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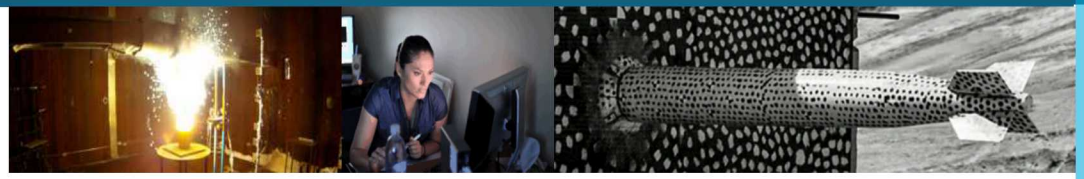
Human Factors Engineering: Applications and Impact



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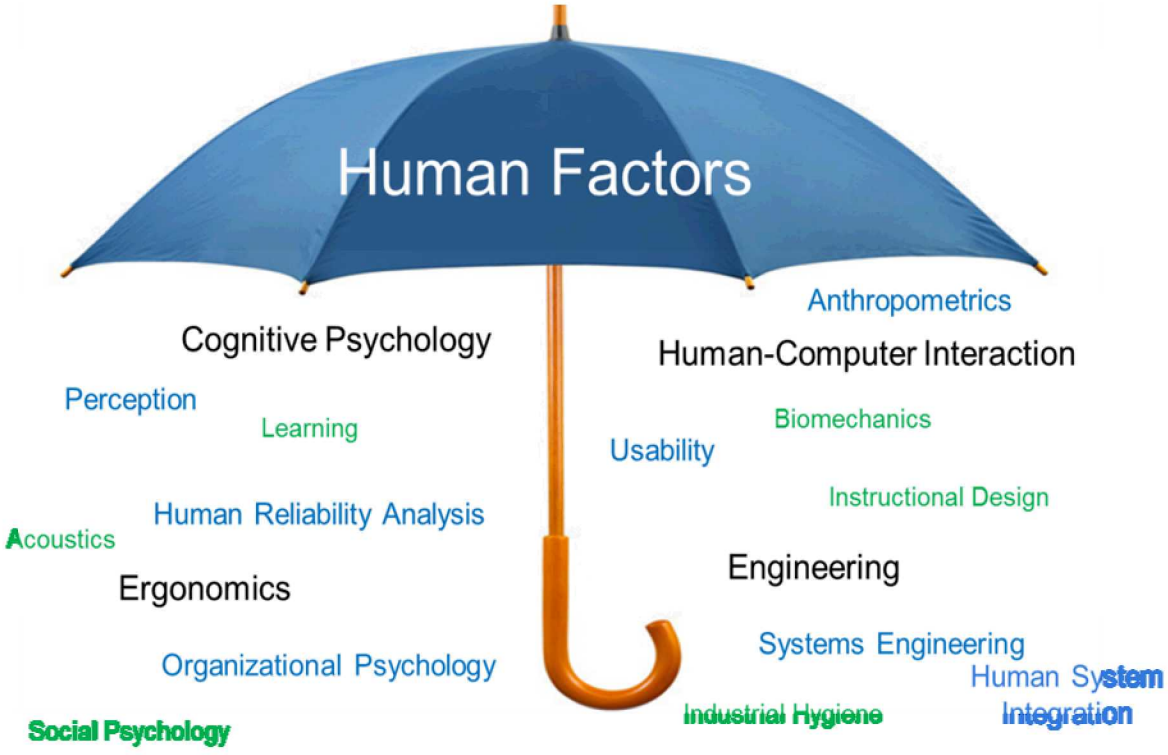
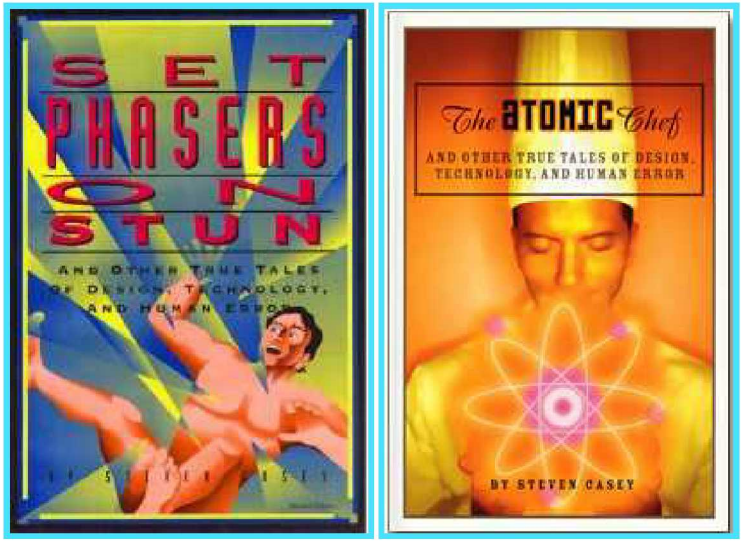
What is Human Factors?

