

# Analysis Considerations Action Plan 5&9

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# Outline

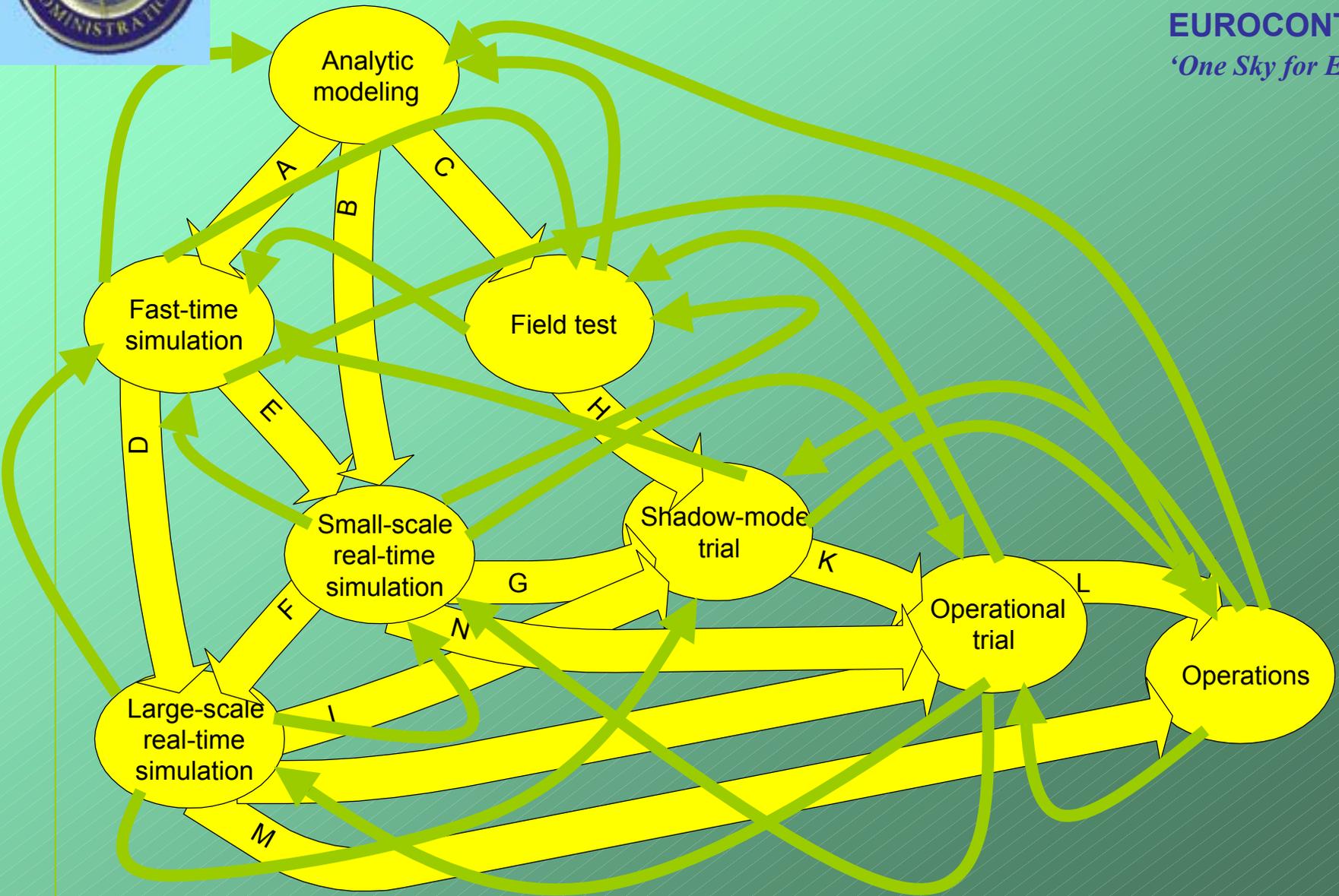
- Under what conditions are these analyses used
- Why are these analyses used
- What are these analytic data used for
- Issues
  - Complexity
  - Granularity
  - Validation
  - Prediction of the  $n+1$  event
  - Measures/metrics, ties to scenarios (safety, efficiency, capacity)



