GSAW Workshop
Emerging Issues in Human Systems Integration (HSI)

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February 2014
What are we trying to accomplish?

Can these warfighters?  With this training?  Using this equipment?

Under these conditions?  TIME PRESSURE  STRESS  Weather  24/7 ops

Accomplish their mission?

Images courtesy of United States Air Force
Human Systems Integration Domains

- Human Factors Engineering
- Training
- Personnel
- Manpower
- Human Survivability
- Health Hazards
- Habitability
- System Safety
- Manpower
- Organization
What drives the decision to automation?

Integration of users across system lifecycle represents 40-60% of life-cycle costs

* Increased demands on operators – new missions, CONOPS, tactics
* Increased volume and rate of information
* Reduced manpower projections - number and experience
* Changing human roles – control of multiple platforms, multi-mission tasking

Is Automation the Answer?
Automation and Human Operator Role

• The human operator’s role in modern high-technology systems is, increasingly that of a systems monitor, systems manager and decision maker

• Automation is a double-edged sword, it has eliminated some sources of error but introduced new sources
  
  – *In some cases these new errors result in consequences that are more severe than those eliminated by the automation* (Weiner and Nagel, 1988)

  – *In some cases, automation has created the situation where small errors are tuned out, but opportunities for large errors are created*

  – *As Weiner states, “some glass cockpits have clumsily used automation that creates bottlenecks where pilots are least able to deal with them – during high workload periods”* (Weiner 1988, Hughes and Dornheim, 1995, p. 52)
Automation

Advantages:
• Eliminates human error and limitations
• Capitalize capabilities of human operator and machine

Disadvantages:
• Computer cannot make judgments
• Computer systems not always reliable to issue alert
• Alerts may be misinterpreted
• De-skill the operator
• Isolates operator from control process
• May lead to degraded failure-recovery
Automation in Complex Technological Systems

• Paradoxically automation can often increase the impact of human error
  – *automation merely shifts the location of human error from the ‘operator’ to the designer, the maintenance personnel, and the supervisor who must deal with automation problems and failures.* (Reason, 1990)

• Automation can help complex technological cope with human error, but it alone will not prevent human error occurrences

• Providing insight into the human error consequences resulting from a particular system design enables designers to choose between alternative designs that includes levels of automation

The goal is a system design that reduces the frequency of human errors, reduces the severity of the consequences of human error, and enables recovery from human errors (error-tolerant systems)
How pervasive is human error?

- Human error is the primary cause of 60 to 90 percent of major accidents and incidents in complex systems...
  - Many errors people commit in operating systems are the result of poor system design or poor organization structure
  - Usually the error was only one of a lengthy and complex chain of breakdowns
  - A lot of effort goes into producing procedures but it seems a lot of effort goes into ignoring them
- An accident is an “error with sad consequences”
  - Human performance “guts of every accident”
  - Human Error is a causal factor in 60-80% of aviation accidents
  - Human Factors deficiencies significantly contributed to Bhopal, Chernobyl and Three Mile Island accidents
Historical View of Human Error

• Oftentimes when dealing with human error, we are tempted to ask –
  – Why didn't they pay more attention?
  – How could they not have noticed?
  – Why didn’t they know how to do xx?
• The proposed solution is to
  – telling people to be more careful,
  – by punishing those that made the mistake,
  – or by adding new rules or procedures
• This is sometimes considered the “Bad Apple Theory” (Dekker, 2006)
  – if it just wasn’t for that person, the system would work just fine.
• Perrow (1984) calls this “blaming the victim”

Assume the source of the failure is “human error”

Analyze the system or “event” to determine where a person is involved

Stop analysis when a person is found
Recent views of human error

• Looks at human error from a systems perspective including the human, organization and technology
• Examines the balance between safety and other goals (including production)
• Move from blame the victim to preclude-detect-mitigate
• Shift from error as a cause to error as a consequence
References


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