Scientific discipline that applies knowledge about human behavior, abilities, characteristics, and limitations to **design tools, products, systems, tasks, jobs, and environments** for *efficient, safe, secure,* and *reliable* human use.



Goals of Human Factors

- Reduce errors
- Increase usability
- Increase productivity
- Increase personnel satisfaction
- Increase safety



Books documenting real-life human error scenarios

Mistakes have occurred in many domains "*because of incompatibilities between the way things are designed and the way people perceive, think, and act*" (Steven Casey, 1993)

Influences & Sources of Human Error

Attention and Distraction

- Human error can occur if people have to divide their attention among many tasks or if they are distracted

Labels and Procedures (e.g. Protocols)

- Human error can occur if labels or procedures are difficult to read or interpret

Resources

- Human error can occur if resources required for the job are not readily available

Human Capabilities and Limitations

- Human error can occur if people are asked to perform tasks beyond their capabilities

Changes in Routine

- Errors can occur when the normal, everyday routine is changed in some way

Human Factors Techniques

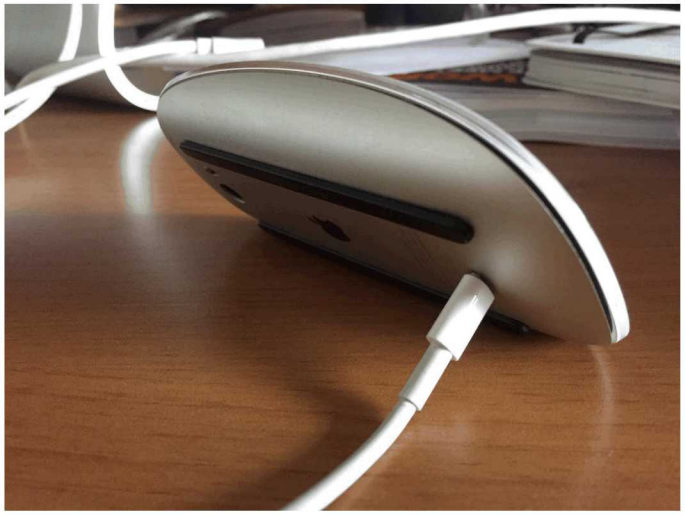
- Observation and task analysis
- Assessment of workload and situational awareness
- Human Reliability Analysis
- Surveys and interviews
- Experimentation
- Usability Analysis
- Environmental measurements (illumination, noise, and temperature)
- Anthropometry (postures, forces, and load demands)
- Physiological measurements (heart rate, blood pressure)
- Analysis of records

What Does HF Influence?

