility and upskilling of the digital workforce of the Trust. It will seek to identify how XR and AI can be both understood and misunderstood and how to share the opportunities, challenges and management of roadblocks at a regional level. The first section of this report will flag the exponential growth of telehealth, wearables and sensor data and the leading position of the UK in genomics to explore what it would mean for the workforce of the Trust to engage with a "data-rich healthcare environment" (Topol review, 2019). The second section of this report will focus on the interface between change management and the specificities of healthcare digitalisation. It will explain how processes of co-design, in which community members are treated as equal collaborators in the design process, can make for enhanced digital literacy in health provision for Torbay and South Devon NHS Foundation Trust. Employing techniques of user participation and simulation this approach actively involves all stakeholders in the design process to help ensure the results meet their needs and is usable. It will investigate the digital/ human balance sheet and look at the tacit knowledge imbued in medicine – the Art of medicine – and in particular the medical touch. To test and refine the outcomes of the design processes we will use the simulation resources that are important to the Trust's vision.

01

Mobile Lab

Anchored in the existing *Digital Futures Hub* in the *Horizon Centre*, we propose to use a mobile lab that offers the opportunity to interact with new technologies in situ. The mobile lab aims to trigger a debate about future challenges and question "how things might be?" and will present an opportunity for co-design and speculative design.

02

Deep Dive

Short Deep Dive sessions organized by the Digital learning Group will give the opportunity to touch, question, discuss how a specific digital technology such as Virtual Reality (VR) is or can be used in the existing processes of the workforce.

03

Virtual Simulation Room

To deepen and anchor the design process in practice, a virtual simulation room will allow the workforce to effectively engage in role plays and pedagogical frames to tackle the people & process challenges of digital transformation.

04

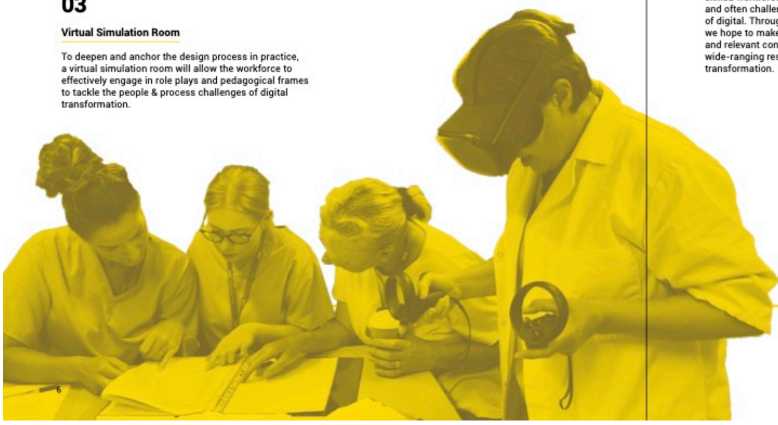
Poster Campaign

To accompany these co-design processes, a poster campaign is designed to peak interest and normalize the presence of digital technologies in the work place.

05

The Hive

Finally, a set of digital terminologies will be made available in a playful manner on the NHS Learning Management System The Hive. It will demystify concepts and link them to national frameworks and guidance to improve digital literacy.



This co-design process will create possible demands and opportunities in relation to new functions that digital literacy will require. These include, for example, the need for new roles such as of a digital health facilitator, a more encompassing simulation and Technology Enhanced Learning (TEL) technician or a data input quality & diversity manager. These roles will be explained in more detail in page 22-24.

The research vision and methodology for co-design and simulation presented in this document respond to the urgency for the integration of digital care in the NHS and the need to take a skilled workforce into an unfamiliar and often challenging territory of digital. Through this research, we hope to make an innovative and relevant contribution to NHS' wide-ranging response to digital transformation.

Background

1. Institutional Landscape Guiding Digitalisation of Healthcare in the UK

The Higher Education England (HEE), formed in 2012, led a strategic process to promote Digital Literacy Capabilities in the NHS. In 2013, it established a Technology Enhanced Learning (TEL) Programme which includes the Digital Literacy Project. This project started with a report to develop a common understanding and definition of Digital Literacy:

> *"Digital literacies are the capabilities which fit someone for living, learning, working, participating and thriving in a digital society."*

It also established Digital Literacy Domains which became the six Digital Capabilities, see fig.1.

These are the nationwide guiding principles for all NHS foundations and trusts, royal college of nursing and medical colleges.

As a following step, HEE published the Health and Care Digital Literacy Capability Framework in 2018 which defines four levels of Digital Literacy for each of the six Digital Domains (fig.1) using affirmative statements (e.g., I promote the fair, equitable access to information, data and content by all). This framework is the basis for self-assessment tools, HEE e-learnings, HEE learnings hubs, the digital champion toolkit and localised processes.

In parallel, also in 2018, the HEE Simulation Based Education (SBE) Framework supports the "development of a well-trained and engaged multi-professional workforce that is able to deliver safe, effective care by utilising meaningful and cohesive simulation-based education.' This practice based and localised guiding framework for "workforce transformation" includes a one stop shop for workplace solutions called the HEE star. There is an implicit use of the concept of digitalisation in the tools offered and displayed (including Virtual Reality use in Torbay hospital) but the SBE framework does not mention digitalisation and does not make reference to digital capabilities. Finally, since 2019, the discourse shifted; a stronger emphasis on data and artificial intelligence is found in subsequent reports. Namely, the NHS long term plan 2019, the Topol review 2019 and the draft Data Saves Lives Policy Paper 2021.

Fig.1 Digital Literacy Domains

2. Torbay and South Devon Foundation Trust Strategies

The Torbay and South Devon Digital Strategy, published in September 2020, is underpinned by an Information Communication and Technology (ICT) Strategy 2019. The Digital Vision is to transform health and care through digital. Integration, collaboration, cohesion and inter-operability are at the centre of this vision, removing silos and hence reducing secondary referrals, waiting times and cost whilst improving care. Torbay is recognised as a national leader in Integrated Care; the region has a strong cultural heritage and has a model of care centred on the well-being of an empowered, independent and supported community.

In January 2021, the Digital Leadership and Education Group of the Torbay and South Devon NHS Foundation Trust published a comprehensive and actionable document: The Workforce Digital Literacy Preparing our Staff for a Digital Future[1]. This document works towards the implementation of the digital goal 1.2 Build a digital workforce of the Torbay and South Devon Digital Vision (fig.3); it responds to the risk of excluding numerous people who lack access to digital skills. The document recognises that uptake, acceptance and upskilling are central to the implementation of goal 1.2.: the project should start with culture and "[provide] capabilities to confidently understand what 'digital' is and how 'digital' can support innovation and transformation and service delivery for our area" (p.2). It is to support

DIGITAL GOALS	1. Build a digital ready organisation
	2. Implement a connected health and care solution
	3. Empower the citizen
	4. Access to systems any time and place

Fig.3 TSD Digital Strategy 2020

this objective that this current research project is undertaken, integrating the strong regional culture with a digital integrated care one. The digital workforce pillar of this strategy was further defined in 2021 by Peres' report on Digital Literacy and Competencies, which received board level sign off.

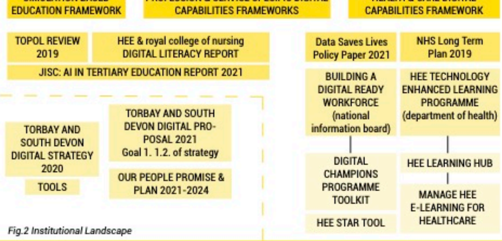


Fig.2 Institutional Landscape

1 Nick Peres, 2020

3. Evolution of National Discourse Since 2019

3.1 From digital to artificial intelligence

The overarching strategy of the NHS (Long Term Plan, 2019) puts digitalisation as one of its five outcomes: Digitally enabled care will go mainstream across the NHS. The Plan presents the existing benefits of digitalisation which improves access and home-based monitoring and care through the new NHS App, 70 further apps, the Electronic Prescription Service, the Global Digital Exemplar whilst ensuring data interoperability. But it goes beyond that, it also features how data will be used as decision support, used in predictive techniques and harvested through intuitive tools. Similarly, the Topol review 2019 "Preparing the healthcare workforce to deliver the digital future" presents detailed avenues for using digital healthcare technologies. The review predicts a substantial increase in data and makes the case for Artificial Intelligence to be the vehicle to make sense of it. It predicts three pathways:

1. a much greater proportion of the population will have their genome sequenced,

2. individuals will be generating their own health data with the help of algorithms to interpret that data,

3. data interpretation afforded by artificial intelligence will support clinicians.

The change in discourse shifts from enabling citizen and the healthcare workforce to access information and data centrally using digital platforms, to using data for prediction, diagnostics, automated image interpretation through artificial intelligence.

Within 20 years, 90% of all jobs in the NHS will require some element of digital skills. Staff will need to be able to navigate a data-rich healthcare environment.

Topol review 2019

3.2 Reflections on the shift to Artificial Intelligence

3.2.1 Tacit knowledge is negated

On one hand, centralizing data from different (medical) sources could seem to provide a more integrated patient care. On the other hand, it relies solely on one means of communication: numerical data. The importance of other forms of knowledge that are not medical per se but that can have a strong influence on a person's health diagnosis might not have an appropriate avenue in a solely data driven care system. In addition, if prediction, diagnostics and interpretation is automated and delegated to Artificial Intelligence there is even less opportunity to input tacit knowledge (from experience and observation) and the reciprocal knowledge of touch[2] (from physical examination). This shift emphasizes the need to involve users from the initial stages of co-design in the use of new digital technologies; this would allow to explore the digital/human balance sheet and highlight opportunities for synergy between the medical touch (physical examination, trust and empathy) and the opportunities that digitalisation offers. This need is recognized by literature on implementing AI projects which emphasizes the importance of co-design for accessibility and uptake[3]. Torbay and South Devon NHS Foundation Trust strategies recognize that digitalisation also needs to integrate culture and human interactions in the design of digital technologies.

3.2.2 Digital capabilities shift

Secondly, a shift in discourse from digitalisation to artificial intelligence will require an additional set of skills necessary to understand and manage the possibilities and constraints of Artificial Intelligence (machine learning, data science and deep learning). The quality of the predictions, diagnostics and interpretation will depend on the data inputs. The quality of the data becomes crucial and the consequences of small changes in data, or using only homogenous datasets, can lead to errors. Issues of diversity between different ethnic heritages and genders need to be taken into account; the person inputting the data needs to be trained to capture the limitations and signal possible inconsistencies with existing algorithms. Consequently, discussion with the healthcare workforce around what opportunities arise when time is freed by digitalisation for example for diagnostic, the importance of separating prediction from action and recommendation[4], and understand the consequences of the loss of social rituals surrounding patient care.

2 (Kelly et al., 2015)
3 (Murray et al., 2016; Bevan Jones et al., 2020; Matheny, Whicher and Thadaney Israni, 2020)
4 (Verghese, Shah and Harrington, 2018)

4. Co-Designing Digital Literacy In Health Provision

First of all, it is important to distinguish what is commonly called Artificial Intelligence (AI) with the maturity it actually reached in the healthcare industry. It is important to note that there is no commonly agreed definition of Artificial Intelligence; the UK research and development of digital solutions organisation JISC proposes "Theories and techniques developed to allow computer systems to perform tasks normally requiring human or biological intelligence". However, this definition of what is also called general AI has not been reached in most industries. Its actual maturity, the narrow AI, uses what is called machine learning: It follows a data maturity pathway explained as Descriptive > Diagnostic > Predictive > Prescriptive[5]. This current status of maturity is confirmed by the TOPOL review (2019) and the NHS Long term Plan (2019) which aims towards the:

- Use [of] decision support and artificial intelligence (AI) to help clinicians in applying best practice (Diagnostic)
- Use [of] predictive techniques to support local health systems to plan care for populations (predictive)
- Use [of] intuitive tools to capture data as a by-product of care (Descriptive)
- Link clinical, genomic and other data to support the development of new treatments to improve the NHS (predictive)

This is why, in order not to confuse a non-actual future and in order to diffuse fears fuelled by popular culture, we have chosen to use the terminologies Digital Assistance instead of Artificial Intelligence and refer to a Digital Ready Workforce to acknowledge the current status of maturity of the digital solutions. From that vantage point, despite the shift in terminologies since 2019, this project will continue using the concepts of Digital Literacy as the entry point to interacting with the healthcare workforce, as did the Torbay and South Devon NHS Foundation Trust and the national frameworks which started in 2012 and created useful strategies and tools since (see Background section).

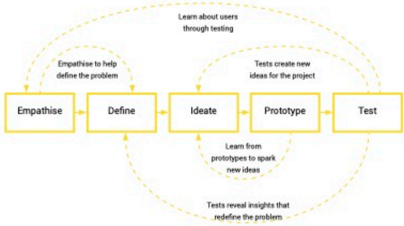


Fig.4 Design process map

5 (JISC, 2021; cognilytica.com)

4.1 Four Proposed Pathways

4.1.1 Method

Design thinking approach

The pathways we thus propose to reduce barriers to digital literacy of the workforce in Torbay and South Devon NHS Foundation Trust, will use two methods: co-design and simulation. These methods are presented as good practices by literature on Digitalisation and Healthcare[6]. Indeed, to promote the uptake of digital health interventions, literature evaluating digital health solutions recommend using a design thinking approach which involves human-centred design.

The core of these approaches is to be user-centred, and through empathy, have a deep understanding of users explicit and implicit needs[7]. This allows for the ownership and uptake of new technologies and processes. It is behaviour and practice based and can be easily embedded in processes that involve multiple actors in the health workforce, patients and decision makers. The Green paper developed by the University of Plymouth in 2020 Designing health systems of the future for HIP2 in the South West: a Green Paper explains the design thinking approach as follows as an iterative, non linear process:

The research team suggests implementing a design thinking approach through two pathways: a mobile lab in the form of a digital tea trolley and digital deep dives. These will be explained in the subsequent chapter.

