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PURPOSE OF WORKSHOP

- Introductions of people, ideas:

  Organizations:

  Los Alamos National Laboratory: CIC, T, EES

  Free University of Brussels (VUB): Center Leo Apostel

  New Mexico State University: Mathematics, Physical Science Lab

  Santa Fe Institute

  City College of New York: Computer Science

  University of New Mexico: Computer Science

  Research Projects:

  Symbiotic Intelligence Project: LANL

  Principia Cybernetica: VUB, LANL, CCNY

  Knowledge and Distribtued Intelligence: NMSU, LANL

- Groundwork for future collaboration:
  - Collaborative distance experiments/development
  - Anthology/journal issue
  - Future workshops

COMPLEX SYSTEMS AS INFORMATION NETWORKS

- Examples:

  Control and Communications Systems: Management of information for planning and control in organizations

  Socio-Technical Systems: Distribution, transportation, communication, markets

  Society: Social communication networks

  Ecosystems: Trophic and reproductive networks

  Neurosystems: Neural networks

  Organisms: Metabolic and genetic networks

  Complex Physical Systems: Chemical and physical networks

- Dual approach to information networks:
  - As *objects of* science themselves
  - As platforms *on which to do* science:
    - Modeling and simulation
    - Manifesting simpler examples of more complex classes

DISTRIBUTED INFORMATION SYSTEMS (DIS)

- A broad vision of Distributed Information Systems (DIS):
  - Computer-assisted information environments ...
  - For the representation and organization of knowledge ...
  - Involving interactions with and among communities ...
  - Of users, whether human, non-human, or autonomous computational processes.
- Current examples:
  - Internet, World Wide Web
  - Intranets, local webs, Web-based Information Systems (WIS)
  - General cyberspace:
    * Financial networks
    * Markets
    * Telecommunications

DIS AS TRANSFORMATIVE TECHNOLOGY

- Properties (potential):

  Breadth: All informational transactions

  Modal: In many media

  Depth: In fine detail, complete “audit trail”

  Accuracy: Mostly lossless transmission

  Symbiosis: Mutual interaction and evolution with user communities

- DIS as “nervous system” of global society
  - All economic activity and communication
  - Radical new forms of social organization and problem-solving
- Immediate applications:
  - Knowledge organization and information retrieval
  - Scientific data management
  - Decision support and Computer-Supported Cooperative Work (CSCW)
  - Information warfare
  - Crisis response and management
  - Infrastructure protection
  - Urban planning
  - Marketting
  - Entertainment

SCIENTIFIC APPROACH

Questions: Of DIS themselves, and in relation to user communities

- Data vs. information vs. knowledge
- Structure
- Dynamics
- Organization
- Self-organization
- Emergent properties
- Local vs. global scaling, hierarchy
- Adaptation
- Evolution

Models: Formal approaches brought to bear

Networks: Automata, agents

Conceptual Graphs: Semantic networks, semantic spaces

Mathematical Graphs: Hyper-, multi-, labeled, weighted

Complex Systems: Insect societies, chemical networks

A SEMIOTIC PERSPECTIVE ON DIS

- Semiotics as the the science of signs and symbols
- Tokens always *interpreted* by users (actors or agents)
- Interpretations always relative to a *frame* (context, language, code)
- Relative degrees of freedom and constraint over possible interpretations
- Consquences of interpretation always "grounded" back into the world
- Formal properties of DIS (syntax) never sufficient:
  - Representations of their *meanings* (semantics) to user communities
  - *Use* by user communities (pragmatics) to aid their persistence or survival