# Analytic Spaghetti

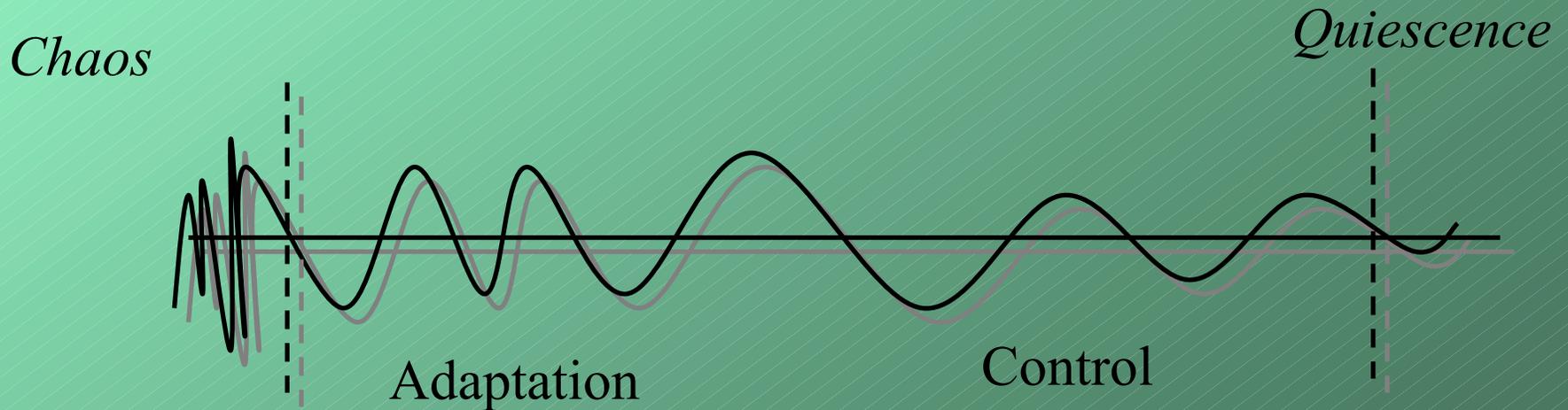


EUROCONTROL  
*'One Sky for Europe'*



# Analytic Conditions?

- Partial Representation of the goals & constituent tasks
- Partial Representation of variety of agents (Artificial & Human)
- Partial Representation of the time interval of performance
- Partial Representation of the operational range



Implication is that choices have to be made

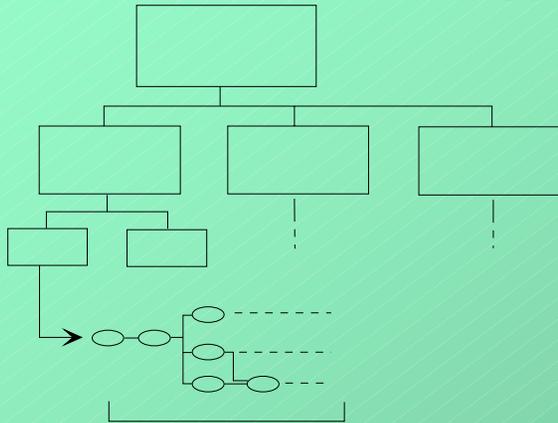
# What: Discrete Event vs. Continuous Simulation

- Discrete Event
  - Discrete event provides the state of the simulation at points defined (events).
  - Simulation world is stateless (does not exist in any sense) between these events.
  - Time progress may be provided or may need to be calculated based on time/event relations
- Continuous
  - Time-based values for entities in simulation
  - Supports unanticipated interruption and interaction with other simulation entities
- Hybrid
  - Define time as a regular event
  - Provide coordinative event messages