Game modalities and gamification

The research vision and methodology developed by the research team uses proven approaches of game modalities and gamification[8] to increase the uptake and usability of digital tools; role play and a reward system are particularly highlighted as good practice. With this in mind, we suggest using an exciting, adventurous scenery in which we create an interface between the workforce and digital tools, stimulating curiosity and a sense of playfulness. To illustrate this, figure 5. Digital Literacy: the Transtechnology plug-in suggests the idea of an expedition to encourage a highly interactive approach between the workforce and digital solutions, and explore a realm where there is an openness to the new, a sense of discovery and excitement.

Fig.5 Digital Literacy; The Transtechnology Plug-in

6 (Murray et al. 2016; Bevan Jones et al. 2020; Matheny, Whicher and Thadaney Israni, 2020)
7 (Roberts et al., 2016)
8 (Montagni et al. 2020)

Fig.6 Digital Tea Trolley

4.1.2 FIRST PATHWAY: A mobile Tea Trolley of Digital Technologies

The mobile lab can take many forms. The research team chose a Digital Tea Trolley – see illustration below. The basic idea of the mobile lab is that digital tools travel through the departments and offer their use in situ. This promotes acquaintance with digital tools, touching them, testing them, interacting with them; it allows a form of incidental learning through listening to discussions among peers around the trolley, and importantly the trolley alludes to the fact that digital tools are there to serve and to resource with ease and might remove a perceived threat.

Concretely, the digital tea trolley is a compact version of the existing virtual simulation room. It presents objects such as a Virtual Reality and HoloLens headsets, wearable technologies, iPad, products of a 3D printer. For the interaction to be optimal, and for the tea trolley to be a springboard to increased uptake of digital technologies, there needs to be a digital health facilitator; a person to present, create the interaction, answer questions, stimulate discussions and thereafter to be a point of contact.

A mobile lab also ensures that underrepresented communities can take part in the interaction and the co-design of the digital solution by being reaching out to them and coming to their workplace. Reach and uptake are crucial elements of improving the digital literacy capabilities; a multi-country study showed that "Tapping the power, potential and energy embedded in diversity are key drivers to wider adoption of digital health innovations"[9]. Involving a wide range of the workforce through a mobile lab can also highlight and prevent possible biases from digital technology.

Other forms of a mobile lab can use culinary metaphors, the idea of a magic assistant, or a science shop. All these would result in exploring the resistance to digital solutions, their usability, questions that arise, their interoperability, etc. They would also allow a discussion around the rich boundary between the digital solution and the human interface; how the Human/Digital Balance Sheet can be tested in a selected and safe setting. It gives the permission to talk about digital technologies in an informal setting and be casual about it.

The digital tea trolley is a taster, a first interaction, which will then be followed by an interaction in a virtual simulation room for Deep Dive sessions. In this room, the simulation of the use of one specific technology will be presented and each participant will take on a role and interact with their work, their colleagues, the human body and digital solutions. They will physically experience how to acquaint themselves, interact with, question the digital assistance and in the process improve their digital capability.

9 (Moen et al. 2020)

4.1.3 SECOND PATHWAY : Deep Dive sessions and Virtual Simulation room

The Deep Dives Sessions will be around 30-35 min and have a lab function. They will gather case examples of what the technology is being used for. It should not just be a presentation of the technology but emphasize the human interface and show the benefits of placing technology in the human care pathway.

In order to make digital assistance appropriate, relevant and own to the culture of Torbay and South Devon, it is important that not only the usability is tested by a diverse range in the workforce, but also the change of practices and behaviours that such a digital technology will create.

The lunch time Deep Dive Session will be a taster session, around one technology. It will allow one particular concept to be explored in depth: explore, explain and co-define the use of technologies and terminologies such as AI, XR and VR to expose different kinds of meanings: How to own the concepts and how to expose the potential of the concepts in different areas. The lunch time Deep Dives will allow for interested individuals to sign up for longer Deep Dive sessions and possibly identify "digital champions".

The longer Deep Dive Sessions will take place in the virtual simulation room. The virtual simulation room offers a plethora of opportunities for participatory approaches to prototyping, speculating and simulating which have proven to be key ingredients for the uptake of digital solutions in healthcare. This room managed by a multi-disciplinary digital team can reduce the cultural barriers to digital literacy. It will allow to focus on one event, test how the use of digital technologies will shift the practices and bahaviours, identify bottlenecks and opportunities.

The illustration below gives an example of such a virtual simulation room, which follow the graphics of the chosen theme of our research vision.

The message throughout is the liberation for more human interaction and greater patient time. Techniques of participatory design and design thinking, such as story boarding, developing appropriate avatars, testing intuitive use, selecting rewards[10] will be used and facilitated by the digital learning team. The prototypes can be tested against the following criteria:

The result of this process is to improve users understanding, ownership and uptake of digital solutions.

- Acceptability and usability (will the target audience (e.g. patients, HCPs) incorporate and sustain the intervention into their lives/clinical practice?)
- demand, (will relevant stakeholders use it?)
- implementation, (will it have high fidelity within real-world use?)
- practicability, (can it be delivered with minimal burden?)
- adaptation, (can it be adapted to novel contexts without compromising fidelity and integrity?)
- integration, (can it be integrated successfully into existing healthcare systems?)

Murray at al, 2016
Evaluating digital health interventions: key questions and approaches

10 (Dederichs et al. 2022); (Yardley et al. 2015)

"The company's capacity for ambidexterity is becoming an important dynamic capability, with on one hand flexibility for new developments and on the other hand stability for hard factors in physical value chains and soft factors in value-oriented attitudes and behaviour based on empathy."

Töpfer, A. and Brabänder, G. (2021)

Further benefits of simulation

The structured inter-personal and inter-professional setting of a virtual simulation room also offers opportunities for peer mentoring and reverse mentoring[11] (younger digitised workforce supporting older ones) to improve the overall digital capabilities and highlight potential blind spots and assumptions. Through participatory approaches and speculative design, the healthcare workforce has the opportunity to imagine and rehearse for near futures; patients can explore their potential for self-management; it allows to explore more complex socio-technical issues; it can be a space to negotiate diverging opinions[12]. Evidence[13] shows that speculative design encourages involvement, offers safety, playfulness, expands imagination and diversity and promotes learning.

Taking a step further, immersive design fiction can use Virtual Reality headsets to create prototypes of speculative interactions[14]. It allows for a level of embodied experience so important in learning[15] in different real time speculative stories. It acknowledges and explores the rich social medical rituals and interactions and have them integrated in the user's immersive experience.

Further considerations around the human/digital interface

Managing the dynamic interface between digital assistance and the medical touch are part of the expanding skillset of a digital workforce. It presents new opportunities to explore the tacit forms of knowledge that accompany touch and physical examinations. Then information coming from diagnosis and prognosis (gnostic knowledge) is gathered alongside information coming from physical examination (pathic knowledge), a tacit form of emotional knowing rooted in presence and compassion[16].

As described in the background section, the model of care of the Torbay and South Devon NHS Foundation Trust digital strategy centers well being of its population and promotes its management at home. It is aligned to a global trend to offer digital interfaces for professional care at home, between citizen, patients and the healthcare workforce. A recent study highlights that "patients are more and more eager to access information that empowers them, and person-to-person relationship in healthcare is becoming increasingly essential"[17]. A person-to-person relationship is strengthened through physical examination, trust and empathy[18]. Touch is a reciprocal process, a two-way flow of information between the patient's body and the professional's medical knowledge imprinted in its memory of what is normal and what shows signs of imbalance or illness13. This moment of person-to-person relationship is therefore far richer than a simple diagnostic tool; it provides a felt sense of disease and its monitoring. Furthermore, a synthesis review done in 2020 highlights the importance of these relational qualities rooted in presence and empathy for reducing workplace stress[19].

Some techniques that explored what our research vision called the digital/human balance sheet have been tested in different medical settings; this field is often referred to as digital empathy and is included more widely in medical curricula. Self-reflection and reflective techniques, through group discussions, writing or other activities have shown a 100% increase in digital empathy[20] in their medical students.

These good practices can be integrated into the mobile-lab and in the virtual simulation room, where group discussions can be prompted, self-reflection on gnostic and pathic knowledge support efficient care. It is suspected that through such discussions and self-reflections, culturally appropriate ways to interact with digital assistance will result in a co-design of digital literacy in Torbay and South Devon NHS Foundation Trust.

11 (Moen et al. 2021)
12 (Knutz et al. 2020)
13 (Tsekleves et al. 2019)
14 (McVeigh-Schultz et al. 2018)
15 (Kelly et al., 2015; Wilde and Evans, 2019)
16 (Kelly et al., 2015)
17 (Purcărea, 2016, p.385)
18 (Verghese, Shah and Harrington, 2018)
19 (Wearn et al., 2020)
20 (Terry and Cain, 2016)

Role changes: what does a Digital Workforce of the future look like?

The digital workforce needs facilitators to accompany these processes. The digital health facilitator eases the interaction between the workforce and digital solutions; the simulation technician prepares the different virtual events and simulation rooms; and finally, the data input quality and diversity manager has a crucial role: They ensure that there is sufficient understanding on the algorithmic effects of data and data bias and how it can lead to false diagnostic and prediction for underrepresented people[21]. The following job descriptions are found in Annex 2:

i. Job description of a digital health facilitator
ii. Job description of a simulation technician
iii. Job description of a data input quality & diversity manager

It will also be important to explore what a future digital workforce looks like. As a consequence of the shift in Torbay and South Devon NHS Foundation Trust towards an improved access to digital and home-based monitoring and care, there is also a need to explore what new roles are needed to accompany such a shift. Indeed, home-based monitoring and care involves managing large amounts of data that is inputted in different locations and then centralised. Such detailed explorations are not part of this research process but should be included in further reflections.

4.1.4 THIRD PATHWAY: A Poster Campaign

Finally, to accompany the two first pathways (Mobile Lab and Deep Dives) it is important to ensure that processes of communication and access to knowledge is included. We thus propose a Poster Campaign that features in the corridors of the workplace; playful posters with the aim of dissipating the potential fear of artificial intelligence and inciting passers-by to think instead of digital helpers. Indeed, the research team would like to emphasise that digital technologies are there to assist the health workforce in their tasks and free up time for people-centred care, diagnostics and other. The messaging will revolve around: how can digital technologies serve us and the patient best and try to be interactive. The design of the poster campaign is a future step in this research process and is not included in this brochure.

4.1.5 FOUTH PATHWAY: Online Digital Resources

To remove a barrier of understanding, we also propose to feed a Digital Resources page on the intranet of Torbay and South Devon NHS Foundation Trust Learning Management System "the Hive". It would offer access to common terminologies such as Artificial Intelligence, Virtual Reality, Hololens, etc. based on the ones published in national NHS guidance documents and answer Frequently Asked Questions. The Digital Resources page can be used as a glossary and can be designed in an interactive way. One suggestion is to have a beehive, in which every honeycomb offers a frequently asked question, or a definition, and allows the user to upload a question of their own. A member of the digital learning team can be responsible to monitor and update the page, and if designed carefully, will be able to analyse the key themes that emerge from the uploaded questions. This is a really interesting opportunity to interact, monitor and gauge the uptake of digital solutions in the workforce, and assess around which topics there might be more concern. A pdf of these terminologies can be found in Annex 3. The actualisation of such a page will be managed by the Digital Learning team.

21 (Murray et al., 2016)

Conclusion

Although the frameworks and strategies guiding the digitalisation of healthcare in the UK seem to offer great potential to innovate patient care, ownership of the workforce at Torbay and South Devon NHS Foundation Trust is necessary. Through the four proposed pathways we intend to facilitate a range of exploratory activities that break down digital literacy barriers by involving the users during the process using a co-design and design thinking approach. The aim is to demystify the concepts of Artificial Intelligence and Digital Technologies and through a playful and interactive approach allow for the user to adapt them and integrate them into their practices and behaviours.

Concretely, the research team suggested to interlink five products to support the co-design of digital literacy solutions in health provision in Torbay and South Devon NHS Foundation Trust. The five products are:

1. This brochure aimed at senior management and advisory teams.
2. A poster campaign to be displayed throughout the buildings.
3. Deep dive sessions: lunch time sessions to explore a particular digital technology.
4. A design for a mobile lab in the form of a digital technology tea trolley.
5. An interactive glossary on the Digital learning portal of the Hive.

These products offer the rationale (brochure), the communication (poster), the engagement and co-design with the workforce (deep dive sessions) and an interface to explore jointly and haptically digital technologies (the mobile tea trolley).

Underpinning the products will be reflections around the digital/human balance sheet, the role changes, and promote an iterative process in which the health workforce and patients can understand, test, interact with and propose solutions around the use of digital technologies as an assistance to usual practices.

The Topol review 2019 will be guiding the themes that will be presented and will serve as a running thread. The four overarching themes of the Topol review are: 1) Artificial Intelligence (AI), 2) Robotics, 3) Extended Reality and emerging immersive realities (XR) and 4) The digital citizen.

The research team thus hopes to make an innovative and relevant contribution to NHS' wide-ranging response to digital transformation.

Appendices

Telehealth and monitoring technologies:

Here are some examples of digital technologies easily available on the market

Virtual reality headset

https://www.vrs.org.uk/the-ultimate-guide-to-virtual-reality-head-sets/

https://concisesoftware.com/blog/virtual-reality-in-healthcare/

Hololens

The Hololens allows for information to appear on the screen whilst interacting with patients. The mixed-reality headset used in many departments at Imperial College Healthcare NHS is linked to a secure live video-feed to a computer screen in a nearby room.

https://www.microsoft.com/en-us/hololens/industry-healthcare

https://news.microsoft.com/en-gb/2020/05/19/imperial-college-healthcare-nhs-trust-uses-microsoft-hololens-to-protect-doctors-and-reduce-need-for-ppe/

Remote medical exam kit

The kit allows you to perform a guided medical exam from home whilst in communication with a clinician.

https://www.tytocare.com/

Wearable ECG monitors

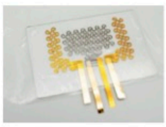
Similarly to the smart watches, wearable ECG monitors are easily available consumer electronics. The difference is that they can also monitor heart rate, oxygen levels, blood pressure, temperature all in one.

https://www.cnet.com/health/medical/healthyus-7-lead-ecg-makes-it-easier-to-monitor-patients-remotely/

Wearable ECG monitors

Wearable ECG monitors also come in the form of a ring. It monitors heart rate, temperature, analyses your sleep and adapts and responds through an app.

https://ouraring.com/



Sensors

The wearables can also be integrated into your body in the form of a tattoo. The Dexcom glucose sensor is placed just beneath your skin and sends wireless information to a monitor.

https://www.dexcom.com/en-GB

Home monitoring

The smart lamp immediately knows when the inhabitant falls and notifies their family.

https://nobi.life/nobi-at-your-place/

Appendices

Job Descriptions

Job Title: SIMULATION TECHNICIAN

Minimum qualifications:

- Degree in medical engineering or medical technologies or industrial design in healthcare or product design with a specialty in healthcare or digital technologies in healthcare.
- Industry experience in precision healthcare technologies, good understanding of their use and their innovative potential in the interface with digital solutions.
- Experience providing scripting and business tool development
- Previous experience of working with different groups to engage in technologies, with an ability to effectively translate technical subjects into digestible and understandable ways.