Design – hardware, software, work environment

Process design & development – improving the user experience, reduce the potential for human errors, or the impact of human errors

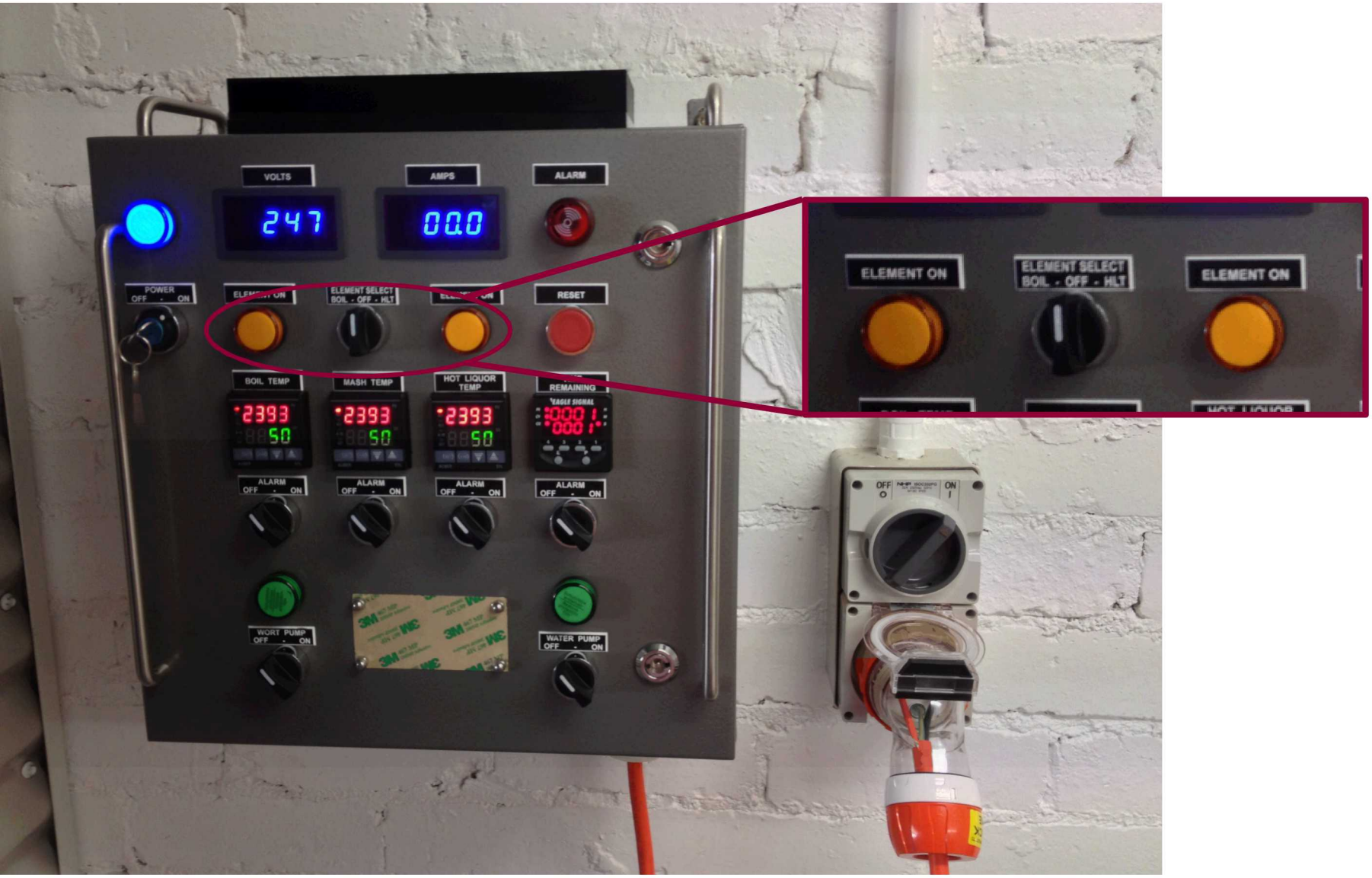
Training – knowledge transfer, instructions, procedures



