IMMERSIVE DESIGN PROCESS

A co-creation by NORR and Advanced Performance

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November 1, 2024

EXECUTIVE SUMMARY

The integration of virtual reality and in-situ simulation technologies create virtual environments before they are built. In the healthcare sector, leveraging these technologies through an immersive design process provides user data sets that inform the way spaces are designed, ensuring highly functional, flexible and safe spaces to deliver specific care.

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INTRODUCTION: PROBLEM / SOLUTION STATEMENT

Imagine trying to understand the complex interaction of people, equipment and technology in a new hospital space by reviewing the architectural blueprints. Now imagine bringing that interaction to life with purposefully designed simulations and a rich data set from which to make informed design decisions.

The objective is to close the language gap between architects and healthcare professionals by understanding each other's world. Enabling a highly agile process between the clinical practice and architects draws on a proven incremental and iterative development model through a series of successive, increasingly refined work sessions. In essence, we are simulating environments in 3D to examine all angles of design with human actions. It starts with critical design thinking through dialogue, sketches, drawings and renderings. The design team composed of architects, designers and expert clinicians create highly realistic clinical situations to observe actual healthcare teams provide patient care using a suite of simulation modalities ranging from VR, AR, 3D replicas, mock-ups and even actual patient care spaces.

This process is not simply asking individual clinicians to "walk through" a VR or mock-up replica of a clinical space. Immersive design differs substantially by doing just that: "immersing" authentic clinical teams together to perform patient care based on real-life scenarios. The design team observes this work in real time, and/or by video review, followed by an expert-led debriefing session. Using scripted narratives to simulate various medical emergencies and routine patient and clinician interactions, participants are guided through each scenario to articulate their needs, preferences and workflow requirements.

Stakeholders experience the proposed space firsthand to identify areas for improvement and potential issues or risks before construction begins. The process allows the collective team to observe, refine and adapt the design as required.

INDUSTRY CONTEXT

With increased demands placed on healthcare systems to deliver more and varied services, and in new ways, the immersive design process works to achieve an informed design that effectively integrates people, space and technology, resulting in high quality design solutions – faster.

The measurable benefits for the broader industry span a range of evidence-based return on investment (ROI) metrics:

DIRECT VALUE
Clinicians and patients are directly and fully immersed in the design process thereby increasing buy-in and reducing the need for post occupancy renovations.

SOCIAL VALUE
The patient experience is improved and optimized by placing the clinicians and patients at the centre of the design process.

OPERATIONAL VALUE
Workflows are streamlined, spatial layouts improved and latent safety threats are identified in advance of any impact on patients.

STRATEGIC VALUE
A culture of patient safety within the organization is fostered from the moment the design process is initiated. This has long lasting effects on building a high-reliability organization and is strongly linked to improved staff retention.

FINANCIAL/ECONOMIC VALUE
Time and cost savings are achieved by addressing design issues early while accelerating build times through improved and more accurate decision-making processes.

APPROACH AND METHODOLOGY

Every environment is unique. The immersive design process helps to make sense of functional design and refine workflow through user-centric, multi-modal simulation by identifying detailed functional needs and - collecting hard data to inform the final design decision.

Rather than training individuals and teams, immersive design makes the system and space the unit of analysis:

- Scenarios are designed to “crash test” common clinical scenarios and weed out latent hazards
- Debriefing sessions afford healthcare teams a dedicated opportunity to reflect on how the system, space and clinical logistics functioned or failed to function
- Simulations are video and audio recorded, allowing for subsequent review of movement tracking, “hot zones” (locations where providers tend to congregate or dwell) and bump analysis (how often do team members bump into equipment, or into one another)

The results of this process are impactful in two distinctive ways:

- The systematic and reproducible nature of data gathering helps to codify and quantify known challenges, driving meaningful design interventions: data is a more powerful tool than anecdote
- Immersive design shines light on safety hazards that would be impossible to see, because the team is not looking for them

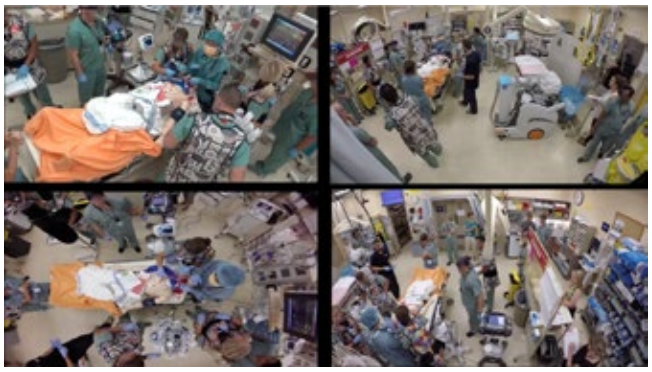
We would not drive a car that has not been crash tested. Why should a clinical environment be any different?

We frequently rely on “work-as-imagined” to inform designs of complex, life-saving clinical spaces yet this often differs from “work-as-done”. More generally, clinicians tell us how they work and the designs to support their work, yet this differs from what happens every day in the delivery of patient care.

Through user group experiences, we understood there was a gap in the market. We co-authored a process with Advanced Performance, led by doctors, who bring the medical simulation knowledge and understand both clinical care and design – translating “the clinical language” to the design team to ensure the client’s needs are captured and understood. Importantly, the architectural and construction teams are integrated into this process to ensure longitudinal engagement with the clinical teams and patients from the earliest stages.