Preferred qualifications:

- Creative and technical knowledge of content creation in immersive media (such as interactive 360 video) and/or 3D environments and asset creation (such as within Unity).
- Experience in innovation pathway design and design thinking approaches
- Experience working/studying in a 'fablab' or R+D technologies space.
- Knowledge and understanding of project management skills for example developing project plans and providing project reports.

About the job

As a simulation technician, you will develop and facilitate simulation deep dives in specialty driven digital technology use (e.g. orthopaedics). You'll create spaces of co-design, prototyping, testing with the NHS workforce, simulating how digital solution can be integrated into practices and protocols. You will integrate self-reflection and dialogic approaches to harnessing team spirit and shared vision for patient centred care.

Our goal is to co-design digital solutions with the Torbay and South Devon NHS Foundation Trust workforce using a design thinking approach. You're equally comfortable explaining how digital technologies can be used in the health care sector as initiate discussions around the digital/human balance sheet respecting diversity, equity, and inclusion and the unique culture of our region.

Responsibilities

Play a key role in the advancement of the digital literacy strategy and supporting tools for operations and provide scripting/tool development as necessary in healthcare digital technologies.

Liaise with a number of stakeholders and clients in relation to engagement and activity in the Digital Futures Hub. This will include contact with other teams both internal and external such as HIS, TECS & Digital & Simulation Education as well as Health Education England and regional networks.

Work with teams to launch and deliver simulations related to digital technology use in different medical specialties, in line with the NHS digital infrastructure.

Job Title: DIGITAL HEALTH FACILITATOR

Minimum qualifications:

- A Degree in a digital creative field \ software design or related field in digital\innovation within healthcare
- Industry experience in the provision and support of emerging & digital technology (to include XR, video, digital media production, 3d printing, 3D scanning).
- Experience providing scripting and business tool development
- Previous experience of working with different groups to engage in technologies, with an ability to effectively translate technical subjects into digestible and understandable ways.

Preferred qualifications:

- Creative and technical knowledge of content creation in immersive media (such as interactive 360 video) and/or 3D environments and asset creation (such as within Unity).
- Experience in innovation pathway design
- Experience working/studying in a 'fablab' or R+D technologies space.
- Knowledge and understanding of project management skills for example developing project plans and providing project reports.

About the job

As a digital health facilitator, you'll develop and facilitate Deep Dive sessions and Mobile Digital Labs with a varied audience throughout the hospitals. You'll work with the Digital Futures team in the Digital hub and follow the NHS digital architecture.

Our goal is to co-design digital solutions with the Torbay and South Devon NHS Foundation Trust workforce, patients and visitors. You're equally comfortable explaining how digital technologies can be used in the health care sector as initiate discussions around the digital/human balance sheet. We aim to build digital solutions that responds to diversity, equity, and inclusion and to the unique culture of our region.

Responsibilities

Liaise with a number of stakeholders and clients in relation to engagement and activity in the Digital Futures Hub. This will include contact with other teams both internal and external such as HIS, TECS & Digital & Simulation Education as well as Health Education England and regional networks.

Play a key role in the advancement of the digital literacy strategy and supporting tools for operations and provide scripting/tool development as necessary.

Work with teams to launch and deliver projects related to data architecture and process re-design around demand and supply-side computer resource management.

Appendices

Job Descriptions

Job Title: DATA INPUT QUALITY AND DIVERSITY MANAGER

Minimum qualifications:

- Degree in software design/engineering or digital technologies in healthcare, or related field in digital innovations.
- Industry experience in developing digital infrastructures and data pathway management
- Experience providing scripting and business tool development
- Previous experience of working with different groups to engage in technologies, with an ability to effectively translate technical subjects into digestible and understandable ways.

Preferred qualifications:

- Creative and technical knowledge of content creation in digital pathways management, eRecords, integrated record (national, regional, local), ePrescribing and medicines administration (ePMA)
- Experience in cyber vulnerability management, threat management, Identity and access management and digital governance
- Proven knowledge in medical anthropology and medical sociology for diversity, equity and inclusion
- Knowledge and understanding of project management skills for example developing project plans and providing project reports.

About the job

As a data input quality and diversity manager, you will ensure appropriate data management and algorithm use that responds to the diversity of patients. You will facilitate trainings on data input, and the consequences of algorithms used in the NHS digital infrastructure for ePMA, integrated records, prediction and diagnostics. You will work within the Digital Futures team in the Digital hub.

Our goal is to co-design digital solutions with the Torbay and South Devon NHS Foundation Trust workforce using a design thinking approach. You're equally comfortable explaining how digital technologies can be used in the health care sector as initiate discussions around the digital/human balance sheet respecting diversity, equity, and inclusion and the unique culture of our region.

Responsibilities

Play a key role in the advancement of the digital literacy strategy and supporting tools for operations whilst providing a good understanding to the NHS workforce on digital pathways and digital record management.

Liaise with a number of stakeholders and clients in relation to engagement and activity in the Digital Futures Hub. This will include contact with other teams both internal and external such as HIS, TECS & Digital & Simulation Education as well as Health Education England and regional networks.

Work with teams to launch and deliver simulations related to digital technology use in different medical specialties, in line with the NHS digital infrastructure.

Image Acknowledgements

Fig. 1. *Digital Literacy Domains*
Higher Education England (HEE) https://www.hee.nhs.uk/our-work/digital-literacy

Fig. 2. *Institutional Landscape*
Illustration by DigLiTT team

Fig. 3. *TSD Digital Strategy 2020*
Digital Leadership and Education Group of the Torbay and South Devon NHS Foundation Trust

Fig. 4. *Design process map*
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Fig. 5. *Fig.5 Digital Literacy; The Transtechnology Plug-in*
Illustration by DigLiTT team

Fig. 6. *Digital Tea Trolley*
Illustration by DigLiTT team

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McKinsey From "wartime" to "peacetime": Five stages for healthcare institutions in the battle against COVID-19

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National Academy of Medicine special publication 2019: Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril

Cognilytica: AI today podcast

Thoughts on a ceiling canvas

If you stare at this image long enough you begin to imagine the sounds of the electrical hum from the strip lights, maybe even see the occasional flicker as you blink. The possibility of the room becoming populated suddenly fills the silence with unrecognisable chitchat and occasional coughing; someone of whom I think has been smoking for most of their life. There is a phone that rings and doesn't get answered but it contently fills a gap. If you keep staring at this image long enough, even after you have counted every square, or divided one row of them by another, and then again, you begin to realise you have probably been staring at this image for long enough. Yet I am told I could be here for hours and I shouldn't move… so I begin to count the amount of squares that go from one corner of my view to the other.

Later, as I continue to wait, I pick an area to focus my attention. My eyes are immediately drawn to the seams of the plastic trunking, and then jump to the corners of the light boxes as I seek after the dark bits. I try to focus more into the finer detail, my vision becomes like pinpoint, my head lifts up in the process to discover the smallest of features. Perhaps no one has stared at this bit before? The thought strangely excites me.

Only occasionally am I disturbed enough to break my hold of the image. Usually it's to answer a question from a women's voice outside of my field of view. As I respond in short sentences while looking toward the ceiling I am reminded of my youth, staring into nothing and calling downstairs to my mother. The other times it's because of that pain again. I try not to think about it. Thoughts of escaping this place and the lights become the lines of a highway.

As I sit staring up towards this ceiling, I wonder at what point I will be told what was happening to me. I had heard the paramedic worry about heart rate in the ambulance. But I'm only 29. I try to quantify my age using the ceiling tiles. The sound of the heart monitor is the same rapid pace now as it was then. I imagine the light strips pinging a pixel shaped ball back and forth to match the rhythm.

Time seems to have slowed but the ceiling has become my star field and the fan appears to have increased in size. Science fiction is my favourite genre and I wonder if I can disappear into that black hole and hide from the blood lady before that needle reaches me. I daren't look down. My gaze is firmly fixed to find the constellations.

As I cycle my interests, I am given more pain relief. I supplement this with thoughts of home and an image of my three boys who appear to me in the form of three strip lights. I think I have been here too long now. In between the gaps, I am just left to pass the time.

The image is representative of a patient's view in a typical A&E hospital setting. The above account is taken and adapted from a journal entry I wrote when I experienced being a patient due to an illness.

Staring up at a ceiling for an extended period of time, I began to imagine the ceiling was more than simply what I could see. I found that the images and the theme of my visual thoughts changed as time passed. I did not intentionally set out to explore notions of the ceiling acting as a canvas for thoughts and images. If I am honest, I believe my thoughts were a way for me to cope with the worry and anxiety of the event. It is as if a mental self defence mechanism kicked in to action and the ceiling was just there for me to adapt.

For the first hour or so I explored my view and every element within it. I counted the tiles over and over and made mental shapes out of them. I wanted the time to pass quicker so I could be treated and go home. However I was in pain and knew this was not an option. Counting tiles was no longer enough of a distraction from the situation for me, and in reflection I believe this may have been the trigger from which a desire to deeper explore and get lost in my thoughts happened.

The hospital environment is unlike other public areas in that it is often where people carry and suffer their anxieties, vulnerabilities and heightened emotions. During periods where there is often no other choice but to wait for medical attention, staring at the bland ceiling space from a hospital bed becomes the individual's only view for extended periods of time. It is at this point where I think this colourless and generic view potentially becomes a canvas from which deepest thoughts and feelings can spill out and make visual manifest in the patients mind.

I believe there is a great benefit in discovering common visual or cognitive themes experienced in these related patient situations in order to explore the creation of a visual representation of such a thought process. By having a visual tool from which a 'patient voice' can be shown and experienced by those who are either unaware or who, through educating, need an insight, this could aid bridging a clinical with humanistic approach in healthcare and perhaps help better understand the way we relate and interact to certain human behaviours.

In the wider context to my research, a cinematic representation of the patient voice potentially plays a key role in addressing an absence in medical education (particularly medical simulation) to aid the teaching of humanistic or 'non-technical' skills to medical students and trainee staff. The concept of the ceiling as an image canvas opens interesting potential in the way visual material should be viewed in specific arenas and projected onto imperfect surfaces. What do we miss if we only ever look for the perfectly presented image or never look up to see where the patient's eyes gaze?

Beckett, S. (1959) 'Krapps's Last Tape' in Beckett, S. Samuel Beckett: Krapp's Last Tape and Embers. London: Faber and Faber, pp.9-20

Krapp's Last Tape can be accessed via https://www.msu.edu/~sullivan/BeckettKrapp.html the risks posed by physical tours of sample cross-contamination, patient confidentiality breaches and infection control.

By offering the experience in VR, all students have an equitable experience regardless of where their clinical placement takes place. Leeds also discovered that VR increased student awareness of the pathology specialty as a future career, with students indicating in feedback that they were significantly more likely to choose it as their specialty.

Patient Focused Education

- VR encourages engagement through developing interactive and digestible content for patients, which in turn increases knowledge retention compared to other educational mediums.

- In comparison to traditional means of explaining or providing information for patients, VR is particularly useful for visualising pathways of care.

- VR can be a tool for capturing whole care environments and different patient perspectives, giving unique insight into activity, interactions and processes that enable people to step into the shoes of another for reflective learning.

- Visually mapping and virtually deconstructing healthcare environments with interaction points can help with navigation and patient flow, reducing both emotional and service load regarding wait times and expectations.

VR offers learning and educational potential for both patients and healthcare staff. The application of VR for patient-focused education has an ever-increasing remit and onward potential, from providing visitors with pre-visualisation of pathways of care to the ability of sharing insights and re-creation of unique perspectives and illnesses. VR patient education brings an experiential awareness of humanistic skills, such as effective interaction and communication between health and care staff to patients and service users. These contexts bridge the importance of human connectivity, a theme that cannot be underestimated when considering emerging technologies.

An experience which gives insights to a pathway of care or pre-surgical visualisation will have learning benefits for both audiences - the patient and service provider/clinician. For the patient, it might mean using a VR intervention that provides anxiety reduction by helping visualise an understanding of a process before having to undergo it physically (Gold et al. 2021). For the clinician, this will not only aid the patient journey and therefore support service, but can also offer an opportunity for reviewing environments, interactions and processes from a different perspective, insights that can bring a greater appreciation and trigger potential positive change.

In this particular arena, there is value found in both the more complex CGI (computer-generated imagery) built experiences as well as 'entry level' and accessible applications of virtual reality content. In the latter, the utilisation of interactive 360-degree videos have been used effectively to help deconstruct unfamiliar environments with rich information and media (in the style of a virtual tour of a hospital operating theatre for example). Low-cost 360-degree video equipment has been used and adopted by a number of hospitals, including education and simulation teams, to build bespoke, in-house, training content in line with individual key learning outcomes. The relatively low-cost implications of 360-degree video production processes have meant several hospitals have designed bespoke in-house training content as a way to explore this emerging technology as a more effective medium to deliver training and education opportunities.

One of the key and most important benefits of VR for healthcare professionals, is being able to rehearse, test, role-play, and respond to materials that can stimulate emotions and a feeling of "being there". What this means is that healthcare professionals can experience a range of scenarios and test out ways to respond, but without real-life consequences. This in turn leads to helpful and appropriate learning opportunities which can work through scenarios that can be increased in intensity. Using VR over traditional digital media enables an increased sense of presence and immersion (i.e. feeling like you are "there"), this in turn can lead to a more realistic experience and therefore authentic response and learning.

