Research in the simulated OR: working within constraints to create the illusion of control

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Background. In addition to being used for education and training[1], patient simulators are being used increasingly in research[2,3]. Under the right conditions, the simulated operating theatre can provide a useful model to test human factors issues that are dependent upon a clinical context but, for a variety of reasons, are not easily tested in a "true" OR[3].

Methods. We chose a high fidelity simulated operating theatre to assess the utility of a head-mounted monitoring display (HMD) for anesthesiologists[4]. To this end, we created operative scenarios within specific constraints, while maintaining a high level of physical, semantical and phenomenal realism[5].

Three scenarios (and one for training) had to include 8 independent events, each associated with a context sensitive[6] visual distractor task. Distractions had to be such that they did not cue participants to events, participants had to be exposed to all events under the same circumstances and with similar resolutions and all had to occur within a "believable" 35- to 40-minute operation. Each event had to be detectable in one of 4 sites (anesthetic machine, HMD, patient or OR) and each distractor had to be either near (within 3 meters of the participant) or far. Furthermore, in order to increase statistical power, the events had to be repeatable and highly controlled.

In consultation with local anesthesiologists, we designed four typical operative scenarios. Intra-operative events were overlaid on the basic scenarios, having been chosen on the basis of conceptual fidelity, predictability of the anesthesiologists' response (based on local expertise) and ease of returning the simulation to a standard state once resolved. We incorporated typical OR distractions into each scenario, with significantly more distractions than events. Scenarios were then translated into a format applicable to the METI ECS^{TM} patient simulator and comprehensive acting scripts were developed. Transitions in scenario and script were cued by participant actions or directly from the control room. Thus, although the participants were given the "illusion of control" by allowing them to choose how and when to manage issues as they arose, the scenarios were largely deterministic in nature.

Results. 12 anesthesiologists were tested over a seven-day period. Participants demonstrated a range of activity in our scenarios that would not have been evident in a laboratory or clinical study[7]. Although the scenarios were tightly scripted, no anesthesiologist commented that they felt any scenario was deterministic. Several participants noted that they "didn't know what was coming" and had expected to be presented with one major crisis event in the scenario.

Conclusion. Meticulous planning and attention to detail, along with extensive consultation with local subject matter experts, is mandatory to design a scenario within such constraints. The "illusion of control" for the anesthesiologist must similarly be maintained to ensure emotional fidelity, while the scenario must also be highly deterministic to achieve meaningful results within the constraints required.

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