Detecting Errors

a distributed cognitive process

Necessary Conditions for Detecting Error

- Access
- Knowledge or expectation
- Attention
- Perspective

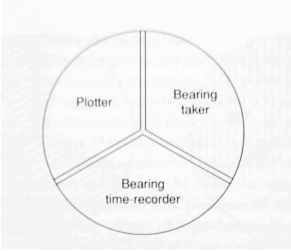
Access

- One must be able to sense the behavior that is in error.
- Affected by a person's location in the system (horizon of observation) and by **what information goes where, when, in what form.**
  - Open interactions
  - Open tools

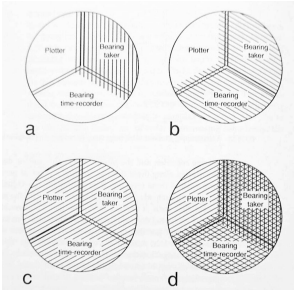
Knowledge

- One must have knowledge or expectation about the correct outcome. **Error detection requires a comparison between two representations of the same thing.**
- What is the distribution of knowledge in the system?
- How is that distribution produced and maintained?

Jobs in sea and anchor detail



Overlap of knowledge



Attention

- One must attend to the sensed information in terms of the knowledge or expectation.
- This may be affected by
  - the nature of the tasks being done
  - the flow of activity
  - arousal state
  - competing cognitive tasks
- High workload can lead to increased error production and decreased error detection

Perspective

- One's place in the system or one's job may make certain kinds of errors easier to detect.
- Monitoring and performing are different activities with different perspectives.

Should we strive to Eliminate Error?

- Human systems always lose experts and acquire novices.
- Expertise is maintained through learning.
- Detected errors are opportunities for learning while doing.
- A paradoxical property of human systems: some non-zero amount of error may be adaptive.

Advantages of distributed architectures

- Decomposition to control complexity (modularity), limiting complexity of input encountered by any individual
- Also enables parallel activity for efficiency
- Filtering reduces processing costs
- Organizing activity on the basis of social relations rather than domain content.
  - Take care of syntax and semantics will take care of itself.
  - Take care of social relations, and syntax will take care of itself!

Advantage of distribution: Graceful degradation

- Robust adaptation or gradual reduction in capacity rather than catastrophic failure.
  - Redundant knowledge and skills
  - Intersubjectively shared understanding of the task and filling in for other agents.

Costs of distributing cognition

- Filtering effects (hard to diagnose causes of failures, premature commitment)
- The need for coordination
- Design of coordination can be difficult (see beam bearings analysis)