Through the Patients' Eyes: Enhancing Empathy, Connectivity and Humanistic Skills for Healthcare Staff

Understanding patient perspectives and narratives are critical in medical education and training. Experiencing the lived conditions, feelings and emotions of a person can help healthcare workers empathise with patients. Empathy is the ability to connect and appreciate with the patients' experience and communicate using this understanding. Within the context of healthcare, empathy is a skill that can help affect the quality of the relationship between the patient and healthcare professional. This in turn can translate into a better conversation, supporting an essential "what's important to you?" approach to care. As an intervention in this context, a change of perspective - or "seeing through the patients' eyes" - provides a valuable moment of reflection and consideration for the health and social care workforce. Such an opportunity to "experience" a different perspective can help empower effective and meaningful care by enhancing the relationship and engagement between parties. A shared appreciation of a condition or lived narrative can help engagement with a treatment or care plan, having positive implications on patient outcomes.

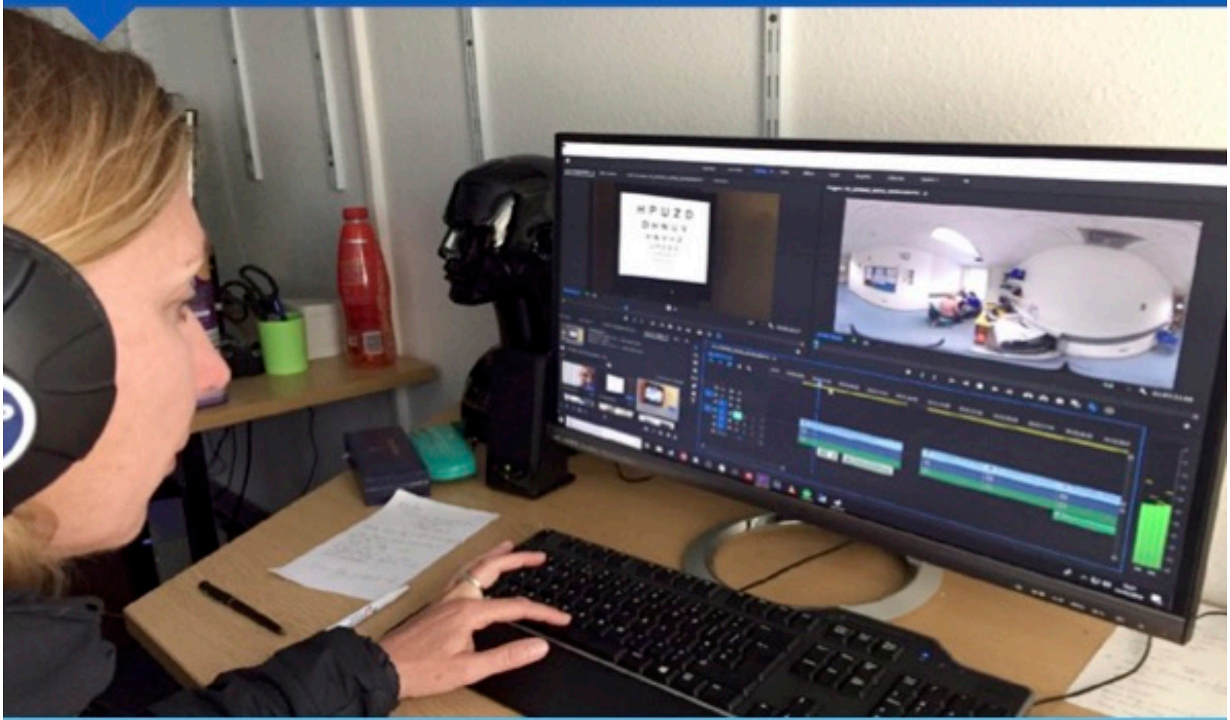
Empathy training and, in the wider context, a continuation of humanities focused teaching, is a vital ingredient in healthcare education and training. However, due to burn out, lack of consistent training, and system pressures, combined with the challenges of teaching humanities focused curriculum as a consistent key skill, leads to a reduction in protected time where practitioners can reflect on their experience and empathise with patients.

The introduction in 2015 of patient perspective 360-degree video scenario content, created at Torbay and South Devon NHS Foundation Trust, has provided unique insights and reflective learning for trainees to access as part of their educational simulation training. This has complemented the teaching as an additional interactive experience, delivered in both VR and as a desktop experience.

Image: Courtesy of Torbay Hospital, Torbay and South Devon NHS Foundation Trust

NHS
Health Education England

How to Develop a Virtual Reality (VR) 360-Degree Video – Part 1



Adobe Premiere Pro in use to edit one of the HEE allied health professional 360 videos

Developed by Health Education England Technology Enhanced Learning

Released: January 2023
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Purpose

This guidance forms part of the Health Education England (HEE) National Simulation in Health and Care toolkit. It has been produced to help those of you who are interested in developing your interests in virtual reality (VR) further.

TEL welcomes your feedback on this document, so please contact: simimmtech@hee.nhs.uk.

Introduction

Interest in immersive technologies is growing at a rapid rate, even more so following the COVID-19 pandemic. As a result, HEE formed a Special Interest Group on immersive technologies, with the aim of delivering a framework for delivery, as well as additional elements of the Immersive Technologies in Healthcare Education and Training Toolkit, to which this guidance is aligned.

Additional guidance documents are available:

- How to Develop a Virtual Reality (VR) 360-Degree Video – Part 2: Stitching and Editing
- A Guide to Creating Accessible 360-Degree Videos.

1. Get involved

So you have seen some 360-degree content online or in a VR headset and now want to try creating your own. With the price of consumer cameras starting at a couple of hundred pounds and with some basic guidelines of best practices in place, now is the perfect time to begin exploring how this medium could be useful to you and your ideas. Maybe it is a simulation you want to record, or a patient journey scenario, a virtual tour around a building or simply to show viewers an otherwise difficult to access environment.

This guide will help you through what you need to consider before filming; how to go about filming immersive content, things to think about when stitching your footage, and how to edit. Before you begin, the bare minimum needed to begin producing 360-degree videos is not too dissimilar from regular film or video production. You'll need:

- a 360-degree camera (different types outlined below)
- suitable camera support rig (though best to avoid a traditional camera tripod, so instead consider a light stand or specialist 360 support system)
- the means for storing your footage – plenty of hard drive space would be useful.

2. What is 360 filming?

- 360 videos are created by using synchronised footage captured on multiple lenses or cameras to create a sphere of video footage which covers the entire field of view (FoV).
- 360 videos are often viewed using VR headsets but it is important to note that these can also be watched on mobile phones, tablets or conventional computer screens whereby the viewer would move their device, swipe the screen, or click and drag to rotate the video. When all of the above ways to view are considered, 360 videos quickly become a more accessible medium than what one might otherwise think.
- 360 videos offer an immersive way of viewing an experience, allowing the viewer to explore the scene around them, and with some cameras, this can even be filmed in 3D to add further to the viewer's sense of engagement.

- 360 videos can also be made to be interactive, using software to build hotspots which are points within the video that allow the viewer to engage in other media material (such as jumping from a 360 video to another 360 video through a doorway or bringing up an information tab). For an example of these types of interactions, please check out the HEE Allied Health Professional Day in The Life Of video series.

A Yi360 camera being used to film a 'Stop before you block' training scenario

3. Different types of 360 camera

Single lens cameras

The simplest, but least common type of camera for capturing 360 video footage, is one which has just a single lens. The lens is highly rounded or dome like and referred to as a 'fisheye'. Fisheye lenses vary in their FoV, for example, how much can be captured in one go, but some offer extreme FoV that can be leveraged for 360/VR applications. NOTE: no current fisheye lens can capture the entire 360 image which is why this approach isn't popular. The resulting footage will always have a black area at the top (zenith) or bottom (nadir) of the video footage sphere.

Back-to-back

The next simplest type of 360 camera and the most common amongst consumers/prosumers is a 2 lens back-to-back camera, and this works through 2 fisheye lenses. This ensures full coverage but introduces the need to join and synchronise the 2 video feeds - this process is called 'stitching'. Most modern back-to-back cameras feature an auto stitch process while shooting (though stitching in post-production can often render better results) making these types of cameras the most accessible and useful to start 360 video production. The most modern of these cameras (such as the Insta360 ONE X2 or GoPro MAX) can achieve good resolutions and often due to the smaller size of these types of camera do make it easier to set up and use in reduced spaces. Most of these cameras can also be controlled remotely using a mobile phone app, which is a great way to stay hidden from the action.

Multi-lens

As we add more lenses each is required to capture less of the total scene. This means each individual portion of the video sphere can be of higher quality, with less distortion at the edge of the frame, but with increased complexity required in the stitching process, more 'stitch lines' (for example, areas where 2 lenses overlap in their contribution to the final video sphere), and more data to collect and process.

Another common advantage of multi-lens 360 cameras is they can capture footage at higher resolutions and in 3D via a slightly different viewpoint of the scene being captured simultaneously to allow for both a left eye and right eye perspective. A higher resolution will give a more comfortable experience to the viewer (particularly in VR) but be warned, the file sizes you will experience from shooting with 6 lenses, like the below Insta 360 Pro 2, will mean big hard drive space needed and a powerful system for any post-production stitching.

The Insta360 Pro 2 has 6 lenses and a friendly robot face

Multi-camera rigs

Similar to multi-lens 360 cameras where each lens serves a video sensor and results in an individual video file for each; multi-camera 360 rigs do the same, but each camera is completely autonomous. This is how 360 video footage was captured during the earlier days of 360 filming and has become much less common today. Many hours have been spent, and sometimes lost, stitching from these cameras – however it was a good way to learn the good, bad and ugly side of 360 production.

A Yi360 camera being used to film a 'Stop before you block' training scenario

3D

As previously mentioned, some multi-lens cameras capture sufficient information per lens/camera to cover both a left eye and right eye view of a scene at the same time (and 3D is an option often selectable as a recording format on the camera). It is worth noting that filming in 3D has both plus and negatives, but there is one benefit even if you are not planning for the viewer to see the final footage in 3D. This is because the overlap between the individual lenses is greater which typically eases the stitching process and results in better looking end results.

VR180

An often-overlooked format and one that has struggled to gain real traction, despite some fanfare and earlier pushes through social media platforms, is VR180 or 180-degree stereoscopic video. This is the process of using 2 fisheye lenses mounted side-by-side instead of back-to-back such that the final content can be viewed in 3D and capturing a wider image, but the coverage is limited to a 180-degree FoV. Whilst it can initially be easy to dismiss this format as being less immersive, the resultant 3D effect is typically more realistic, and due to the close proximity of the 2 lenses, it is possible to get much closer to the subject you are filming without running into 'parallax' issues when stitching. This format proved useful for recording perspective-based work, where capturing a point of view would benefit from a wider image and where a 360 camera would not be suitable – the extra width of the image offering much to consider around the point of view periphery. This format however, as alluded to, has struggled for uptake with some camera manufacturers pulling out of this market.

SimMan enjoying wearing a side-by-side GoPro 3D rig for perspective video

4. What about sound?

Stereo

The simplest form of audio track in VR and 360 videos is the familiar stereo track where a separate, synchronised, audio track is played to the viewer in each of their ears. This will be a familiar method to those who are involved in video production. The limitation of this approach is that as the viewer turns their head in the VR headset they instinctively expect the sound to adjust accordingly, for example, if they were to turn 180 degrees and nothing in the scene they are viewing has physically moved, they instinctively expect what they were previously hearing in their right ear to now be in their left ear and vice versa.

Ambisonics

Ambisonics is a full-sphere surround sound format: in addition to the horizontal plane, it covers sound sources above and below the listener. Ambisonics is a method for recording, mixing and playing back 3D 360-degree audio. This allows VR content producers to give their audience an experience whereby the audio matches what they're seeing; with both adjusting in line with the direction the viewer is looking. Some modern 360 cameras have on-board or 'built in' 360 audio recording capability, which is useful for quick content capture but may not have the quality desired versus using a dedicated microphone, such as the Zoom H3-VR audio recorder. This process, though more immersive for the final experience, can take a bit of extra time to get right.

The basic approach of ambisonics is to treat an audio scene as a full 360-degree sphere of sound coming from different directions around a centre point. The centre point is where the microphone is placed while recording – a good breakdown explanation of this can be found here.

Insta360 Pro 2 with a ZOOM H3-VR audio recorder mounted as a 'hat'

Other audio sources

In addition to capturing audio from the scene, you may want to think about other ways you are planning to incorporate audio for the experience, and whether this will be done at a later stage, such as recording a stereo voiceover for narration.

5. So, what does this all mean for video production?

- more immersive content (when shot right)
- capturing previously missed or unseen things
- new technical considerations throughout the production process
- new challenges
- new opportunities
- lots of things for us all to learn

There can be many points to consider when capturing VR 360 video footage (some examples are listed below) but the most important thing when getting started is to keep things simple, concise and relevant.

Patient perspective captured for communication training during COVID-19 simulation

- Whose perspective or point of view do you want your audience to take?
- How long can you expect to hold your audience's attention? Think about duration of the scene and comfort – is the camera going to be still and positioned well?

- Is there a specific lesson, insight or key outcome you need your viewers to learn/discover?

- Is your story best told in a single linear thread, or do you want your viewers to arrive at different outcomes depending on choices they make? This might be particularly useful if you are encouraging a debrief element

- Where do you want your audience to look and how will you help direct that attention in the 360 space?

- What camera and audio settings to use

6. With simplicity in mind, why not start by following these simple considerations for filming:

Keep the camera stable

While newer 360 cameras offer incredible image stabilisation, 360 video arguably works best when you simply place the viewer into a specific location/scenario and let them observe. Fast camera movement can work negatively through 2 main reasons:

- it isn't often comfortable for viewers watching moving, fast paced content using VR headsets, so think about comfort for your audience

- it can distract the viewer, not giving them opportunity to explore and this often causes lower levels of immersion (agency removal) when they are concentrating just on the action in front of them.