The data from these simulations (e.g. simulations that involve performing an operation in an operating room – virtual or using a preliminary mock-up) informs the architectural design process. Clinicians and patient advisors participate through subsequent simulation sessions that involve table tops or mock-ups of proposed designs to ensure work-as-imagined aligns with work-as-done.

Prior to patient care, a plan is initiated to “crash test” the clinical space to ensure that **no patient is the first test of the new clinical environment** – mitigating risk and enhancing team confidence with the space.



Scripted narratives simulate medical emergencies and routine interactions, guiding participants to express their needs, preferences and workflow requirements.

Simulations are video and audio recorded, allowing for subsequent review of movement tracking, “hot zones” where providers tend to congregate or dwell.

MEASUREMENT AND ANALYSIS

The value of immersive design is substantial. For every dollar invested in the immersive design process it is estimated to save between $5 and $25 on future renovations or change orders translating to 500-2,500% ROI. The benefits are wide-ranging with enhanced project efficiency resulting in accelerated timelines by >21%.

In one case study, we built a resuscitation space within an emergency department using the immersive design process.

The design of the space was inspired from work we completed in advance using an evidence-based process that began by identifying latent safety threats. These are design and system-based elements that are not immediately apparent but emerge under specific circumstances and negatively impact patients. There were 23 critical threats identified and we successfully mitigated >80% of these through design updates (Petrosoniak et al. BMJ Qual Saf 2020). Furthermore, by using this process we reduced time to blood delivery for bleeding trauma patients by 21%, which translated to improved odds of patient survival by nearly 15% (Gray et al. CJEM 2020). It is clear the patient impact has been substantial. Lives are literally being saved by this process.

At an economic level, we achieved an 18% cost savings from the original design based on data-driven changes to improve the utility of the space. We created a space that is the envy of acute care hospitals worldwide with more than 15 international teams visiting the space to learn about the process. Furthermore, this case study has been presented at more than 20 national and international healthcare and design conferences.

POSITIVE IMPACT

With growing research in healthcare design, evidence-based healthcare design (EBD) has emerged as an important influence as new facilities are built. While it may seem self-evident that designs for the resuscitation of the critically ill be informed by research and user feedback, remarkably EBD remains a relatively new concept.

The immersive design process represents a shift in healthcare design methodology. It seeks to streamline the user group information gathering stage by providing a platform for clinicians to collaboratively work with architects and contractors. This holistic integration results in an enriched understanding of user needs, translating into designs that harmonize functionality with the nuanced demands of healthcare delivery.

Business and technology sectors have long understood the importance of the customer experience. Apple built the iPhone with careful and continuous feedback from users resulting in a highly functional device that even the most novice users can navigate with ease. The immersive design process in healthcare follows similar principles by placing the user at the centre of the design process. We go beyond asking what clinicians and patients want in the built environment; we watch the care happen. We observe, we refine and we improve with each design iteration based on results from carefully crafted simulated clinical events.

The current process relies on superficial interactions between design teams, clinicians and construction teams. The result is often substantial change order requisitions and post-occupancy changes to clinical spaces because the space simply doesn't work as intended for the clinical teams. It isn't uncommon to hear reports that a stretcher cannot fit through the door or that all the equipment isn't able to be accommodated within an ICU room. Besides the clear negative clinical impact, the changes are expensive.

ECONOMIC BENEFIT

The immersive design process serves to create economic benefit in three main ways:

DELIVERS A HIGH RETURN OF INVESTMENT TO MITIGATE POST-OCCUPANCY CHANGES

Researchers in Alberta have determined that for every $1 allocated to immersive design, this results in savings be-tween $5 and $26 in future renovation costs.

ACCELERATES PROJECT TIMELINES BY ASSISTING TEAMS TO MAKE DECISIONS FASTER THAN TYPICAL PROCESSES

Using simulations (e.g. recreations of clinical care) in immersive design allows clinicians to understand whether the designs will be suitable for their workflows and changes can be made before it is too late, thus mitigating expensive change order requisitions. This follows the principles outlined in the well-known MacLeamy curve which illustrates that the cost of changes is lowest early in the design process and grows exponentially as the project progresses.

CAPITAL COST SAVINGS

Traditional design processes make best guesses at what is required in the clinical space. Using immersive design, we have found up to 18% cost savings on capital project costs. This is possible because the designs can be made more precise for the needs of the team, therefore ensuring no extraneous equipment or design elements are included.

HUMAN OUTCOMES

The immersive design process is not just a shift; it's a testament to the commitment to pushing the boundaries of healthcare design. As this approach continues to redefine the intersection of Health Planning and Investment, it exemplifies the synergy between expert insight and architectural finesse, setting a new standard for excellence in global healthcare design.

We've observed an increase in interest in designing for the patient experience over the past decade. The immersive design process makes this explicitly possible.

This process has a direct impact on all of us as a society. If we can deliver better patient-centred care, we can positively impact patient satisfaction. This may even result in better medical outcomes according to Rathert et al. Medical Care Research and Review, 2012.

Furthermore, clinician satisfaction is increased because the designs allow clinicians to better care for patients. In an era when clinician burnout has never been higher, any systemic changes that we can make to positively improve the work environment should be undertaken. In speaking with clinicians, they are often not frustrated by the patient interactions but rather the systemic encumbrances to delivering the care they feel is required.

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