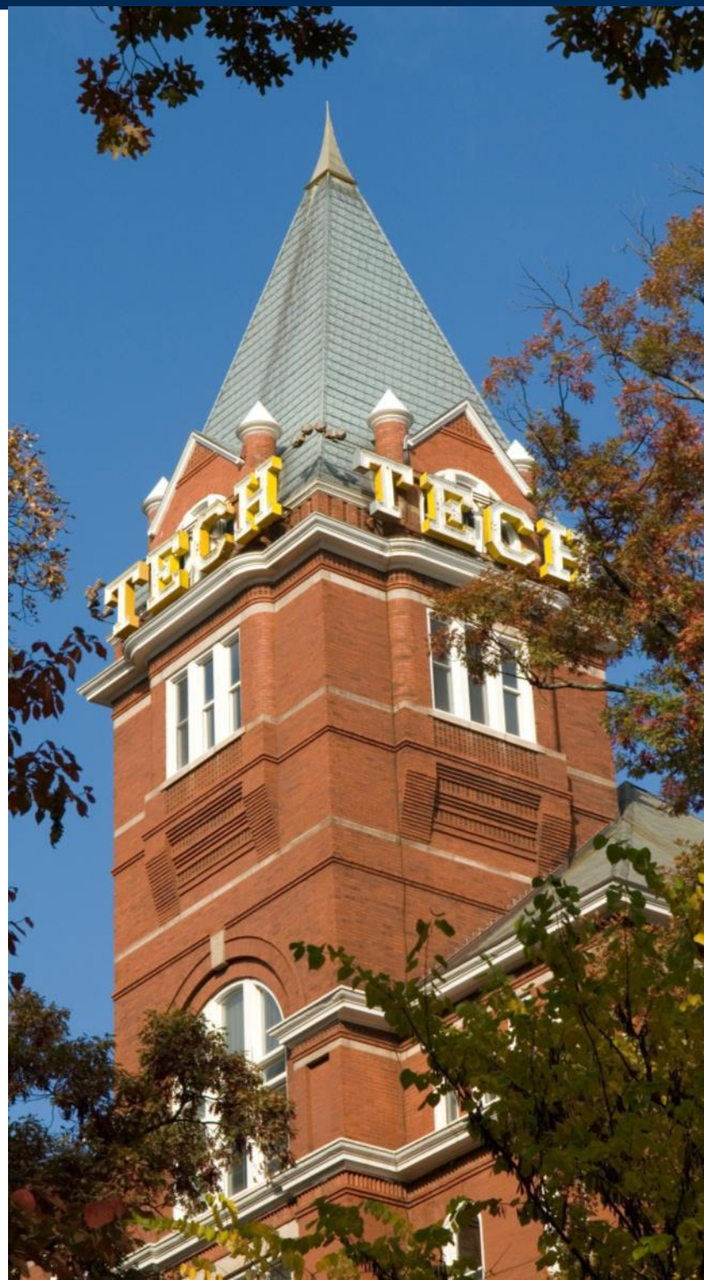
simpathē:
A Computational Model to Facilitate Human Systems Integration Evaluations

Elizabeth Weldon, M.S.
CJ Hutto, Ph.D.

Human Systems Engineering Branch
Georgia Tech Research Institute



Human Systems Integration Domains

- Human Factors Engineering
- Manpower
- Personnel
- Training
- Habitability
- Safety and Occupational Health
- Force Protection and Survivability

Human Systems Integration Domains

- Human Factors Engineering
- Manpower
- Personnel
- Training
- Habitability
- Safety and Occupational Health
- Force Protection and Survivability