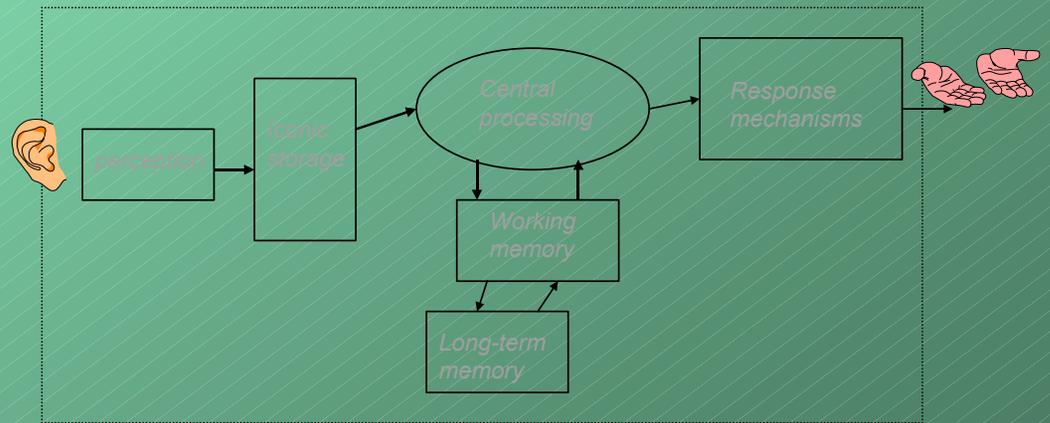
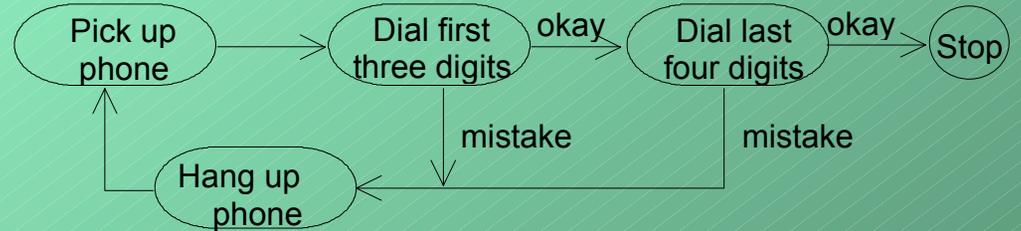
# Why Are These Analyses Used

- Performance Distribution Based on Sources of Variability
  - “Within” Variability
    - Action Selection
    - Decision
    - Response times/accuracy
  - “Between” Variability
    - Event Probability (stochastic or fixed)
    - “Error”

# Example from Human Performance In Two Forms



Task Network Mode



Human Function Model

# Task Description

**Task Description**

Edit

Looking at Task    

Task Number  Name

**Task Timing Information**

Time Distribution

Mean Time:

Standard Deviation:

