Human System Integration - Cybernetics

S&T Campaign: Human Sciences
Integration of Humans and Systems
Integration Technologies

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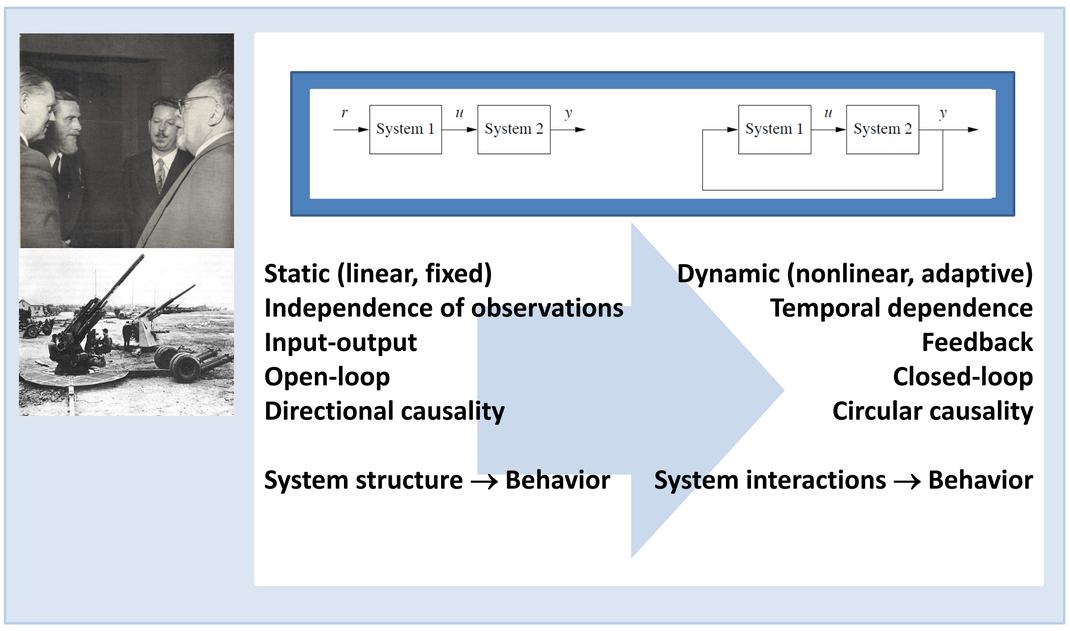
Research Objective

- **Apply the concepts, insights, and methods of *cybernetics* for the study of adaptive behavior in human closed-loop interactions with technology to exploit the *dynamic* nature of human behavior to improve the integration of human and system capabilities**



Left: Cybernetic foundations; Right: Paradigm shifting perspectives

Challenges

- **Theoretical conceptions and computational models of adaptive systems and behavior are immature**
- **Human systems are closed-loop, though current models typically ignore the state and temporal dependences inherent to human behavior**
- **Human systems are high-dimensional, though most current models are low dimensional**
- **Relationships of system organization, dynamics, and functional behavior is not well-understood**

Human systems are cybernetic systems

ARL Facilities and Capabilities Available to Support Collaborative Research

- **Available Facilities (APG, MD)**
  - **Multisensory augmented reality testbed platform**
    - Wearable, Head-mounted
    - Highly Immersive
    - Flexible, reconfigurable sensor arrays
    - High-resolution, wide field, stereoscopic displays
    - Embedded eye tracking capabilities
    - Depth sensing, including hand and finger tracking
  - **Multi-aspect real-world measurement capabilities**
    - Wearable, Un-tethered Operation
    - Flexible, Fully Customizable User Interface
    - Multiple modalities: EEG, EKG, EDA, respiration, blood pressure, motion, posture, and others
  - **Environment for Auditory Research (EAR)**
    - Multiple, reconfigurable spaces
    - Unique stimulus arrays, suitable for visual and auditory, as well as tactile displays
  - **Access to Army High Performance Computing resources**
- **Unique ARL expertise includes:**
  - Sensory& perceptual processes
  - Adaptive mechanisms in multisensory integration & Pprception
  - Real-world experimental design and analysis

Complementary Expertise / Facilities / Capabilities Sought in Collaboration

- **Additional expertise needed in:**
  - **Computational and statistical modeling of adaptive and neural systems**
  - **Systems and adaptive control theory modeling of human and biological systems behavior**
  - **Algorithm development and software implementation**
- **New research approaches sought in:**
  - **Innovative experimental paradigms and proof-of-concept implementations to probe adaptive processes in human behavior**
  - **Novel stimulation modalities to enhance perceptual and motor performance**
  - **Embodied approaches to functional behavior, including multisensory integration and multi-sensor fusion**