simpathē

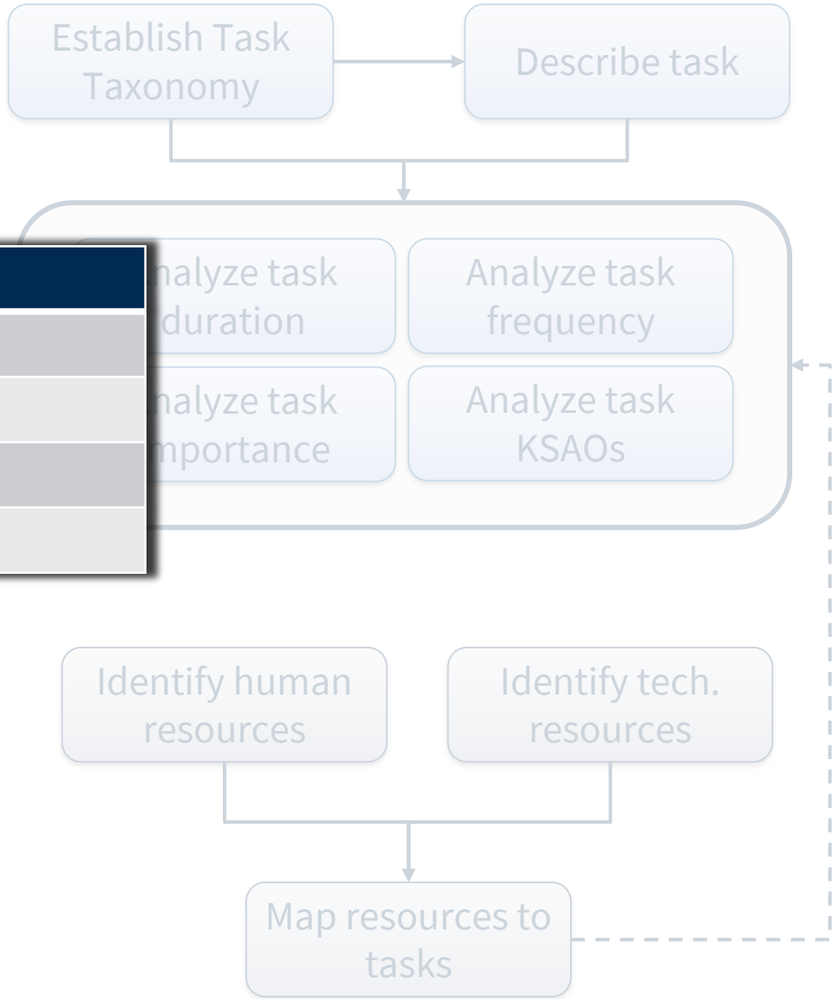
- **S**ystems **I**ntegration of **M**anpower, **P**ersonnel, **a**nd **T**raining for **H**SI **E**valuations

- Technical process model and decision support aid for MPT trade space visualization and exploration

Manpower, Personnel, & Training Analysis

- Task Analysis
  - Timing / Duration, Frequency
  - Difficulty, Importance / Criticality
  - Knowledge, Skills, Abilities

Importance Ratings
1 = Minor
2 = Marginal
3 = Critical
4 = Catastrophic



- Resource Analysis
  - Human resource elements (roles, jobs, individuals, etc.)
  - Technology resource elements (weapons, CSCI, controls/displays, etc.)
  - Allocate resources to tasks