**Release Condition and Task Execution Effects**

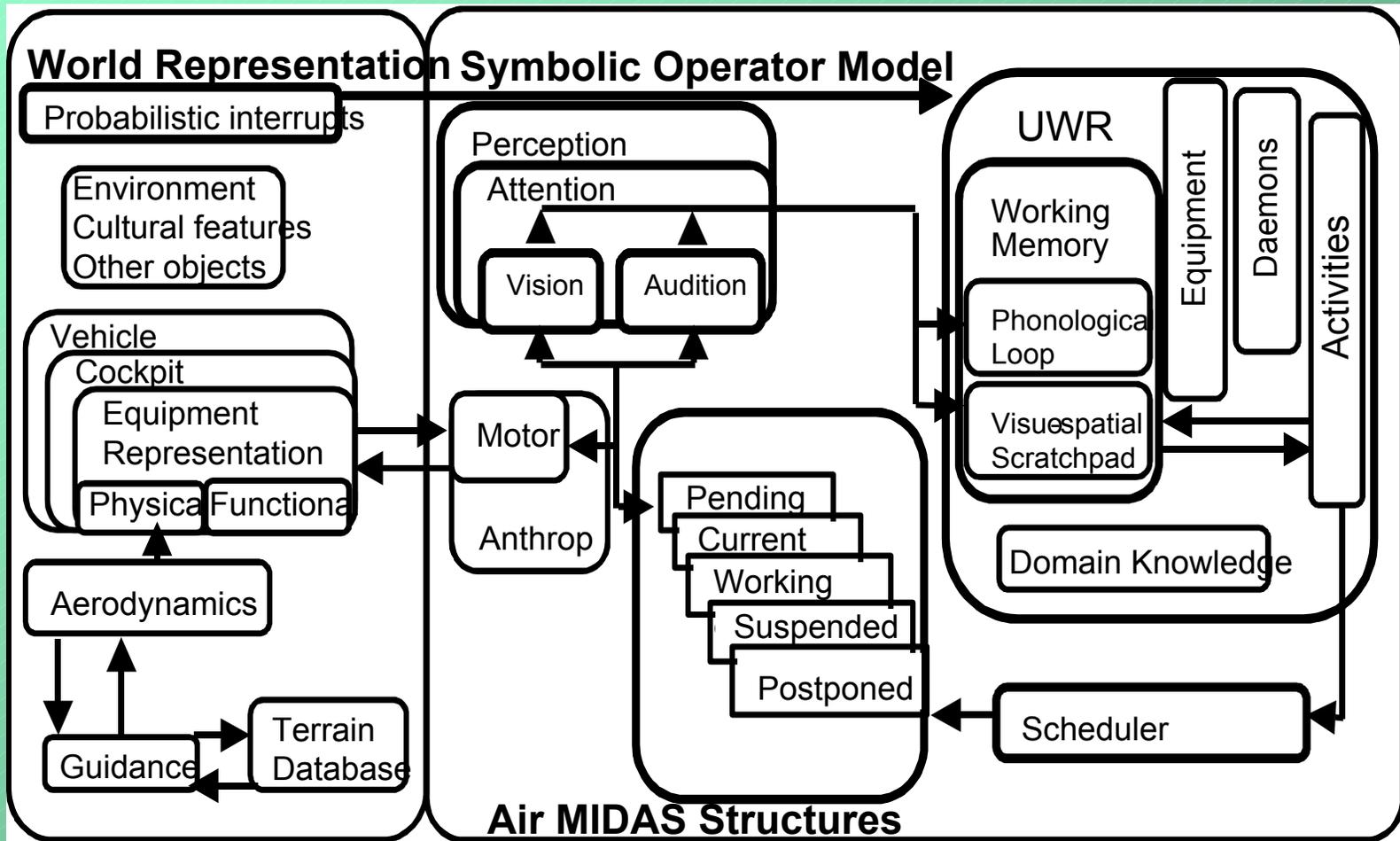
Release Condition:

Beginning Effect:

