



Lessons and Challenges in Health Care and Cyber Physical Systems

Dan Siewiorek
Carnegie Mellon University

June 25, 2012

Based on a Lecture

Dan Siewiorek, Thad Starner, Asim Smailagic
Morgan & Claypool

- **U - User**
- **C - Corporal**
 - » Interface physically without discomfort or distraction
- **A - Attention**
 - » Divided between physical and virtual world
- **M - Manipulation**
 - » Controls quick to find, easy to operate
- **P - Power**

User Lessons

- **“The user is not I”**
 - » Built two dozen systems to identify repeated patterns (e.g. procedures, work orders, team collaboration)
- **Mobile Users are more impatient than desktop users**
 - » Must operate more like a flashlight than a computer rebooting
- **Institutional Review Board**
 - » “But madam, they are Marines and they do what they are told”
- **Be prepared to reduce functionality**
 - » “It’s a fine goal”
- **Instant Creditability**
 - » “I served with you on the Vinson’s first world cruise”
- **Our secret sauce**
 - » Dick Martin: Two tours in Vietnam, 600+ carrier landings, first F-14 Squadron, Top Gun, Commissioning Captain of the Carl Vinson Nuclear Aircraft Carrier

Attention Lessons

- **The more information and more engaging the virtual world, the less interaction with the physical world**
- **Use systems for reference (e.g. information dashboard) then focus on physical world**

But, I' ve Always Done it This Way!

A KC-135 Aircraft was being pressurized at ground level. The outflow valves which are used to regulate the pressure of the aircraft were capped off during a 5 year overhaul and never opened back up. The post-investigation revealed: that a civilian depot technician who, "had always done it that way," was using a homemade gauge, and no procedure.

The technician's gauge didn't even have a max "peg" for the needle and so it was no surprise he missed it when the needle went around the gauge the first time. As the technician continued to pressurize the aircraft, and as the needle was on its second trip around the gauge the aircraft went "boom" - the rear hatch was blown over 70 yards away, behind a blast fence!

KC-135 Pressure Test Results



Manipulation Lessons

- **Strong user interaction mental model**
 - » Not only trained in the field in less than ten minutes but also able to train the next user
 - » No users manual
 - » Training without access to what the user is seeing
- **Without stationary reference, users easily become disoriented and confused with traditional input devices**
 - » “Which is the left button”
- **Control devices have to be flexible to mount on different parts of the body**
 - » Boeing – shoulder holster
 - » Sailors on aircraft carrier – shoulders used to carry tie-down chains

Future Challenges

Pro Active Assistant Research Challenges

- **When and How to Interrupt**
- **Privacy of Data**
 - » What information is collected
 - » Who can access information
 - » How long information is stored
- **How User Specifies Preferences on Data Availability**
- **User Attention**
 - » Charge Market Value to those demanding attention
 - » Combine theories from social science, cognitive science, and economics