Background

The Stanford Medical School’s simulation lab has a fully functional operating room, including working medical equipment. The simulator has a dummy with a heartbeat that can breathe and sweat, with pupils that dilate. Observers can control the dummy in true Wizard of Oz fashion, as they run crisis care scenarios to instruct medical doctors on crisis management techniques.

Medical simulation was originally inspired by the culture of simulation in aviation training. Simulation offers a unique opportunity to deploy and evaluate new software and processes in medical practice.

Medical Checklists & Cognitive Aids

Checklist usage has been shown to reduce medical error rates, however their usage is not yet widespread.

Checklists can act as cognitive aids during crisis scenarios, where working memory is compromised and attention is limited.

We observed simulated crisis care scenarios and participated in iterative design & prototyping sessions with doctors from the School of Medicine. We identified an opportunity to improve on existing aids. By introducing interactive cognitive aids on a large-screen, we might be able to help crisis staff in maintaining a shared mental model, which has been shown to increase team performance.

Crisis prompts:
Adapted from the principles of anesthesia crisis resource management, these crisis prompts are phrased as questions to elicit action.

Cognitive aids:
A table of cognitive aids, focusing on cardiac arrest and related conditions, offer memory and cognitive support during crisis.

Insights & Design Principles

- Integrate cognitive aids into an “always on” system also used during routine care.
- Usage patterns range from low-tempo to high-tempo periods: “hours of boredom punctuated by moments of terror”
- Cognitive aids can be seen as a “leaf node” of a more general Resource Management system, where doctors can manage their resources of people, supplies, and other kinds of help.
- Pixels and screen real estate are limited: always use contextual emphasis.
- Nurse controls a tablet mirrored on a large-screen display.
- Large-screen display can be wall-mounted or on a crash cart wheeled in on demand.

Routine care:
The middle column displays the pre-surgery/time-out checklist, and could possibly display useful information on upcoming surgeries or Point of View cameras from the surgeon’s or anesthesiologist’s perspective.

Resources column:
People are a crisis team leader’s most important resource. Doctors in crisis resource management courses learn how to ask for “heads-help” and “hands-help”

Resources dock:
A “bucket” of accessible resources allow for calling for anesthesiologist/nurse/surgeon help, or requesting services such as a crash cart or cardiologist consult.

Patient information:
Could be retrieved from electronic medical record systems, and offer the opportunity to adapt cognitive aids based on patient data.

An informal gaze analysis

An informal analysis of a simulation training video demonstrates the variety of information sources. As the crisis proceed, the anesthesiologist would often look back and forth between two different locations, such as the TV’s and the vital monitor, or the crash cart. Most gaze sequences lasted less than six seconds.