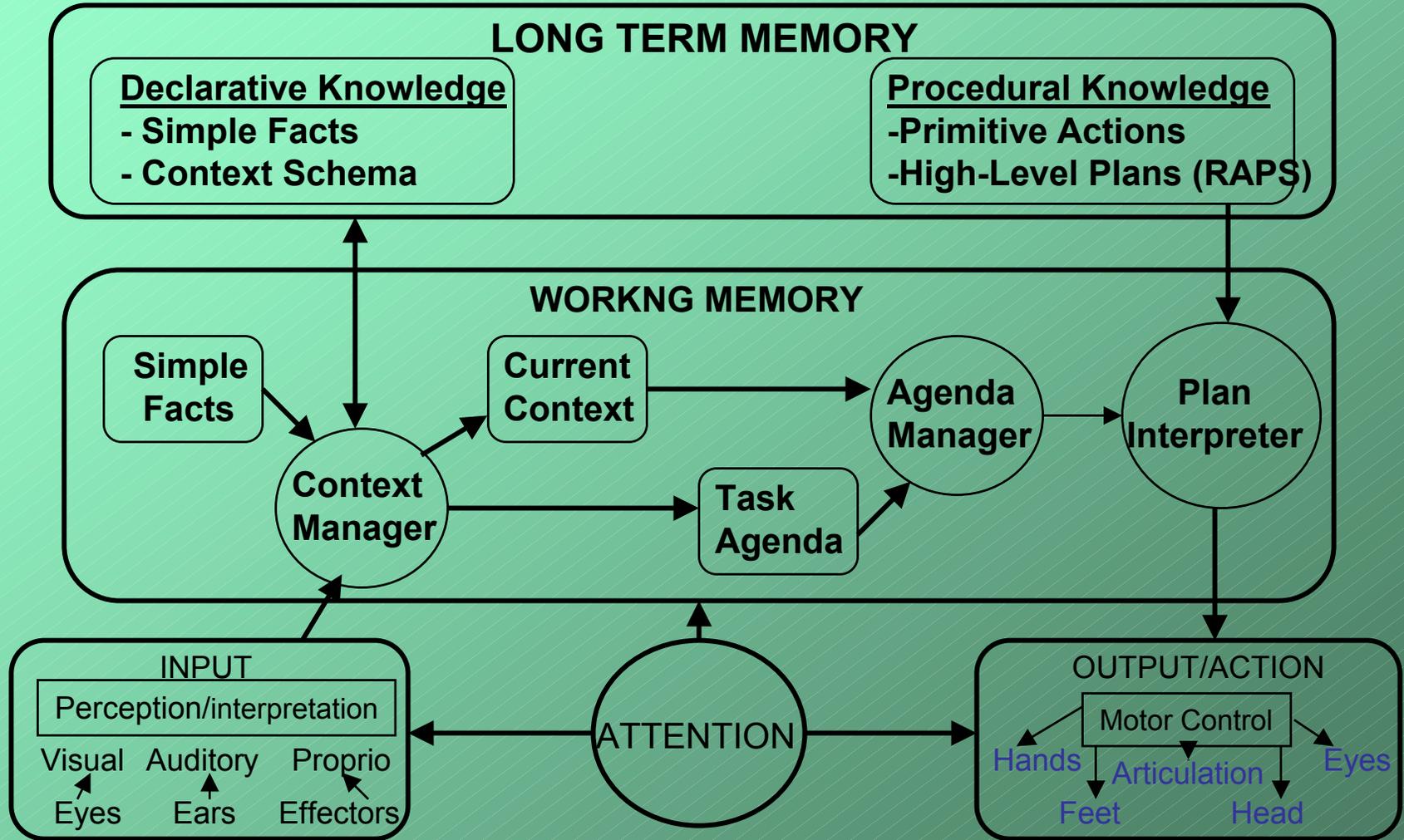
Launch Effect:

Ending Effect:

Data Collection



# MIDAS Cognitive Architecture



Overall functional architecture of the human operator model in MIDAS. The functional architecture is repeated as multiple operators need to be represented in larger team simulations.