Manpower Calculations

- Equivalent Man-Week

$$EMW_{task} = \mu_{task} \times eqp_{task}$$

- Full-Time Equivalent

$$FTE = \frac{\sum EMW_{task}}{workweek} \times 0.75$$

Personnel Calculations

- FTE for particular job roles

$$FTE_{role} = \frac{\sum EMW_{task*role}}{workweek} \times 0.75$$

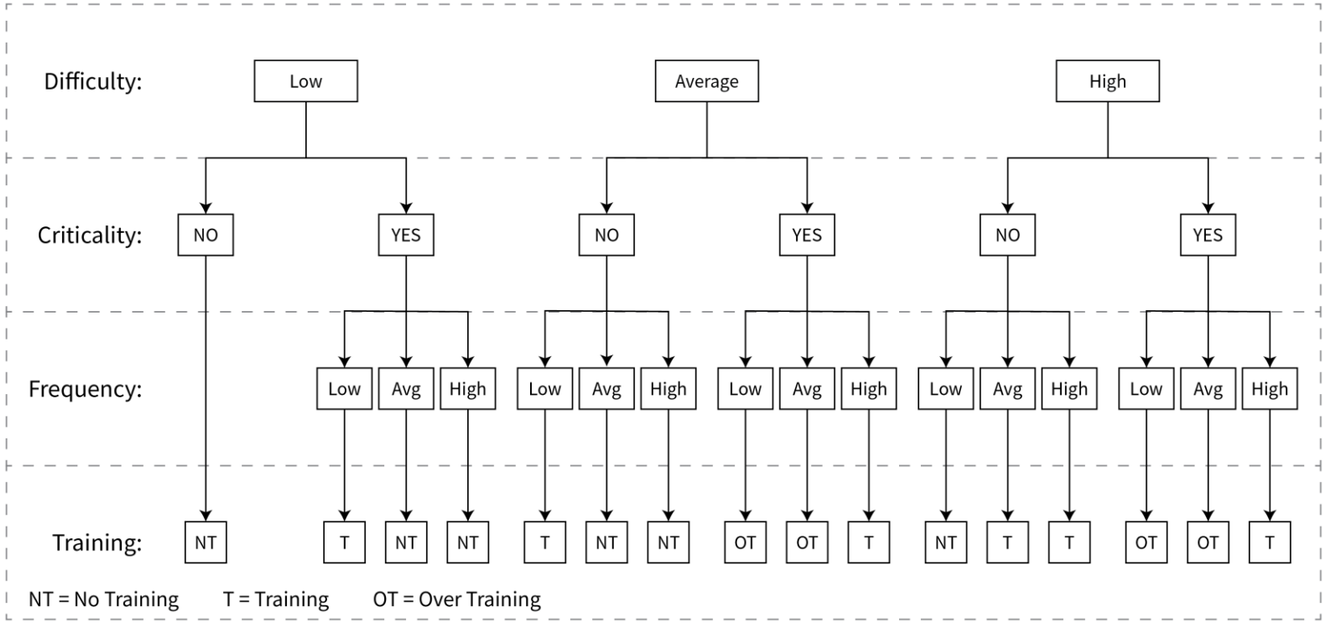
- KSAO mismatch

$$\Delta KSAO = KSAO_{requisite} - KSAO_{personnel}$$

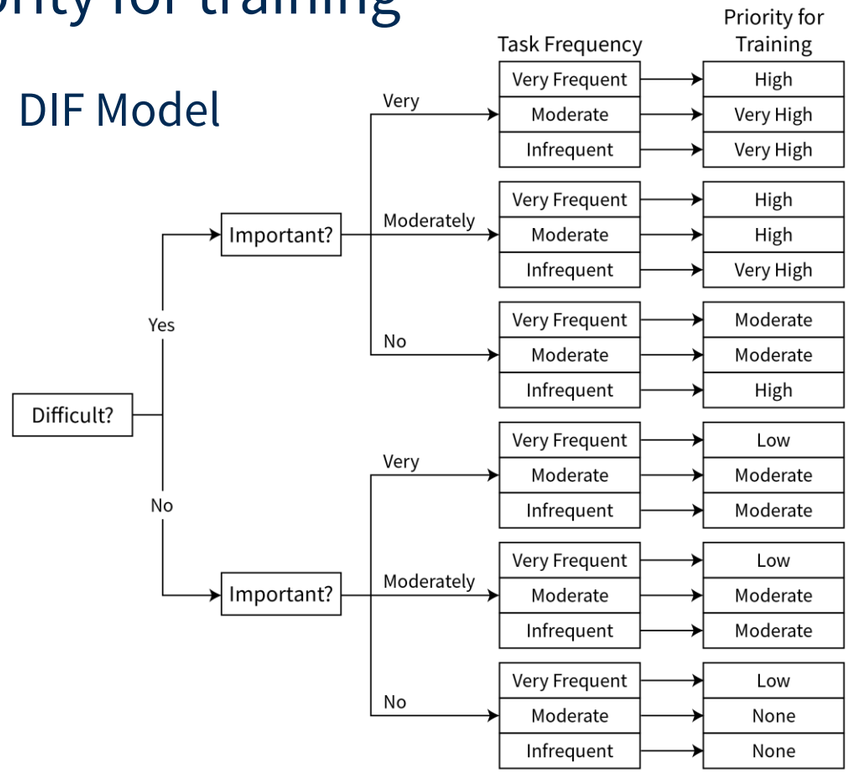
Training

- Knowledge and skill gaps can be addressed in training
- Task analysis elements can inform selection and priority for training