A support system/stand will also help those in front of the camera to concentrate on the environment and activities by not getting too distracted from a moving or intrusive camera, which will yield a better performance from them. A traditional video tripod isn't the most suitable way of stabilising the camera due to how wide the tripod legs spread, which isn't attractive to look at in the 360 footage. Instead consider a solid duty lighting stand or a specialist 360 support system, like the Manfrotto range that have a differently positioned way of using legs to act as a tripod.

Using a heavy duty light stand makes it easier to cover up the legs in the edit as they are positioned further down versus a normal video tripod

Position the camera at eye level

Typically, it is best to set the viewpoint at the most natural position possible. If you elect to play with this rule it is best to go higher (becoming observational) rather than lower with the camera positioning. For lower camera angles, be aware that positioning the camera down low may make some viewers feel uncomfortable, intimidated, or simply prevent them from paying attention to the action and information you are trying to share with them.

By meeting eye level with the camera, you create an engaging and more natural way for the viewer to associate themselves within the immersive content, the camera taking on a perspective that meets eye contact, etc. Again, think carefully about comfort for your audience.

High camera positioning tends to give a 'fly on the wall' perspective which can be useful for enabling the viewer to see a summary of all the action (for example, observing a medical simulation), but this typically reduces both the sense of engagement with those in the scene and detracts from the emotional and narrative connection. Think about what you want to achieve and if you desire your audience to feel like they are part of the story or whether you are wishing just to capture a lot of activity. A helpful tip for immersion; treat the camera as a person or as another observer in that scenario.

Make sure the scene is set to maximise the 360 environment

Even when most content takes place within 180 degrees (for example, for some medical training practice or simulation scenarios focused primarily on activities around the manikin) try and position the camera in the position of an observer involved in the scene and position things like trays, equipment or other things sensibly distanced around the camera. Add interest and even occasional interaction around the space to utilise 360 degrees (perhaps a fleeting interaction) but be aware of making the whole space too busy throughout, as this will be too much for the viewer to digest and take in and detract from any main learning points.

When shooting think about the perspective you want. The camera for the most part should be considered as a person observing the scene as closely as possible (an invisible participant). The camera can also be put into first person using a head mount or having the actors/participants talk directly to the camera can be a very powerful way of involving the viewer – but keeping the camera as stable as possible for this is very important for post viewing comfort.

Do not position interactions and objects too close to the camera. Due to parallax issues (making it difficult to have a clean stitch between lenses) as well as feeling like an invasion of personal space (even the virtual space for your audience) it is good practice to leave some room around the camera, enhancing both the user experience and maximising the visual area of what the camera is capturing (more on this below, but treat the immediate area around the camera area as a minimal or even no go space).

Positioning the camera to capture the main activity but leaving room for movement and 'safe space'

7. Planning your scene

A good way to place the camera and map activity from it is to use a combination of storyboards and a bullseye diagram with circled areas that describe the camera's position, a no go safe zone, a main activity area and then spanning out to a viewer's peripheral vision. Imagine this mapped out on the floor from the position of the camera, or in pre-production, draw this out for each scene to help consider the following:

Minimum stitching distance (no go zone)

An important circle to draw or visualise on the diagram is the distance away from the camera that objects must be to avoid parallax issues with stitching or getting too close to feel like someone's 'virtual' personal space.

The specifications for every 360 camera should indicate what distance this is, and the distance will vary for when objects are directly in front of a lens, versus being between them (for example, on a stitch line). Try and perform your own tests to find this out and see the result. In my experience, a rule of thumb would be a minimum of 60cm away from the camera.

Initial Field of View (FoV)

Which direction should the camera's main lens face? While this can be adjusted in post-production in a process called 'offset', it is better to film with the camera 'pointing' in the direction you want the viewer to be shown at the start of the scene.

Intended FoV

For very structured or planned films, if the intention is for the viewer to follow specific action that is moving in the scene, or for them to change the direction they are looking before the scene is 'cut', a main FoV area could be shown on the bullseye diagram using lines that demonstrate the main area being captured outward from the central camera point. This could also be detailed in any storyboarding using movement lines of actors or objects of attention. For very natural observational 360 video, for example, where you would want to record a scenario as normal to everyday practice as possible, this amount of detail is likely not be required. Just be sure to place the camera in a safe (so it doesn't get knocked) but useful point in the scene.

Object and character movement

Again, for the more structured approach to certain types of 360 films, it is useful in pre-production to name actors in storyboards using their on-screen character names. Actors should be shown in plain view with arrows indicating the path of any movement they make throughout the scene. The arrows should show the full extent of their movement rather than a general indication of the direction they will set off in (there is no stage exit left or right in 360). This isn't necessary for observational filming.

Light sources

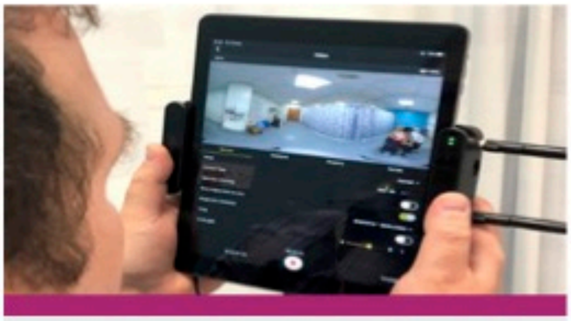
The position of all light sources and their type, for example, sunlight, lamp, strip light, etc., could be plotted on the bullseye diagram and within any storyboards – particularly artificial/deliberately placed ones. If the scene is already well lit or if you wish to keep it authentic, it is often best to work with the current environment or natural lighting to avoid introducing other elements that might be difficult to hide in 360.

Previewing the image – connect your phone/device and see what the camera sees

Most 360 cameras will allow you to preview what the camera is seeing using a companion app on your phone or other smart device such as a tablet. Once you have physically set everything up, take time to check how things actually look to the camera. The first thing to double check is the 3 points above re: camera positioning. Scroll around your footage to check everything looks stable, level, and free from stitch lines crossing faces, objects or other key areas within the scene.

This is also a good opportunity to check how big or small your actors look in the scene. Think about how intimate you need your 360 experience to be to the viewer and be confident in taking the time to move the camera or actors until you get this right. This is one thing you cannot 'fix in post' with 360 footage.

Check the lighting – is the sky, or areas around overhead lighting, windows, etc. completely burnt out? This might be affected by how close a camera is positioned to that light. Some companion apps will let you correct and change the exposure of the scene.



Remote viewing preview of footage also allows others to see the shot

8. Directing your scene

Direct your talent

Remind those being filmed what you want them to do, and how long you want it to take. Describe the intention or walk them through it and let them practice if need be. Consider this more like theatre than traditional filmmaking (unless you are a budding Mike Leigh) as you will typically be capturing longer scenes than traditional filmmaking. As a 360 filmmaker, you will need to be away from the scene while filming takes place (or risk being seen) so be prepared to talk through the activity before you begin filming.

Encourage those you are filming not to look directly into the camera unless the storyline specifically calls for that sort of interaction or camera perspective with the viewer. Remember this is a powerful mechanism of engagement, but unless this is otherwise part of the narrative this can detract the viewer from the more observational nature of 360-degree content – such as recording a simulation or career shadowing film.

If you are planning to create quite a structured film, guide your talent on the extremes of how close and how far you want them to be from the camera by giving them physical and visual references for these points if any such options exist in your scene. For example, do not go past that chair to the left of camera, or do not lean back past the windowsill.

Go hide

360 cameras see **everything**. This means you need to make sure you, and anyone else you do not want in the film are well hidden - ideally out of the room (though I have hidden under beds, behind pillars and even acted as an extra in scenes in order to help direct).

Removing unwanted objects or blurring sensitive information is possible later on, but this can be time-consuming and can easily be avoided by checking your scene properly first. Best to get it right during filming rather than trying to fix in the edit.

Shout 'ACTION!'

Shouting action or clapping your hands might feel cliché but genuinely is really helpful, as it not only tells everyone the camera is filming and the scene should begin, but is a useful point to help synchronise the audio and video in the edit (if the 2 have been separately recorded). A useful tip; count to 5 before doing so. You can always cut off this part of the footage in the edit, but it allows time for everyone to settle and focus right before the scene begins.

If you are filming more than 1 scene or scenario during the shoot, it is also worthwhile saying or showing on a piece of paper (or clapper board if you have one) the scene and shot number before commencing the action. This tends to be for more advanced shoots or long days where shot logging multiple scenes will aid the post-production process, but it is a good practice to get into.

During the take, use the preview mode on your phone or other device to keep an eye on the action as best you can. This isn't always possible as playback can sometimes be slow/juttery or delayed but you might spot something that requires you to call a halt to proceedings before the whole scene/shot has played out and noticing this early can save a lot of time and frustration. It is also a good way to share what is being filmed with others involved in the project to make sure what is being captured is accurate. It is also a great way to help explain how 360 video works (there is always lots of interested people who want to engage).

Live previewing the filming from a different room with the AHP occupational therapy team

Shout 'CUT!'

Again, it is important to make it clear when footage is being captured and these start and stop instructions give confidence and organisation on set, but in practical terms it also means anyone hiding knows when they can move again without fear of appearing in shot.

Review your footage before moving on. It is always better to double check and film again than assume you have got what you need.

Check your recording format and camera settings

Record at the highest resolution possible in order to maximise quality for the viewer when watching back (5.7k resolution is currently the top spec on double lens cameras). This is particularly important for details in a film but also the higher the quality you can achieve, the better and more comfortable the experience for those watching it using VR headsets.

Some cameras have an auto stitch function, which means the camera will stitch the images from the lenses together, meaning you have a 360 video created relatively quickly and ready to go. This is useful for footage which requires a quick response, perhaps you are filming a scenario that you would like to use in a debrief soon afterwards, or a live viewing of an event. However, an auto stitch will often be an option with a reduced resolution on the camera, or, as often is the case, the stitch will not be as neat or accurate as what it would be if done in the post-production phase.

So think about the purpose of your 360 videos – is it for quick review or prototyping, where the ease and speed of an auto stitch is more important than the quality, or is this a video that you can go into more detail and time with, that requires some post production work?

[ADVANCED] Check what 'white balance' setting you are using. Auto is fine in many cases but look at peoples' faces, and the colour of white objects in the scene. If there is a bias towards any colour then manually choose a white balance setting to match the most dominant light source in the scene.

[ADVANCED] Keep your ISO level to the lowest possible without the scene becoming dark or motion becoming blurred.

[ADVANCED] If you have control over shutter speed, make sure it is one over twice the FPS setting – for example, 1/50th for UK when filming at 25FPS, or 1/100th for 50FPS.

Hopefully some of these tips will be helpful for you to begin your own exciting 360 content journey. You may like to start with familiarising yourself with 360 video by utilising your camera's auto functions to get a feel of the process, and if you are using auto-stitch or your smartphone to stitch and do some basic editing, you can begin sharing your experiences quite quickly.

In 'How to Develop a Virtual Reality (VR) 360-Degree Video – Part 2: Stitching and Editing', we will delve into the process of post-production and talk about the software and options you have to enhance your 360 videos further – even making them interactive.

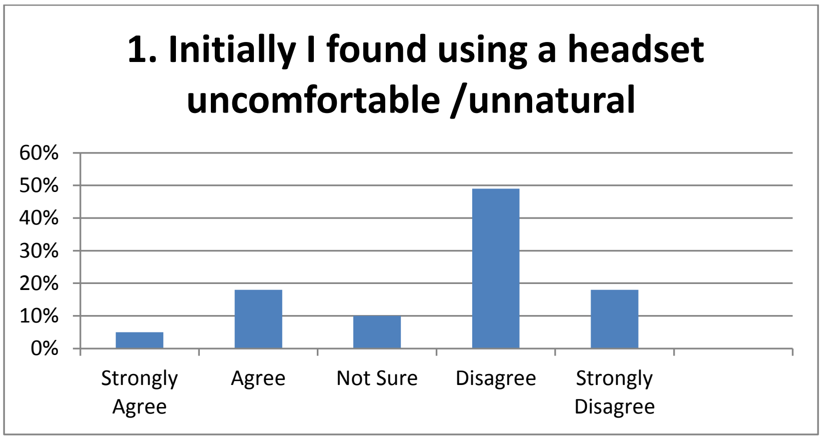
For more information, please contact
simimmtech@hee.nhs.uk

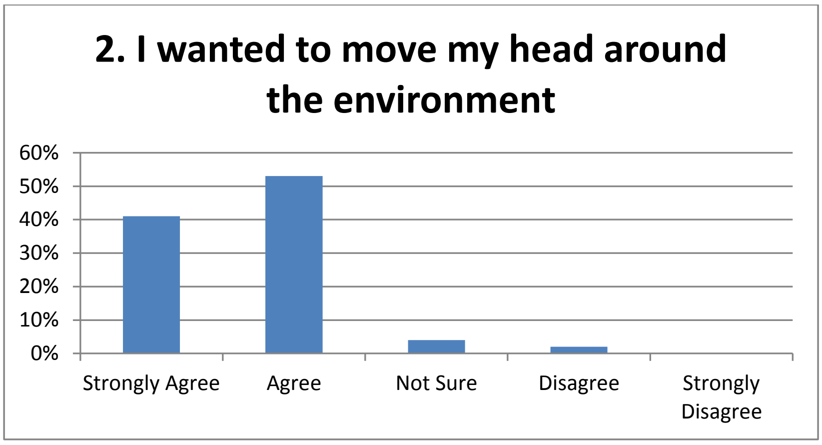
TEREMA VR FEEDBACK (First 100 Participants 2016-2017)

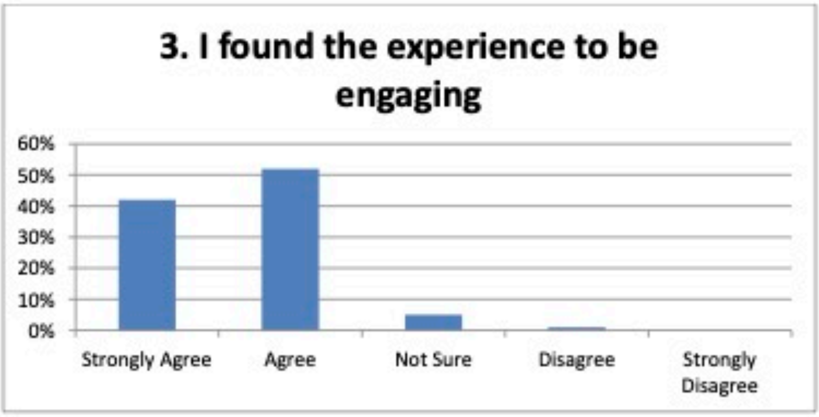
These results have been gathered from an 11 point questionnaire which was supplied to our first 100 participants of the TEREMA course following the VR experience.

