# Engineering Systems Doctoral Seminar ESD.83-- Fall 2009

Class 5--October 7, 2009

Faculty: Chris Magee and Joe Sussman

TA: Judy Maro

Guest: Professor David Mindell (STS Program and Engineering Systems Division)

# Class 5-- Overview

- Welcome, Overview and Introductions (5 min.)
- Dialogue with Professor Mindell (55min)-- Redaction provided by David Ramberg
- Break (10 minutes)
- Discussion of ESD.83 faculty-provided theme-related papers led by Farzan Sasangohar (30 -40 min)
- Theme and topic integration: Report from the front;Where historical knowledge fits; processes for knowledge generation; Hughes-Rescuing Promethesus (Sussman)
- Next Steps -preparation for Class 6- (5 min.)

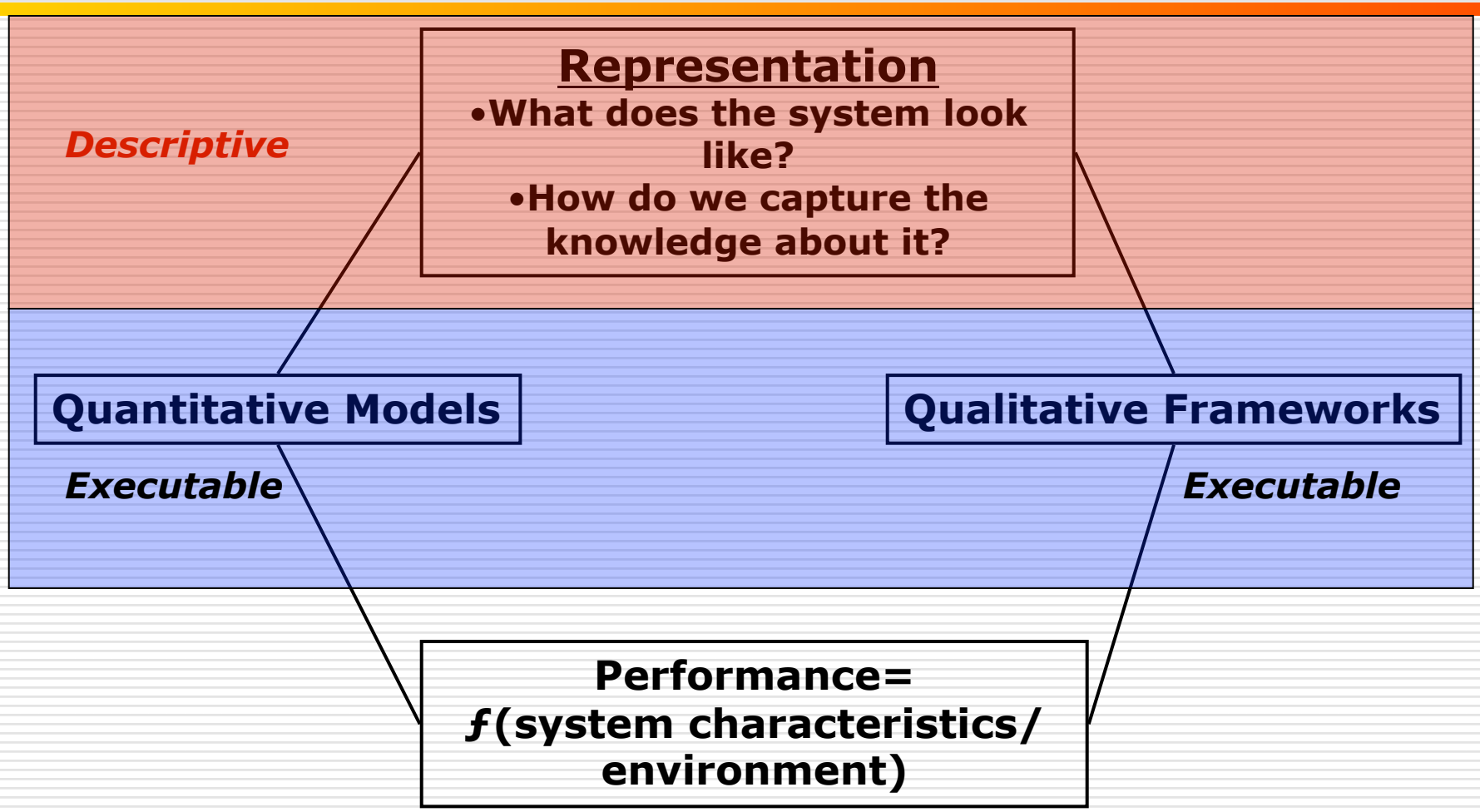
# Theme and topic integration: Class 5 October 7, 2009

- Report from the front-- New York Times, September 27, 2009, "The New Sputnik" by Op-ed columnist Thomas L. Friedman
- "Teaching and Learning Time"
- Class 6 Plan (Sussman)

# "Teaching and Learning Time"

- Where historical knowledge fits
- Processes for knowledge generation
- *Rescuing Prometheus* by Tom Hughes
- Match-up of Class 5 with
  - Framing questions and
  - Learning objectives

# Representations, Models, Frameworks and Performance



# The CLIOS Process

- 3-Stage Process for studying and designing complex, large-scale, interconnected, open, socio-technical (CLIOS) systems
- A Christmas Tree--hang appropriate methods from the tree
- System representation separates all organizations (formal or informal) from other system components-- "the institutional sphere" with the rest of the CLIOS System nested within it.
- Concepts: nested complexity, evaluative complexity, dealing with uncertainty….

# CLIOS Process

**Stage 1:**
Representation
-- Descriptive and Normative

**Stage 2:**
Design, Evaluation, and Selection
-- Normative and Prescriptive

**Stage 3:**
Implementation
-- Prescriptive
NB-- Iterative by nature, throughout

# CLIOS Process

| Stage | Key Ideas | Outputs |
|---|---|---|
| Representation | ▪Understanding and visualizing the structure and behavior<br>▪Establishing preliminary goals | System description, issue identification, goal identification, and structural representation |
| Design, Evaluation, and Selection | ▪Refining goals aimed at improvement of the CLIOS System<br>▪Developing bundles of strategic alternatives | Identification of performance measures, identification and design of strategic alternatives, and selection of the best performing bundle(s) |
| Implementation | ▪Implementing bundles of strategic alternatives<br>▪Following-through -- changing and monitoring the performance of the CLIOS System | Implementation strategy for strategic alternatives in the physical domain and the institutional sphere, actual implementation of alternatives, and post-implementation evaluation |

# CLIOS System Checklists

| Characteristics Checklist | Opportunities/Issues/ Challenges Checklist | Preliminary CLIOS System Goals Checklist |
|---|---|---|
| | | |

# Rescuing Prometheus-- Thomas Hughes

- Four Historical Case Studies
  - SAGE (Semi-automatic Ground Environment)air defense project
  - Atlas Project- first ICBMs
  - Boston's Central Artery/Tunnel Project
  - ARPANET

# ESD.83 Doctoral Seminar in Engineering Systems

Fall 2009