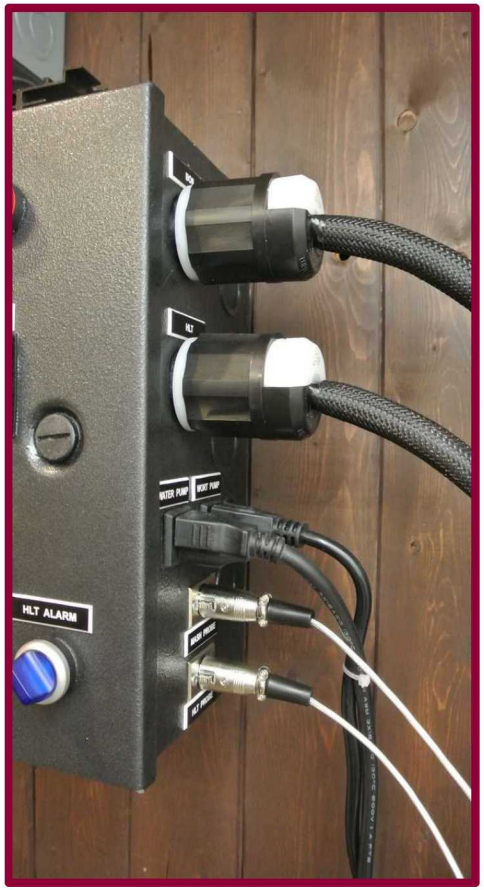
Misunderstanding User Needs

Symmetric Design

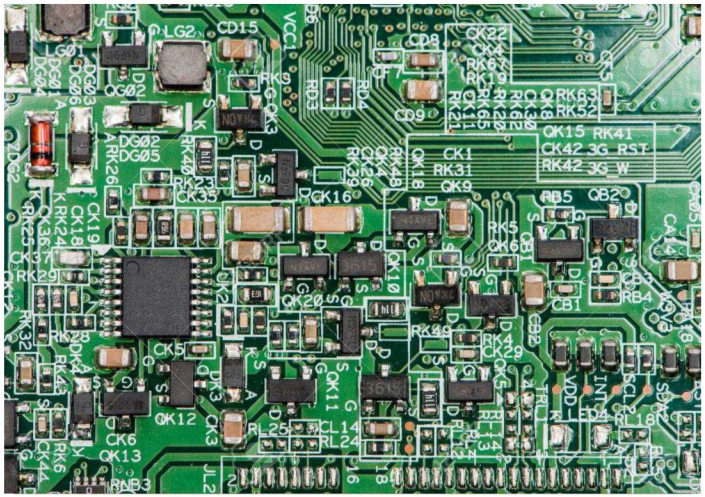
Interface Ambiguity

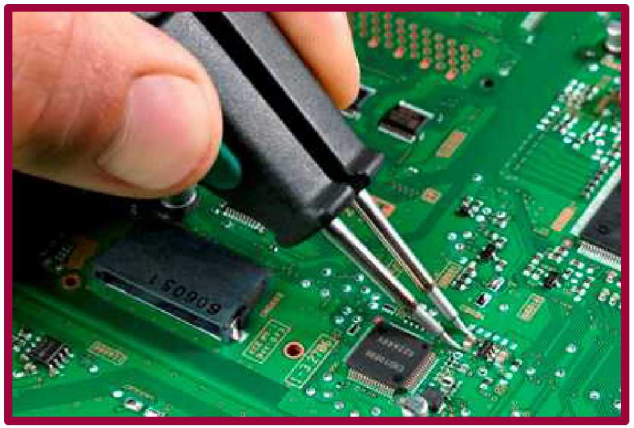


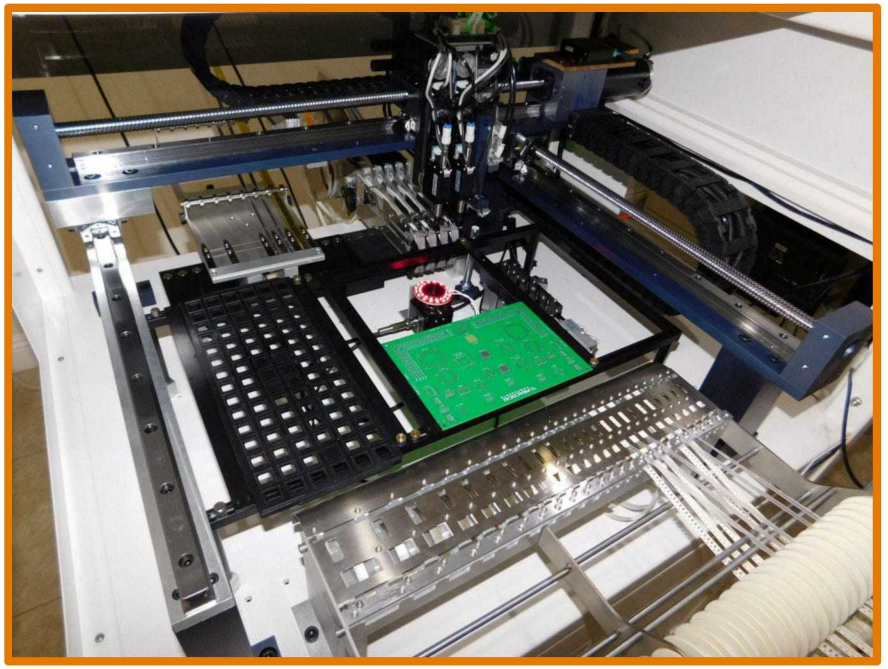
Common Components



Manual Processes and Tasks







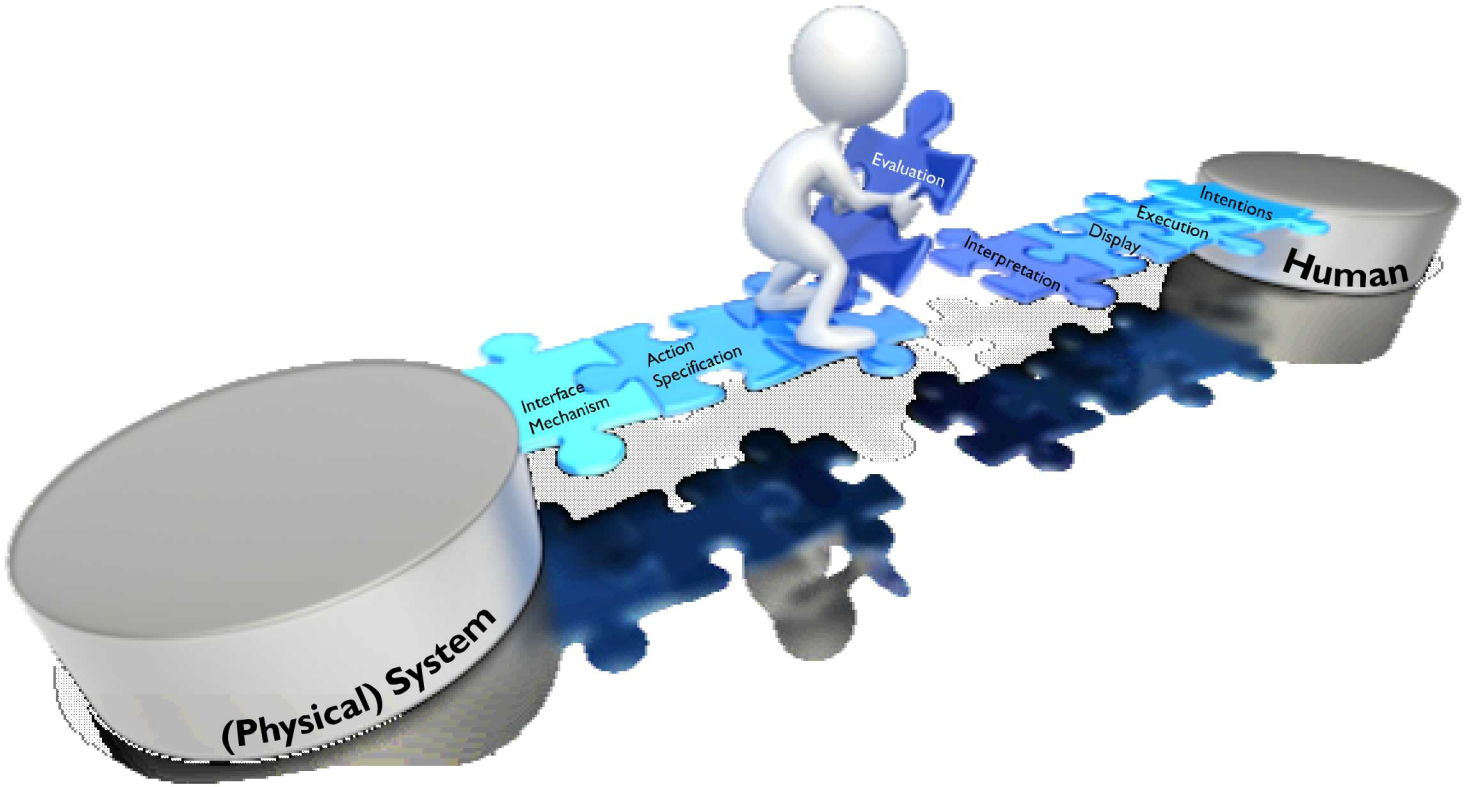
Takeaways

Understand who your customers/users are

Consider limitations of humans; strengths and limitations

Conduct user testing with a appropriate userbase; get feedback

Design systen
requirements/

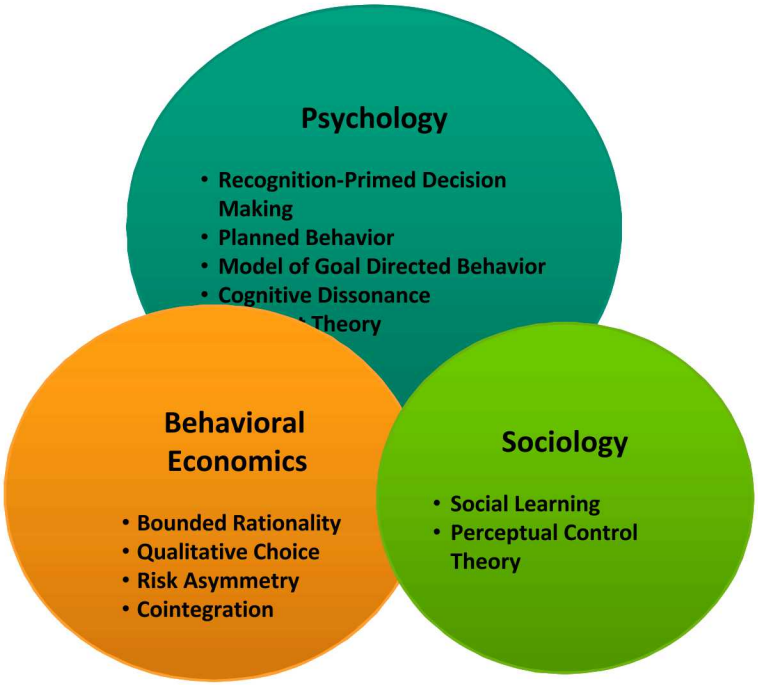


Thank You and Hook'em!

Supplemental Slides

Based on Theories of Human Decision Making/Behaviors

Incorporates a Set of Theories Across Domains



Theory Descriptions (Examples)

Perceptual control theory

- Model of behavior based on the principles of negative feedback, but differing in important respects from engineering control theory

Prospect theory

- People make decisions based on the potential value of losses and gains rather than the final outcome, and that the losses and gains are evaluated using certain heuristics

Recognition-primed decision making

- Model of how people make quick, effective decisions when faced with complex situations

Qualitative choice theory

- *Daniel McFadden: 2000 Nobel Prize*
- Social responses are dominated by uncertain decision logic, parameters, and information processing

Social learning theory

- Individual's behavior is influenced by the environment and characteristics of the person

Human Reliability Analysis

Reflects an understanding that people and systems are not error-proof, and that improved reliability requires an understanding of error problems, leading to improved mitigation strategies.

Can assist in identifying vulnerabilities within a task, and may provide guidance on how to improve reliability for that task.

Basic Process

- Observe work and perform task analysis
- Highlight potential errors within tasks
- Identify nominal error rate for task types
- Incorporate effect of performance shaping factors to increase or decrease likelihood of error
- Identify mitigation strategies