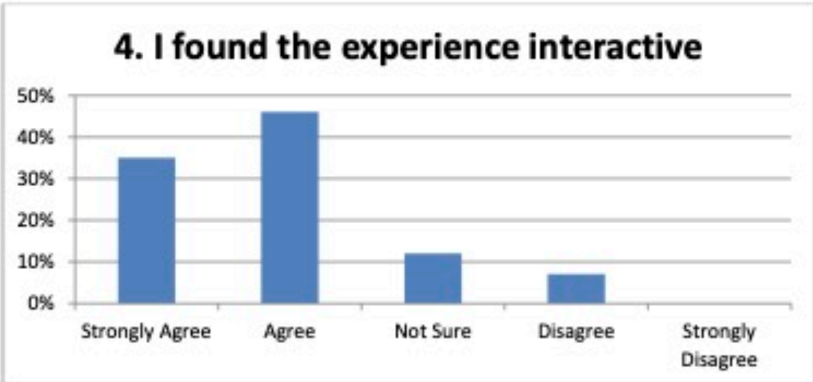
The VR experience entails the viewer using a cardboard headset to view a 360 degree video of a communication scenario in an operating theatre. The headsets and film is controlled from a facilitator ipad, so the film begins and ends on all headsets at the same time. During the immersive film, the viewer has the ability to look around the complete 360 degree scene and notice key learning points and character narratives within the sequence. Upon completion of viewing the film, a group discussion takes place, led by the module teacher.

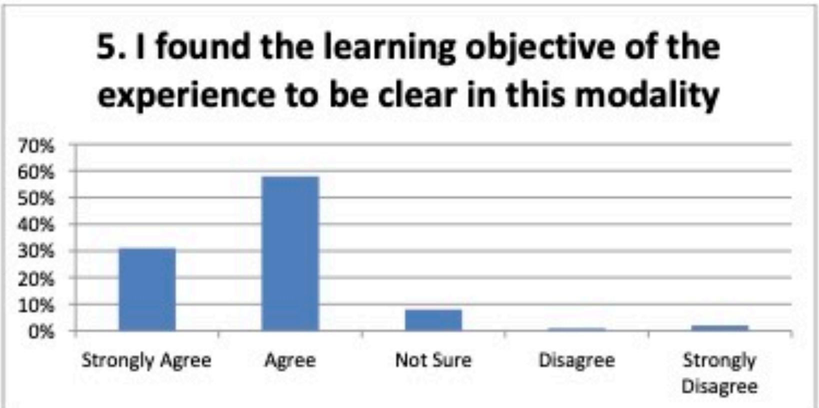
Out of the 100 participants who have experienced the VR intervention so far, three had chosen to watch the 360 degree film on a projected screen instead of through a VR headset. Two of these cases have been due to sight and focus concerns (compatibility with glasses) and one individual who felt they would rather watch on projected screen due to a previous unrelated experience of VR causing nausea.

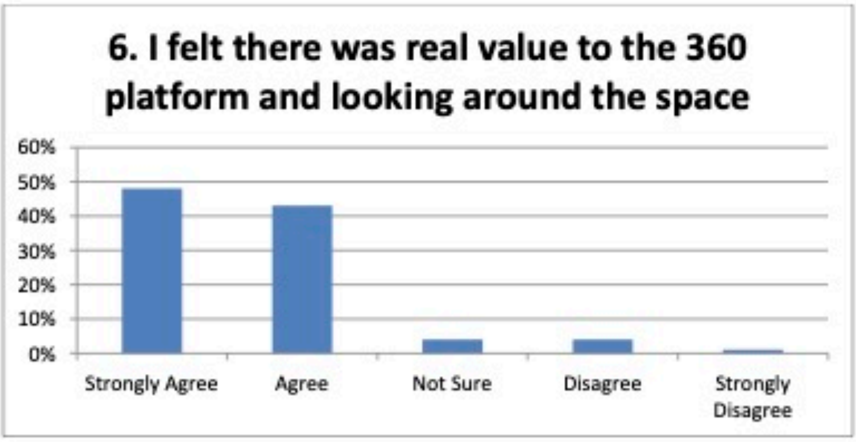


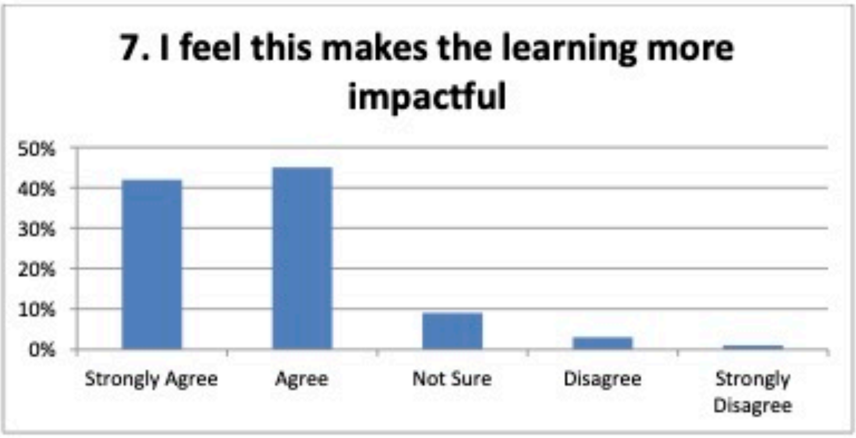


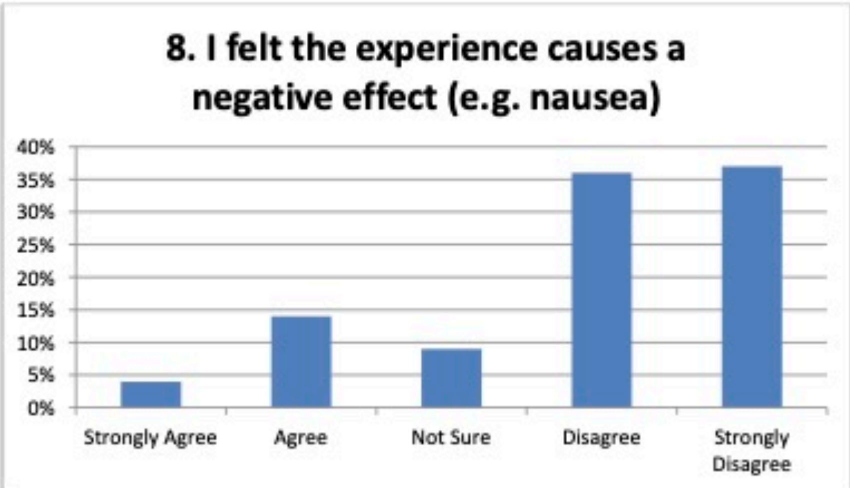

3. I found the experience to be engaging
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Not Sure
Disagree
Strongly Disagree

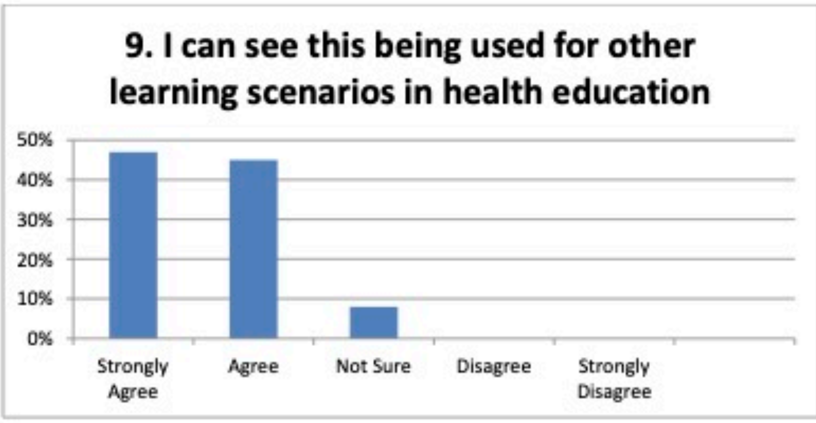

4. I found the experience interactive
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Not Sure
Disagree
Strongly Disagree

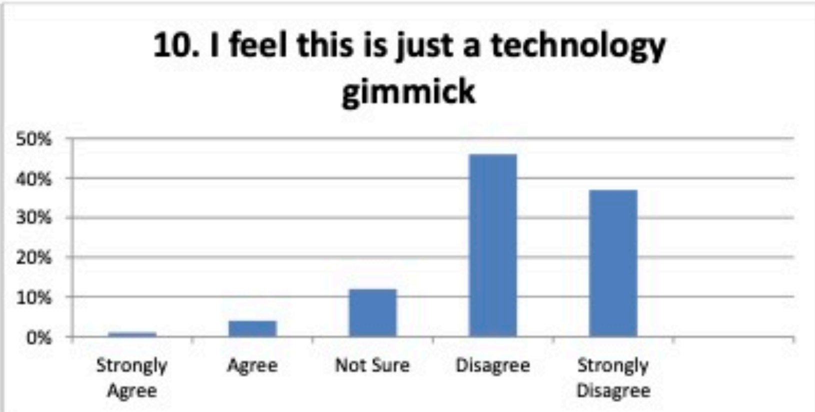

5. I found the learning objective of the experience to be clear in this modality
70%
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Not Sure
Disagree
Strongly Disagree

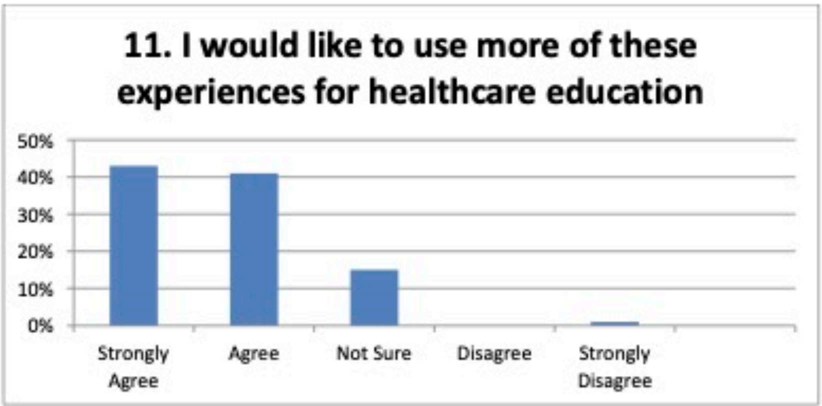

6. I felt there was real value to the 360 platform and looking around the space
60%
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Not Sure
Disagree
Strongly Disagree


7. I feel this makes the learning more impactful
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Not Sure
Disagree
Strongly Disagree


8. I felt the experience causes a negative effect (e.g. nausea)
40%
35%
30%
25%
20%
15%
10%
5%
0%
Strongly Agree
Agree
Not Sure
Disagree
Strongly Disagree


9. I can see this being used for other learning scenarios in health education
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Not Sure
Disagree
Strongly Disagree


10. I feel this is just a technology gimmick
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Not Sure
Disagree
Strongly Disagree


11. I would like to use more of these experiences for healthcare education
50%
40%
30%
20%
10%
0%
Strongly Agree
Agree
Not Sure
Disagree
Strongly Disagree

Please note, this was for a separate research study carried out at Plymouth University than the core practise and use of Immersive 360-degree video on the Torbay Hospital site.

PLYMOUTH UNIVERSITY **FACULTY OF HEALTH & HUMAN SCIENCES**	**Application No:** (for FREC use)

RESEARCH WITH PLYMOUTH UNIVERSITY

Faculty Research Ethics Committee

APPLICATION FOR ETHICAL APPROVAL OF RESEARCH

Title of research: *Evaluation of the Patient VR application*

1. Nature of approval sought (Please tick relevant boxes)

(a) PROJECT*: [X] (b) PROGRAMME*: [ ]

If (a) then please indicate which category:

- Funded research project [ ]
- MPhil/PhD project [ ]
- Other (please specify): [X] Unfunded

**Note: In most cases, approval should be sought individually for each project. Programme approval is granted for research which comprises an ongoing set of studies or investigations utilising the same methods and methodology and where the precise number and timing of such studies cannot be specified in advance. Such approval is normally appropriate only for ongoing, and typically unfunded, scholarly research activity.*

2. Investigators/Supervisors

Principal Investigator (staff)*:

Name: Dr Arunangsu Chatterjee

Email: arunangsu.chatterjee@plymouth.ac.uk

Address for written correspondence: C512, PSQ, Plymouth University, UK

Other staff investigators:

Miss Payal Ghatnekar

Mr Nick Peres

Dr Daranee Boon

Dr Matt Halkes

Dr Daniel Zahra

Dr Julian Archer

Director of Studies/other supervisors (only where Principal Investigator is a postgraduate student):

Please indicate Department of each named individual, including collaborators external to the Faculty:

**Note: Principal investigators are responsible for ensuring that all staff employed on projects (including research assistants, technicians and clerical staff) act in accordance with the University's ethical principles, the design of the research described in this proposal and any conditions attached to its approval.*

3. Funded Research

Funding body (if any)

Is there a potential conflict of interest in the research arising from the source of the funding for the research (for example, a tobacco company funding a study of the effects of smoking on lung function)?