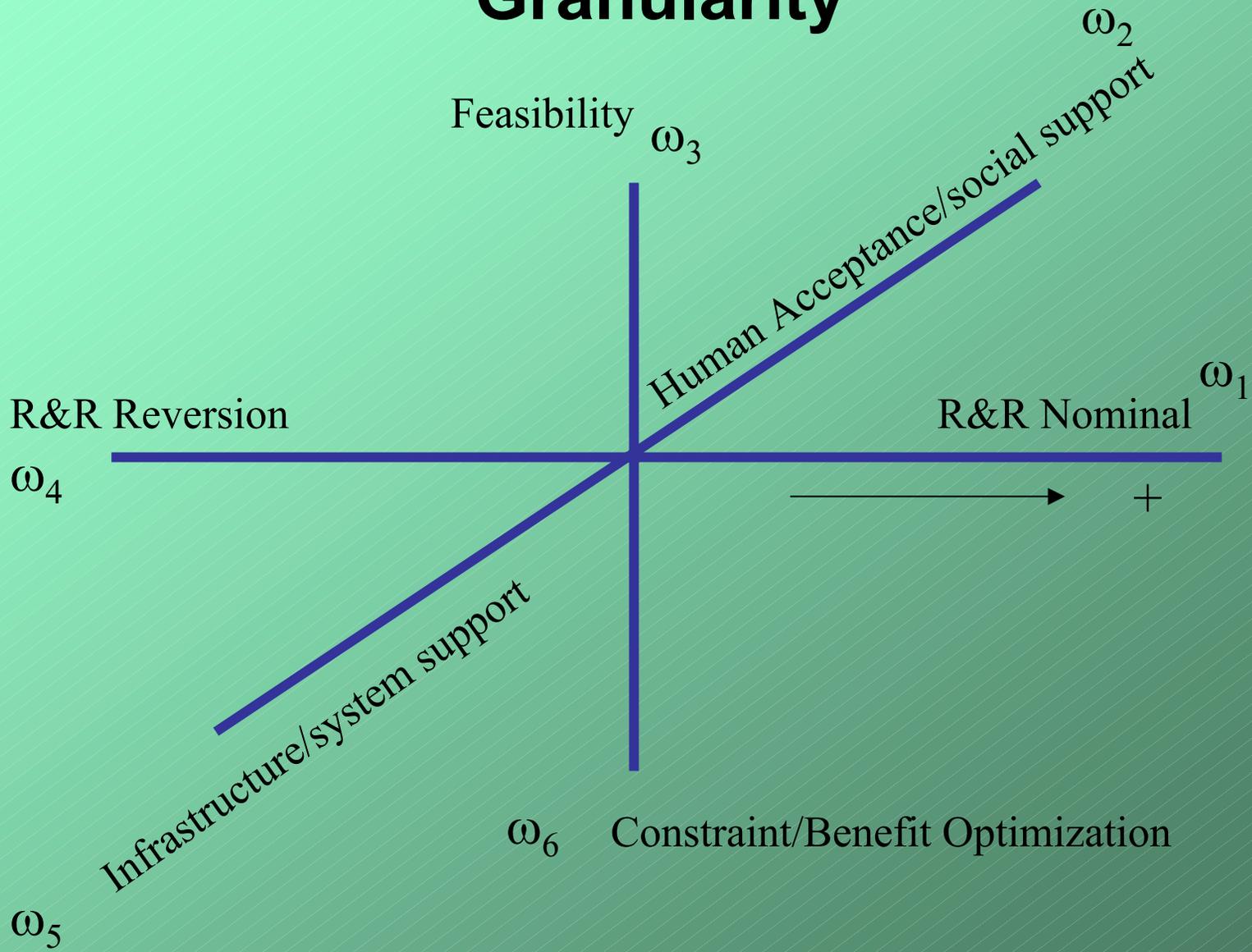
# What Are Analytic Applications

- Event Course to stability in response to perturbation
  - Perturbation may be standard state
    - Time to stability
    - Effort to stability
- Examine Design Point Changes
  - Propagation or Signature or Design
    - Roles & Responsibilities
    - Information Requirements
    - Temporal Structure
    - Span of Control
- Examine the Interaction of Variabilities
  - Amplification or Damping of Natural System State
    - Impact of WX, Schedule uncertainty, Logistics, etc...
    - Impact of System Outages, abnormal operations, catastrophe, etc...
    - Demand structure, schedule, business case...
    - Airspace structure, operating principles...