CDF Model



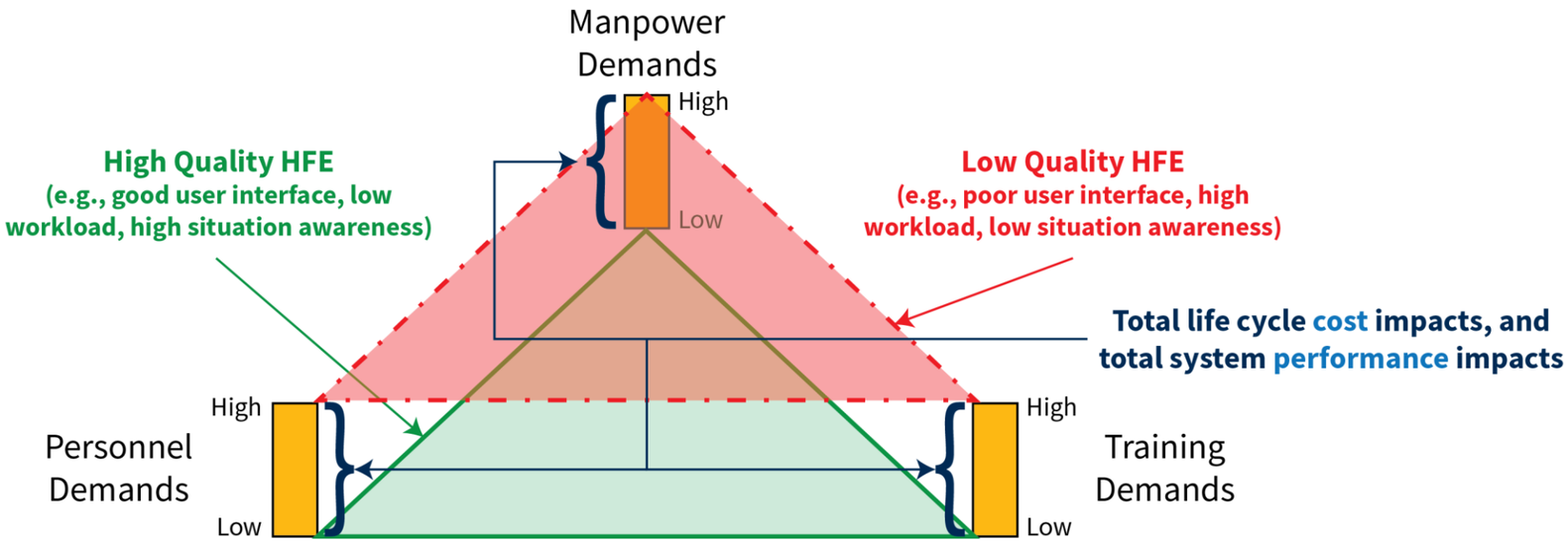
DIF Model



Source: MIL STD 29612-2A

M-P-T (and HFE) Interactions

- The trade-space between Manpower, Personnel, Training (and Human Factors Engineering) quickly becomes complex when considering analysis of alternatives



“What-if” Trade-space Analysis Example

- Do we have the appropriate manpower and personnel to operate, maintain, and support existing systems?
  - Given: data from Total Force Structure Management System (TFSMS)
    - List of all units, each with {x number} systems assigned and {y number} of each personnel type
  - Given: data from a mission task analysis
    - List and descriptions of all tasks, each with details related to {duration, DIF, KSAOs}
  - Show: utilization profiles, labor-to-task/function allocations, impact of alternate MPT allocations, KSAO coverage by personnel type
  - Explore: summary by selected unit(s), utilization/KSAO coverage impacts of alternate staffing concepts, optimization recommendations (re-allocate technology or human resources)
  - Compare: system or job design alternatives, MPT impact of technology or force modernization

simpathē: demonstration

Other “What-if” Trade-space Analyses Supported

- What is the optimal number of systems the existing organizational force structure is able to support?
  - Details by unit at varying levels of hierarchy
- What are the MPT-related tradeoffs in relation to competing {system or job} design alternatives?
  - Differences in manpower, utilization/workload, personnel requirements, KSAO coverage
- What are the MPT-related impacts in response to a new or updated system?
  - How do tasks change in response to a new or updated system?
    - New tasks are added? (more people? different personnel/KSAO reqs? different training?)
    - Some tasks removed? (fewer people? less skilled/knowledgeable? reduced training time/cost?)
    - Same tasks, but different {duration, frequency, DIF, KSAOs}

Questions? Comments?

Liz Weldon

Elizabeth.Weldon@gtri.gatech.edu

404.407.8438

Dr. C.J. Hutto

cjhutto@gatech.edu

404.407.6887