Yes ☐

No ☒

If the answer to the above question is yes, please outline the nature of the potential conflict of interest and how you will address this:

4	**Duration of project/programme with dates*:** April 2017-April 2018 **Approval is granted for the duration of projects or for a maximum of three years in the case of programmes. Further approval is necessary for any extension of programmes.*
5.	**Research Outline:** *Please provide an outline of the proposed research. Note that this should be sufficient to enable the committee to have a clear understanding of the project. It should normally be a maximum of 2,000 words. While this should be written in a way appropriate for your research you should address the following areas:* *Background: situating the study within its research area, including references, and, where appropriate, within relevant policy and practice developments or professional agendas* *Aims/Key Questions: should be stated clearly, including how the researcher anticipates their fulfilment will move forward knowledge and, where appropriate, policy or practice* *Recruitment: of participants – including where and how participants will be recruited; any inclusion or exclusion criteria; justification of the sample size* *Methodology: the application should contain a clear outline of methodology, including both data collection and data analysis processes. This should include a description, including references of the particular methodology being used;*

how it will be employed in relation to this study; which techniques of analysis will be used once data are collected and how this will be applied to the particular data set.

Background

Empathy is one's ability to put oneself in the place of another person via "transposition or mental projection" (Jackson, Michon, Geslin, Carignan, & Beaudoin, 2015). Decety & Jackson (2004) have defined empathy as "the naturally occurring subjective experience of similarity between the feelings expressed by self and others without losing sight of whose feelings belong to whom". Ickes (1993) have explained empathy to be a complex form of psychological inference in which observation, memory, knowledge and reasoning are combined to gain insights into other's thoughts and feelings. Empathy is complex because it is a multi-dimensional concept, making it elusive and hard to define or measure (Fields et al., 2011; Jackson et al., 2015).

Within the medical context of patient care,(Olson, 1995, p. 151) has defined empathy as "the skill of understanding what a patient is saying and feeling, and communicating this understanding verbally to a patient". Fields et al. (2011) have expanded upon Olson's definition of empathy by focusing on the cognitive attributes that involve an understanding of patients' experiences combined with the capacity to communicate the knowledge with an intention to provide help to the patient. It has been suggested by (Alligood, 1992; Nerdrum, 1997; Hojat et al., 2002; Fields et al., 2011) that empathy within healthcare can be developed through basic and graduate professional education and/or supported through focusing upon the education efforts of practitioners. Davis (2009) explains that often medical students become less empathetic as they progress through their education. According to Davis (2009), formulating empathy during a clinical encounter is dependent on the practitioner's ability to relate effectively with the patient's experiences. In order to relate with a patient's experience effectively, the provider must imagine what it would feel like to be in the exact same situation as the patient. Connecting with the patient on this level can stimulate empathy in the provider (Davis, 2009; Olson, 1995).

Empathy is dependent on the mental simulation of the subjectivity of others, which can be initiated automatically or intentionally (Decety & Jackson, 2004). Virtual reality (VR) is one such medium that can be used to intentionally simulate others to experience empathy via experiencing someone else's experiences in first person view. The VR intervention used in this study is the Patient VR system designed by Plymouth University PhD candidate, Nick Peres. The app offers a series of unique immersive cinematic experiences from the patient perspective for healthcare education in humanistic skills. Patient VR is built upon the concept of representing the patient's voice in medical education and training, in order to address the important gap in humanistic skills such as communication and empathy. The Patient VR experience is based on the understanding that cinematic theory can help the viewer in understanding how visually captivating characters, stories and perspective can have implications on reflective learning. The Patient VR offers a number of filmed scenarios from simulated first person patient perspectives that can be viewed in a 360-degree environment. These experiences employ extended cinematic aspects to offer the user a visual and emotional demonstration of the power and learning outcomes, which can be attained from viewing a serious life event from the patient's eyes. Furthermore, these experiences might be able to teach the user humanistic skills such as communication, eye contact and genuine empathetic gestures, which can play a significant role in the patient's treatment process.

Aims and Objectives

The primary aim of this study is to explore the effects of Virtual Reality to enhance empathy education among undergraduate medical students OR role of Virtual Reality as an empathy enhancement tool for undergraduate medical students.

Research objectives

1. Evaluate the implications of VR on undergraduate medical student empathy measures
2. Investigate and compare the usability and fidelity of two HMDs used in VR intervention (Google Cardboard and Samsung Gear VR)
3. Contribute to the overall knowledge on VR based TEL interventions on empathy education

Methodology

The research will involve a randomised controlled trial design; where in volunteers will have equal opportunities to be selected to participate in either intervention.

Recruitment of sample

Medical students from Y3 and Y4 will be offered the opportunity to participate in the research. Participation will be voluntary and we will seek explicit consent from each participant using the participation information sheet and consent forms. We are hoping to recruit at least 40 participants. The participants will be divided into 2 equal groups G1 and G2 (control and experimental). Group G2 will be further divided into 2 equal groups of 10 participants each. Participants in G2 will swap places upon completion of the intervention to experience the same intervention again using a different VR head set. Random sampling methodology will be employed to separate the participants into two groups with equal numbers of participants.

Research Experiment Overview

Both, the experimental and the control group will first undertake an Empathy Test based on the Jefferson Physician Empathy scale (JPE; Appendix 1). This test will be emailed to the students a day before the experiments are scheduled. On the day of the experiment, both groups G1 and G2 will participate in an Empathy Self Assessment (EmAssess1) based on trigger statements. Upon completion of the test, both groups will proceed with experiencing either of the two interventions. When G1 and G2 have finished experiencing the interventions, both groups will proceed to undertake an Empathy Self Assessment (EmAssess2), which will be followed by focus groups. Group G1 will conclude at this stage, however, G2 will experience the intervention one more time with their headsets swapped. Upon completion, all participants in G2 will undertake perceptions/opinions toward VR HMD fidelity and perceived value test based on the Technology Acceptance Model (TAM3) (Appendix 2). Table 1 displays the research design used.

Table 1: Research Design

Groups	Research phase 1	Research phase 2		Research phase 3			
G1	Em T1 (20)+ EmAssess1	Forum Theatre intervention		EmAssess2			
G2	Em T1 (20)+ EmAssess1	Gear VR(10)	Cardboard (10)	EmAssess2	Cardboard (10)	Gear VR (10)	TAM3 T1 (20) + Nominal group (6)
Teaching team				Semi structured interviews with the teaching team			

(Em T1=Pre-experiment Jefferson Physician Empathy Scale; EmAssess1= Empathy self-assessment trigger test pre-experiment;EmAssess2= Empathy self-assessment trigger test post-experiment; TAM T1= Technology Acceptance Model post-experiment test)

Participants will be separated into G1 and G2 based on random selection. Both groups will have 20 participants each.

- G1 will get the opportunity to try both Gear VR and Cardboard when G2 finish the intervention.
- G2 will get the opportunity to experience the theatre intervention at a later date of their choice.

Outcomes to be tested

- Em T1 to get insights into base level empathy behaviour
- Possible changes in EmAssess1 vs EmAssess2 for both G1 and G2, individually
- EmAssess2 (G1) vs EmAssess2 (G2)
- TAM3 T1 (Fidelity and perceived value of Google Cardboard vs Gear VR)
- Nominal group to get further insights into user perceptions and opinions of both Google Cardboard's and Gear VR's usability and fidelity
- Semi-structured interviews with the teaching team to get insights into their opinions and perceptions of integrating the VR intervention within the curriculum

Research Phase 1

Both groups will participate in an Empathy Test 1 (Em1) prior to participating in the intervention experiences. The test which will be based on Jefferson's Patient Empathy Scale (Appendix 1) will be emailed out to the students. This test will establish the base levels of empathy amongst all the participants. On the day of the experiment, both groups will undergo an Empathy Self Assessment based on trigger statements (EmAssess1) (Appendix 3).

Research Phase 2

Intervention for G1

Participants in G1 will experience the forum theatre intervention. Actors in the forum theatre will put on a performance that will be similar to the case scenario used in the VR intervention. Upon completion of the performance, the participants will have an opportunity to have an open discussion with the lecturer.

Intervention for G2

Participants in G2 will be divided randomly into two equal groups of 10 each. One group will get to experience the VR intervention using Google Cardboard and the other group will experience the same intervention using Samsung Gear VR. Upon completion of the experience, the participants will have an opportunity to have an open discussion with the lecturer.

Post intervention both G1 and G2 will undergo the Empathy Self Assessment based on trigger statements (EmAssess2). Having completed the EmAssess2, G1 will have the opportunity to experience the VR intervention, while G2 will participate in research phase 3. G2 will have the opportunity to experience the theatre forum intervention at a later date.

Research Phase 3

Swapping headsets

In phase 3, the 20 participants from group G2 who were divided into groups of two (Google Cardboard and Samsung Gear VR), will swap their headsets and experience the intervention once again. The participants will have another opportunity to have an open discussion with the lecturer upon completing viewing the VR video.

TAM3 questionnaire

Post intervention, G2 will undergo a TAM3 test designed to assess perceptions/opinions of fidelity of the two VR headsets. Upon completion of the TAM3 test, 6 randomly selected participants will proceed onto participating in the nominal group.

Nominal Group

We will try and recruit 6 separate students from the experimental group who upon their voluntary participation, will participate in a nominal group research experiment. The nominal group will assist in triangulating the data regarding usability and fidelity.

Semi Structured interview with teaching team

Semi-structured interviews will be conducted with Dr. Daranee Boon and ANOTHER PERSON. The interviews will be approximately 30 minutes long. The purpose is to gain insights into the teaching team's perceptions and opinions toward the VR app.

Data Analysis

The data generated by the TAM3, trigger statements, and Jefferson Physician Empathy (JPE) scale will be a combination of quantitative and qualitative data, though the latter will be coded numerically for the purpose of analysis. The quantitative data from the TAM3 and JPE will be numeric Likert agreement scales. Trigger statements will be responded to with short text-based responses, which will then be coded by independent reviewers and scored on a scale of 0 (aggressive or derogatory response) to 4 (facilitative).

The JPE will be completed prior to undertaking the intervention. This data will provide a baseline assessment of the participants' empathy. Empathy assessment based on the trigger statements will be presented before (T1) and after (T2) the intervention in order to allow an evaluation of the impact of the interventions on empathy. Analysis of this data will begin with correlation and partial-correlation analyses of T1 and T2 trigger statement scores. In the partial correlation, JPE scores will be factored in to control for baseline empathy. Analyses of change in empathy will be conducted both within and between groups; differences in empathy at T1 and T2 between G1 and G2, and changes in empathy between T1 and T2 within each group. This will be achieved by conducting the above mentioned correlational analyses on pre- and post-intervention scores for G1 and G2, and following up with an analysis of variance in which the effects of Group (G1, G2) and Time (T1, T2) factors on Empathy scores are assessed. This will allow us to evaluate the effect of time on empathy, as well as compare the effect of the interventions on empathy. Additional analyses will be conducted as appropriate and where further exploration of emerging patterns is required.

In addition to this, G2's responses to the TAM3 with respect to the GearVR and Cardboard will be compared in a similar way. Overall TAM3 and subscale ratings will be compared between the GearVR and Cardboard groups using repeated-measures t-tests or equivalent analyses as data allows. Psychometric analysis of the TAM3 as a scale (e.g. reliability, and sensitivity) will also be undertaken to ensure its effectiveness and applicability to the current setting and for comparison to previous studies utilising similar methodologies.

These analyses combined will allow us to address the overall aims and intended outcomes of the research.

Max 300 words

References

Alligood, M. R. (1992). Empathy: The importance of recognizing two types. Journal of Psychosocial Nursing, 30(3), 14-17.

Danish SJ & Hauer AL (1973). *Helping Skills: A Basic Training Program.* New York: Behavioral Publications

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Jackson, P. L., Michon, P.-E., Geslin, E., Carignan, M., & Beaudoin, D. (2015). EEVEE: the Empathy-Enhancing Virtual Evolving Environment. *Frontiers in Human Neuroscience*, *9*(March), 112. http://doi.org/10.3389/fnhum.2015.00112

Nerdrum, P. (1997). Maintenance of effect of training in communication skills. A controlled follow-up study of level of communicated empathy. British Journal of Social Work, 27(5), 705- 722.

Olson, J. K. (1995). Relationships between nurse-expressed empathy, patient-perceived empathy and patient distress. Image: Journal of Nursing Scholarship, 27(4), 317-322

Pike, A. W. (1990). On the nature and place of empathy in clinical nursing practice. Journal of Professional Nursing, 6(4), 235-241

Winefield, H. R., & Chur-Hansen, A. (2000). Evaluating the outcome of communication skill teaching for entry-level medical students: Does knowledge of empathy increase? *Medical Education*, *34*(2), 90–94. http://doi.org/10.1046/j.1365-2923.2000.00463.x

(*Please expand to requirements*)

6. **Where you are providing information sheets for participants please INSERT a copy here. The information should usually include, in lay language, the nature and purpose of the research and participants right to withdraw:**

Information and consent form for the Virtual Patient system experiment

Introduction

The Patient VR application has been has been developed out of the PhD research project of Plymouth University's student Nick Peres. The application offers a 360 degree view of the healthcare experience from the patient's point of view. The videos play on a VR headset, when the user puts the headset on, the experience lets the user visualise the situation as if they were themselves the patient. This first person perspective is expected to enhance the user's communication and humanistic- skills such as empathy, which is turn are expected to have implications on the treatment of the patients.

Right to withdraw

You have the right to withdraw at any time from the experimental process. This includes withdrawing data from records after the experiments have taken place. Once this has occurred any data related to the participant will be permanently deleted and removed from any future publications. This will not affect any research published prior to withdrawal. To exercise your right to withdraw please contact: arunangsu.chatterjee@plymouth.ac.uk

Protection from harm

Participants from both groups (G1 and G2) will have the option to experience the intervention they missed out on during the experiments. Furthermore, the participants' performance on the pre-and post-experiment empathy tests will in no way contribute or inform decisions regarding student degree performance.

Consent to participate

I …………… (your full name printed) give my consent to participate in the Patient VR experiment. I have read the information provided in this document and sought clarification from the research team where necessary. I understand my right to withdraw, the use that will be made of my data, and the measures that have been taken to ensure no harm or disadvantage to participants.

Signed……….

Date………….

7. Ethical Protocol:

Please indicate how you will ensure this research conforms with each clause of Plymouth University's *Principles for Research Involving Human Participants.* Please attach a statement which addresses each of the ethical principles set out below. Please note: you may provide the degree of detail required. Each section will expand to accommodate this information.