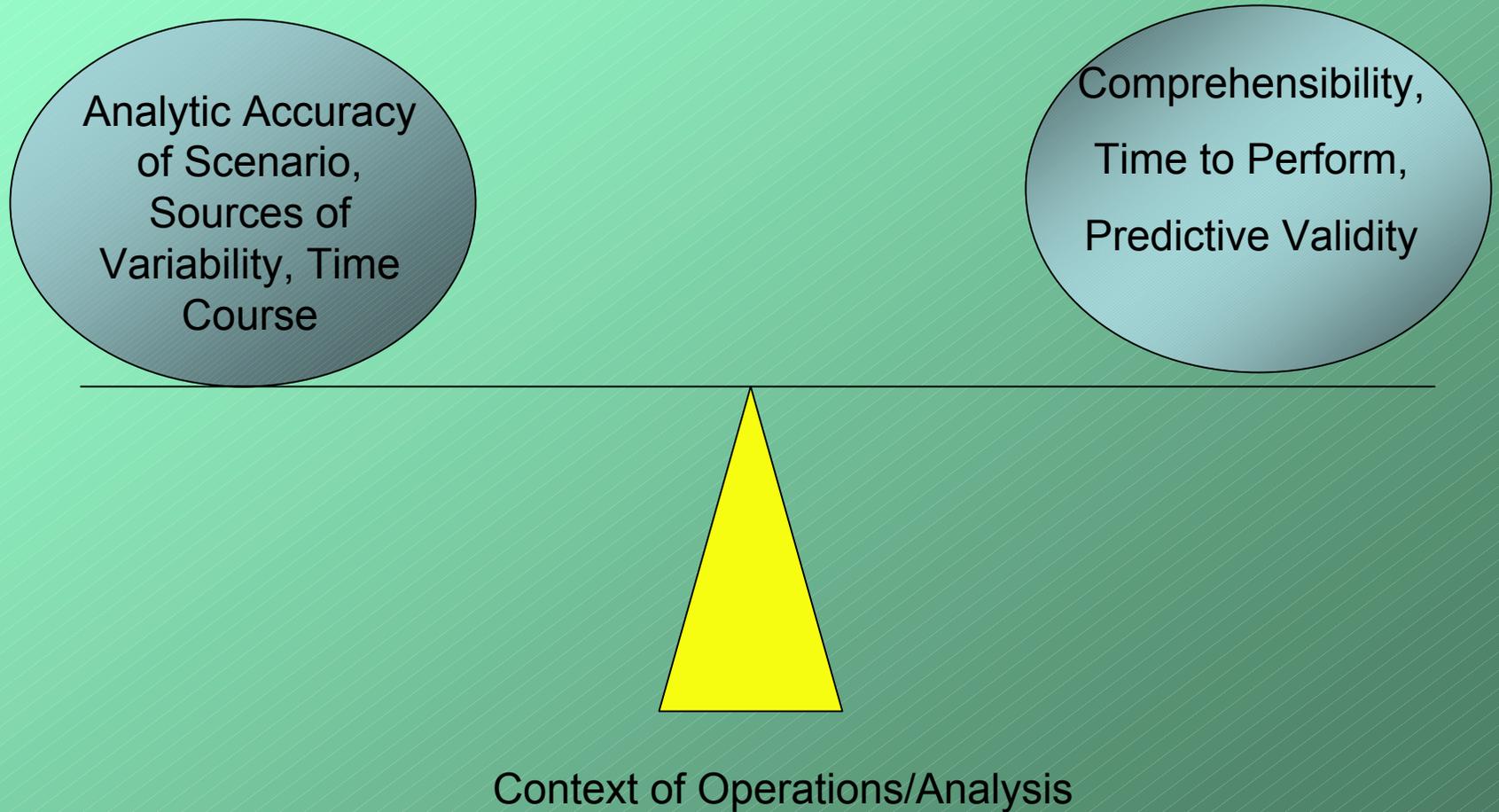
# Issues

- Complexity
- Granularity
- Validation
  - Prediction of the  $n+1$  event
  - Measures/metrics, ties to scenarios (safety, efficiency, capacity)

# Granularity



# Complexity



# Validation

- Prediction of the N+1 event
- Baseline
  - Purpose
    - Starting Point for Time Series Analysis
    - Comparative Point for Judging Change
    - Calibration point for Models (predict the past or present)
- Definition of Simulation
  - What are the elements that comprise a scenario
  - What characteristics of these need to be represented
- Degrees of Freedom Issue in Validation
  - “What you want this thing to say?”
  - Multivariate interaction in high dimensional simulations