

A Hybrid Physical-Digital Simulation Laboratory to Expedite Context-Aware Design and Usability Testing in Digital Health

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Abstract. Fit within existing physical and digitalised workflows is a critical aspect of digital health software usability. Early, iterative exploration of contextual usability issues is complicated by barriers of access to healthcare settings. The Validitron SimLab is a new facility for digital health prototyping that augments immersive, realistic physical environments with a digital sandbox allowing new and existing software to be easily set up and tested in the physical space.

Keywords. Digital health, usability, human-computer interaction, simulation, sandbox, validitron

1. Introduction

The design of digital health software innovations that aim to improve clinical care is complicated by the need to integrate successfully with existing repertoires of user behaviour [1], such as clinical workflows and care management routines, where factors such as perceived time to *overall* task completion may substantially affect acceptability. These repertoires can involve multiple actors and, increasingly, incorporate digital tools, such as electronic medical and health records. As a result, detection of usability issues, a key determinant of implementation success [2], should ideally incorporate not just questions of *within-tool* quality but also what happens when a tool is situated in its intended socio-physical *and* digital contexts of use.

Digital health innovators face substantial barriers to accessing healthcare contexts for *in situ* usability exploration. Barriers include perceived risks to clinical care; data security concerns; care organisation capacity to support non-core clinical and/or technical integration activities and the dynamic nature of care provision. Lengthy and limited approvals processes, which may be justified from a governance perspective, are nevertheless a poor match for the rapid, iterative design philosophies now typical of software development, and a desire for early feedback on possibly incomplete prototypes.

We describe the development of the Validitron SimLab, a dedicated digital health simulation laboratory that aims to address challenges of access to real healthcare contexts by providing an immersive, realistic setting to explore issues of use-in-context.

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2. Methods

A multi-stakeholder requirements gathering process consisting of informal 1:1 and group interviews, iterative feedback and refinement of a prioritised set of indicative users and use cases. Prioritised uses were: i) human-computer interaction and usability studies; ii) informal talk aloud around existing workflows for problem scoping and ideation prototyping; and iii) technology-supported workflow demonstrations for education and stakeholder engagement. Design requirements were derived from these use cases.

3. Results

Completed in August 2022, the Validitron SimLab contains three immersive, reconfigurable physical simulation rooms replicating, respectively, home/therapy, primary/allied care and hospital environments. To enable study of uninterrupted user behaviours, each room has a covert observation area behind one-way glass.

Digital infrastructure including mobile workstations, desktop and mobile computers and sensors can be set up as required in each space. Software experience is managed by the Validitron Sandbox, a cloud-based, containerised orchestration system that allows different configurations of real and simulated digital health tools, such as electronic medical records, telehealth clients and backend infrastructure, to be quickly instantiated, populated with data and reset as needed on a per project basis. Standards-based mechanisms such as SMART-on-FHIR are used to facilitate integration scenarios.

We will use the example of a current study using patient-generated data to enhance doctor-patient communication to illustrate how the virtual and physical aspects of the SimLab can support usability testing and enable novel inquiries in digital health.

4. Conclusions

The Validitron SimLab extends the established concept of simulation environments in medical education [3] by addressing the need for a digital ‘sandbox’ environment, complementing physical space, in order to be able to demonstrate and test how digital health innovations fit into increasingly digitalised workflows.

The SimLab will support the Digital Health Validitron, a research-guided platform for digital health innovation being developed at the University of Melbourne. Future work will incorporate a critical component that compares digital health usability evaluations undertaken in real versus simulated settings.

References

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