(a) **Informed consent:**

i. How will informed consent be gained?

ii. Are there any issues [e.g. children/minors, learning disability, mental health] that may affect participants' capacity to consent? If so how will these be resolved?

iii. *Will research be carried out over the internet? If so please explain how consent will be obtained*

Patient VR experiment

All participants will be required to complete a written consent form prior to joining the project. A Participant Information Sheet will also be provided that explains the purpose of the research and reiterates participants' right to withdraw.

No photographs of individuals or audio or video recordings will be taken during experiments. No personal data, except for name and email (through the app) will be recorded. The entire data set will be encrypted and stored in a secure server.

(b) **Openness and honesty:**

i. *How will you ensure that participants are able to have any queries they have answered in an open and honest way?*

ii. *Is deception being used? If so, please indicate which of the following is relevant to its use*

Deception is completely unavoidable if the purpose of the research is to be met	☐
The research objective has strong scientific merit	☐

Any potential harm arising from the proposed deception can be effectively neutralised or reversed by the proposed debriefing procedures ☐

iii. *(If deception is being used) please describe here why it is necessary for your research*

The aims and objectives of the project will be fully explained to participants on the participant information sheet. Any further information or clarification can be sought from the principal researcher, whose contact details are provided on the participant information sheet. No deception will be involved in this research. Consent for the Patient VR experiments will be requested for participation.

(c) **Right to withdraw:**

i. *Please indicate here how you will enable participants to withdraw from the study if they so wish [where this is not research carried out over the internet]*

ii. *Is the research carried out over the internet? If so please explain how you will enable participants' withdrawal.*

Participants will be made aware, both verbally and on the Participant Information Sheets, of their right to withdraw either themselves or their data at any point, without having to provide a reason for doing so or incurring any form of penalty.

Participants are informed on the information sheets that they have the right to withdraw at any time, and for any reason. An email address (arunangsu.chatterjee@plymouth.ac.uk) is provided as point of contact. A one-month cooling off period between experiments and any publication will exist to allow for participants to change their mind about their data included in the study, as outlined in the information and agreement form.

A database, linking the participant and their data (held separately), provides the link between recorded data and participant. This will be kept by Dr. Arunangsu Chatterjee (project PI) after the date of the project's completion. All participants will have the right to their data being removed from the experiment (though this will not affect any publications prior to withdrawal).

(d) **Protection from harm:**

Indicate here any vulnerability which may be present because:

- *of the participants (they may for example be children or have mental health issues)*
- *of the nature of the research process. Indicate how you shall ensure their protection from harm.*

Please note *- researchers contacting children as an aspect of their research must be subject to DBS/CRB checks. These can be arranged through Human Resources.*

Does this research involve:

Vulnerable groups	☐
Sensitive topics	☐
Permission of a gatekeeper for initial access	☐
Deception or research which is conducted without full and informed consent	☐
Research that will induce psychological stress, anxiety or humiliation or cause minimal pain	☐
Intrusive intervention (eg, the administration of drugs, vigorous physical exercise or hypnotherapy)	☐

This research will not involve any vulnerable groups.

Will your samples include **students whose coursework will be assessed by the researcher(s**) (for example you are recruiting students for your study which includes some that will be assessed by you as part of their degree/diploma)?

Yes ☐

No ☒

If **Yes,** please answer the following

(1) Student participation in research for pedagogic purpose

Where recruitment of the research sample involves participants who are being academically assessed by the researcher but whose participation forms part of the overall assessment for their degree/diploma

(i) does participation in the research form part of the students' own assessment as part of their degree/diploma (e.g. psychology students who can opt to participate in a research project as part of their assessment for their degree)?

(ii) If this is the case please describe how assessment follows from this research and alternative arrangements available for those who decide not to participate

(2) Student participation in research for non-pedagogic purposes

Where recruitment of the research sample involves participants who are being academically assessed by the researcher but whose participation does not form part of their assessment for their degree/diploma

*Please state where and how you will ensure students understand that their participation is entirely voluntary and that they can participate or withdraw at any time without prejudice to their relationship with the University or any staff, and without prejudice to their assessment of academic performance***.**

(e) **Debriefing:**

Describe how you will debrief participants

Once the experiment is over and post data analysis has been conducted the researcher will prepare a debriefing summary and email all participants the findings and any associated recommendations. The summary will also revisit the approach and why we did this study. The summary will include the email address of the PI for further clarification and discussions.

(f) **Confidentiality:**

How will you ensure confidentiality and security of information?

The data collected during this project will be labelled by reference numbers to protect the confidentiality of the participants. The participants' details will remain confidential to the research team. Participants will be ensured that their data and any direct quotes used in subsequent publications will be anonymous and not linked to their names in any way. The consent form and Participant Information Sheet will both contain this information. In line with the University's Research Ethics Policy, we will keep data generated in paper and electronic form securely, for a period of ten years after the completion of the research. We will not allow secondary use of the data without obtaining further consent from participants.

(g) **Anonymity**

How will you ensure anonymity of participants?

All data will be anonymised in all written, oral and communicated presentations of the experiment including any publications that may arise from the research. However, there will be a record (held separately to the data) of which subject corresponds to which data in order to provide participant withdrawal at any given time.

(h) **DBS/CRB Checks**

Do researchers require DBS/CRB checks? If so, how will this be managed?

No

(i) **Professional bodies whose ethical policies apply to this research:**

The project will be conducted in accordance with the BERA (2011) *Ethical Guidelines for Educational Research* and the host University *Principles for Research Involving Human Participants.*

8. Researchers' Safety

(a) **Are there any special considerations in relation to researchers' safety?**
No

(b) **If so what provision has been made *(for example the provision of a mobile phone, or a clear recording of movements)***

9. Declaration:

To the best of our knowledge and belief, this research conforms to the ethical principles laid down by Plymouth University and by the professional body specified in 6 (g).

Principal Investigator: Dr Arunangsu Chatterjee	Signature AC	Date 7/1/16
Other staff investigators: Payal Ghatnekar	Signature(s) PG	Date 02/08/16
Director of Studies (only where Principal Investigator is a postgraduate student):	Signature	Date

Appendix 1: Jefferson Empathy Scale

The Jefferson Empathy Scale (JES) (Hojat, 2016) will be used prior to research phase 1. It will establish the baseline levels of undergraduate medical students' empathy. The statements will be ranked on a scale a 7-point Likert scale with 1 = very strongly disagree and 7 = very strongly agree

Level of training: Gender:

1. An important component of the relationship with my patients is my understanding of the emotional status of the patients and their families.

2. I try to understand what is going on in my patients' minds by paying attention to their nonverbal cues and body language.

3. I believe that empathy is an important therapeutic factor in medical treatment.

4. Empathy is a therapeutic skill without which my success as a physician would be limited.

5. My understanding of my patients' feelings gives them a sense of validation that is therapeutic in its own right.

6. My patients feel better when I understand their feelings.

7. I consider understanding my patients' body language as important as verbal communication in physician-patient relationships.

8. I try to imagine myself in my patients' shoes when providing care to them.

9. I have a good sense of humour, which I think contributes to a better clinical outcome.

10. I try to think like my patients in order to render better care.

11. Patients' illnesses can be cured only medical treatment; therefore, affectional ties to my patients cannot have a significant place in this endeavour.

12. Attentiveness to my patients' personal experiences is irrelevant to treatment effectiveness.

13. I try not to pay attention to my patients' emotions in interviewing and history taking.

14. I believe that emotion has no place in the treatment of medical illness.

15. I do not allow myself to be touched by intense emotional relationships among my patients and their family members.

16. My understanding of how my patients and their families feel is an irrelevant factor in medical treatment.

17. I do not enjoy reading nonmedical literature or experiencing the arts.

18. I consider asking patients about what is happening in their lives an unimportant factor in understanding their physical complaints.

19. It is difficult for me to view things from my patients' perspectives.

20. Because people are different, it is almost impossible for me to see things from my patients' perspectives.

Appendix 2: Technology Acceptance Model 3 constructs to be tested

Following are constructs based on the Technology Acceptance Model (TAM 3)(Venkatesh & Bala, 2008). Each item will be responded to using a 5-point Likert-scale, anchored at Strongly-Agree and Strongly-Disagree.

Constructs	Code	Items

Perceived Usefulness (PU)	PU1	Using the system improves my performance
	PU2	Using the system increases my productivity
	PU3	Using the system enhances my effectiveness
	PU4	I find the system to be useful
Perceived Ease of Use (PEOU)	PEOU1	My interaction with the system is clear and understandable
	PEOU2	Interacting with the system does not require a lot of mental effort
	PEOU3	I find the system to be easy to use
	PEOU4	I find it easy to get the system to do what I want it to do
~~**Computer Self-Efficacy (CSE)**~~		~~I could use the system…~~
	~~CSE1~~	~~…if there was no one around to tell me what to do as I go~~
	~~CSE2~~	~~…if I had just the built-in help facility for assistance~~
	~~CSE3~~	~~…if someone showed me how to do it first~~
	~~CSE4~~	~~…if I had used similar packages before this one~~

~~Perceptions of External Control (PEC)~~	~~PEC1~~	~~I have control over using the system~~
	~~PEC2~~	~~I have the resources necessary to use the system~~
	~~PEC3~~	~~Given the resources, opportunities and knowledge it takes to use the system, it would be easy for me to the use the system~~
	~~PEC4~~	~~The system is not compatible with other systems I use~~
~~Computer Playfulness (CPLAY)~~		~~The following questions ask you how you would characterize yourself when you use technology systems:~~
	~~CPLAY1~~	~~…spontaneous~~
	~~CPLAY2~~	~~…creative~~
	~~CPLAY3~~	~~…playful~~
	~~CPLAY4~~	~~…unoriginal~~
~~Computer Anxiety (CANX)~~	~~CANX1~~	~~Technology systems do not scare me at all~~
	~~CANX2~~	~~Working with a technology system makes me nervous~~
	~~CANX3~~	~~Technology systems make me feel uncomfortable~~
	~~CANX4~~	

		~~Technology systems make me feel uneasy~~
~~Perceived Enjoyment (ENJ)~~	~~ENJ1~~ ~~ENJ2~~ ~~ENJ3~~	~~I find using the technology to be enjoyable~~ ~~The actual process of using the technology is pleasant~~ ~~I have fun using the system~~
~~Objective Usability (OU)~~		~~Ratio of time spent by the subject to the time spent by an expert on the same set of system tasks`~~
~~Subjective Norm (SN)~~	~~SN1~~ ~~SN2~~ ~~SN3~~ ~~SN4~~	~~People who influence my behaviour think that I should use the system~~ ~~People who are important to me think that I should use the system~~ ~~The lecturers have helped me in using the system~~ ~~In general, the University has supported me in using the system~~
~~Voluntariness (VOL)~~	~~VOL1~~ ~~VOL2~~ ~~VOL3~~	~~My use of the system is voluntary~~ ~~My supervisor does not require me to use the system~~

		~~Although it might be helpful, using the system is certainly not compulsory~~
~~**Image (IMG)**~~	~~IMG1~~ ~~IMG2~~ ~~IMG3~~	~~People at the University who use the system have more prestige than those who do not~~ ~~People at the University who use the system have a high profile~~ ~~Having the system is a status symbol at the University~~
Job Relevance (REL)	REL1 REL2 REL3	In my job usage of the system is important In my job usage of the system is relevant The use of the system is pertinent to my various job-related tasks
Output Quality (OUT)	OUT1 OUT2 OUT3	The quality of the output I get from the system is high I have no problem with the quality of the system's output I rate the results from the system to be excellent
Result Demonstrability (RES)	RES1 RES2	I have no difficulty telling others about the results of using the system

	RES3	I believe I could communicate to others the consequences of using the system
	RES4	The results of using the system are apparent to me
		I would have difficulty explaining why using the system may or may not be beneficial
Behavioural Intention (BI)	BI1	Assuming I had access to the system, I intent to use it
	BI2	Given that I had access to the system, I predict that I would use it
	BI3	I plan to use the system in the next <n> months
~~**Use (USE)**~~	~~USE1~~	~~On average, how much time do you spend on the system each day?~~

Appendix 3

Instructions and trigger statements used in the empathy scale based on (Danish & Hauer, 1973; Winefield & Chur-Hansen, 2000). The following is a sample. These statements will be adjusted based on the interventions and presented in a randomised order.

1. My parents really get me down. They insist I study physics and chemistry, when I'm not at all interested in those subjects.

2. I thought I'd have a talk with you because you did well in that subject. But you've been no help to me all.
3. My children tell me I'm old-fashioned. After all I've done for them! However, hard I try they just don't appreciate me.
4. So I studied hard for years and now nobody wants to give me a job. Perhaps I'll go back and work on the farm.
5. If my exam marks don't improve I'm going to fail and lose my government allowance. I don't know what to do.
6. I just can't communicate with my parents. Whenever I try to explain how I feel about things they get all upset and call me a fool.
7. I finally got up courage to tell him that we all think he's big-headed. Then he turned on me and made me feel so stupid I ended up apologising and slinking away.
8. I try so hard to please everybody, but it always seems to go wrong. Nobody seems to care whether I'm around or not.
9. Whenever I try to get close to someone of the opposite sex I always mess it up. Am I so physically unattractive? How do I turn them off?
10. My brother has started to act so strangely. He's very-very nervous- I'm wondering if I should do anything.

The coding rules for the trigger statements are as follows:
0 = aggressive or derogatory response
1 = non-empathetic: does not acknowledge feeling or content of trigger; includes advice, reassurance, closed question
2 = partially acceptable: open-ended, or response which acknowledges feeling or content of trigger
3 = interchangeable/empathetic acknolwedges both the feeling and the content of the trigger (I.e., some variation of the classic 'you feel...because...')
4 = facilitative: reflects but also adds deeper feeling and meaning to the trigger statement in a way which encourages self-exploration (not really to be expected after a brief statement of the problem).
When a written response includes several different elements, it is scored as the highest of the possible ratings. The difference between the two total empathy scores over the 10 items

showed the degree of either improvement or, where the baseline score was higher than the post-test, deterioration in skills.