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Human Factors in Healthcare: Simulation Challenges

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Abstract. Simulators can be used to study medical device evaluations and innovations as well as device interface design. When physiological fidelity and good experimental control are needed, existing patient simulators quickly show shortcomings. A technical approach from the authors' ongoing research on advanced visual and auditory display design is provided, in which Body™ dynamic linked libraries and the METI ECS™ software are used side by side.

1. RESEARCH QUESTIONS

Healthcare organizations use simulators for a variety of training and skill certification needs. In other domains such as aviation and power systems, simulators are used not only for training and skill certification but also for the design of and evaluation of equipment. In healthcare, simulators can be used to identify equipment design flaws and demonstrate the potential benefits of new designs before new devices come in contact with patients.

However for simulators to be useful in the design and evaluation of equipment they require both physiological fidelity and the means for good experimental control. Faced with these requirements, the limitations of existing patient simulators for evaluating advanced visual and auditory patient monitoring interfaces quickly become apparent.

2. SOLUTIONS

Most medical simulators have been designed to support training requirements rather than design. Medical simulators built for training frequently lessen physiological fidelity in order to give medical instructors greater control. In design and evaluation of new devices, a balance between fidelity and control can be achieved by testing the devices with a range of simulators and by careful scenario design (Figure 1).

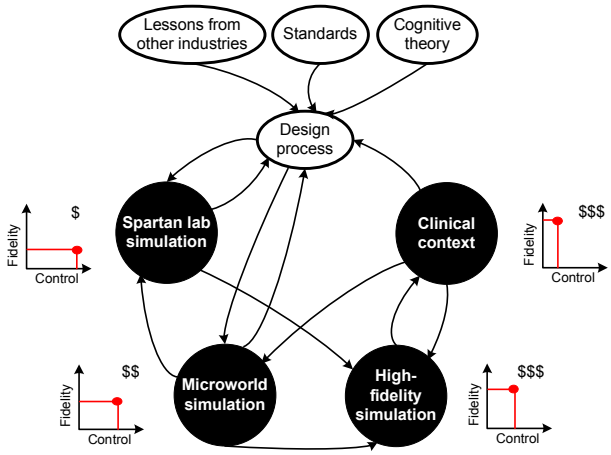

Figure 1: Display evaluation pathways and elements

In prior work we have used a variety of "spartan" laboratory and microworld simulations to evaluate new patient monitoring devices such as head mounted display[1] and new auditory displays[2]. We now require greater fidelity while retaining adequate control.

For our most recent work in full-scale patient simulators, we used two patient simulators (Body™ dynamic linked libraries and METI ECS™) running in parallel to provide the realism of an operating theatre plus the control required to evaluate new displays. The full scale simulator was modified to allow the experimental team greater control over what the participant heard and saw. (Figure 2). With the aid of realistic distractor tasks we could assess each display under controlled high workload monitoring conditions.

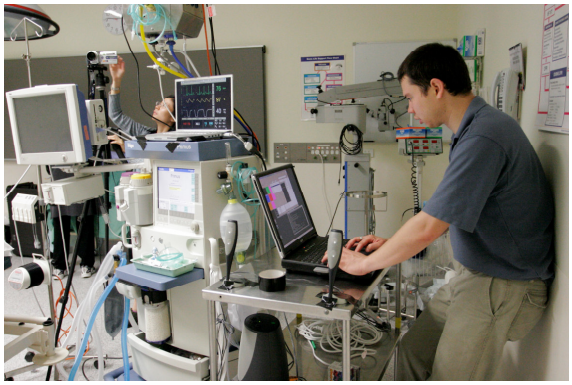

Figure 2: Augmenting existing displays and simulators

3. FUTURE STEPS

In future studies we will provide greater levels of team interaction while still controlling the types of events to be analyzed. The increase in fidelity required to achieve team interaction will increase the number of controllers required to run evaluation studies.

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