

# *Identifying Real World Processes Amenable to Modeling*

Lawrence A. Kuznar  
National Security Innovations  
lkuznar@natlsec.com  
(260) 636-1041

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Analyzing the Impact of Emerging Societies on  
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# Agenda

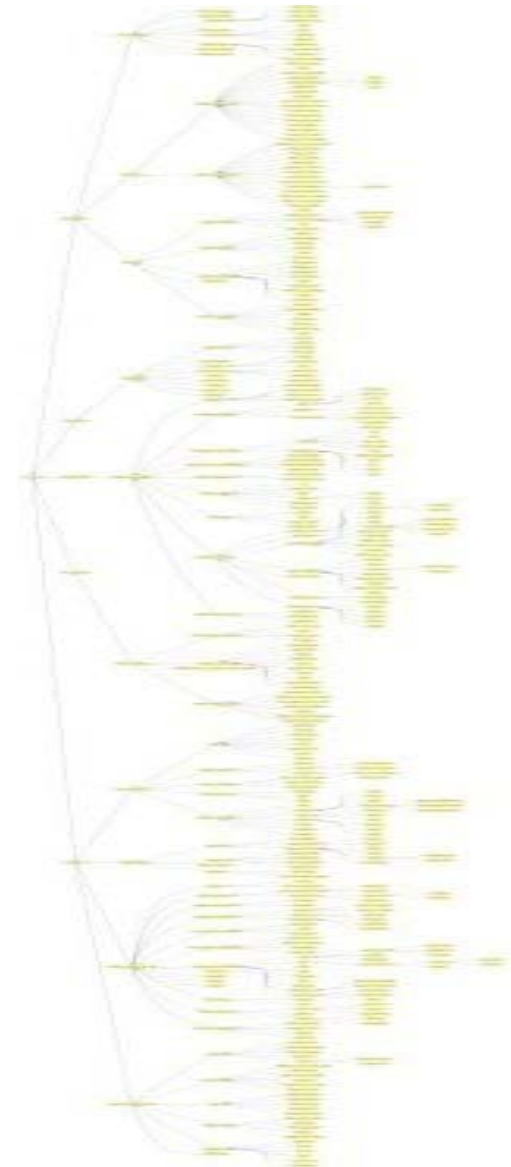
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- Social Ontology – What Are We Trying to Model?
- Modeling Social Emergent Processes: Who Should be Involved?
- Complexity and the Issue of Reductionism
- Micro-Macro Approaches and Bridging the Micro-Macro Gap
- The Nature of Cognition – Simple or Complex?
- The Benefits of Modeling: KISS vs. HiFi?
- What Are We Explaining, Things or Processes?
- Causality
- Validation

# Ontology: HRAF OCM

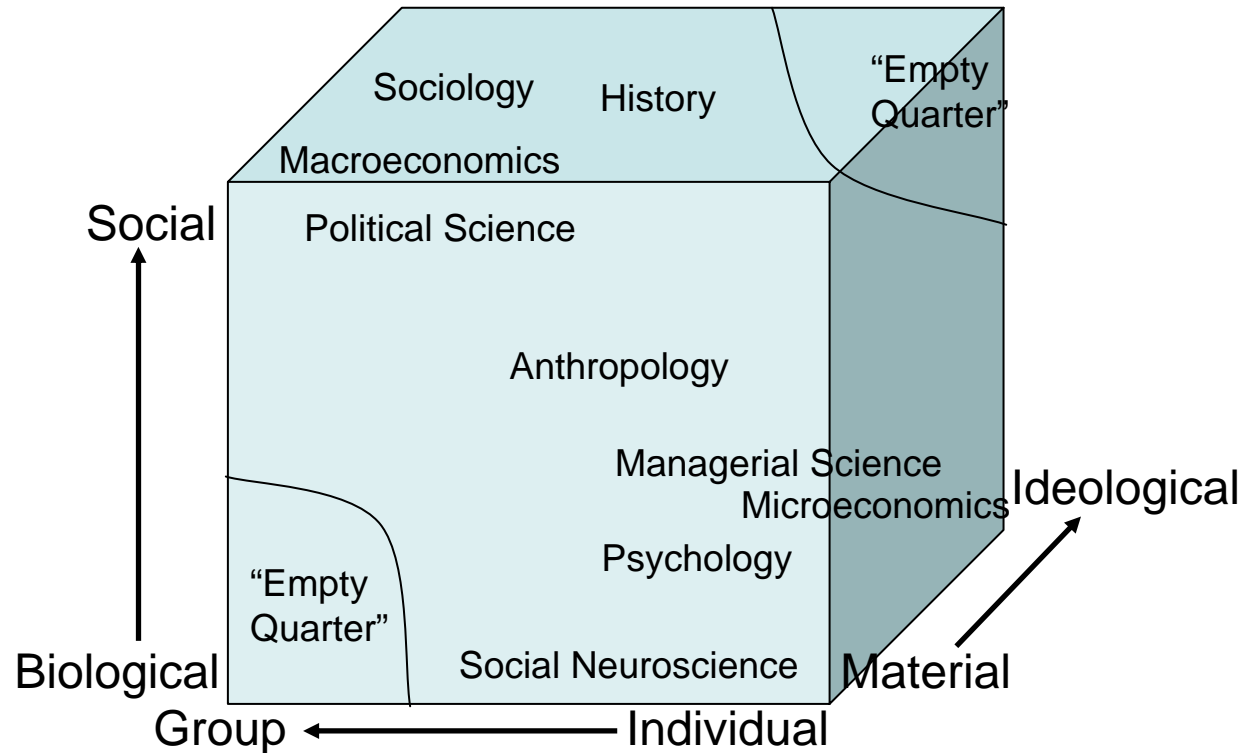
(Human Relations Area Files, Outline of Cultural Materials)

- History, Prehistory, and Culture Change
- Language and Communication
- Economy, Food, and Resource Exploitation
- Technology and Material Culture
- Marriage, Family, Kinship, and Social Organization
- Social Relationships
- Life Cycle
- Sexuality and Reproduction
- Political Organization and Behavior
- Justice, Law, and Social Problems
- International and Interethnic Relations
- Religion
- Health, Illness, Medicine, and Death
- Education and Knowledge
- Arts
- Recreation



# What Are the Relevant Social Science Disciplines?

- **Emergence Involves Micro-Macro Processes**
- **All Social Science Disciplines Relevant**
  - **Neuroscience**
  - **Psychology**
  - **Microeconomics**
  - **Managerial Science**
  - **Anthropology**
  - **Political Science**
  - **Macroeconomics**
  - **History**
  - **Sociology**

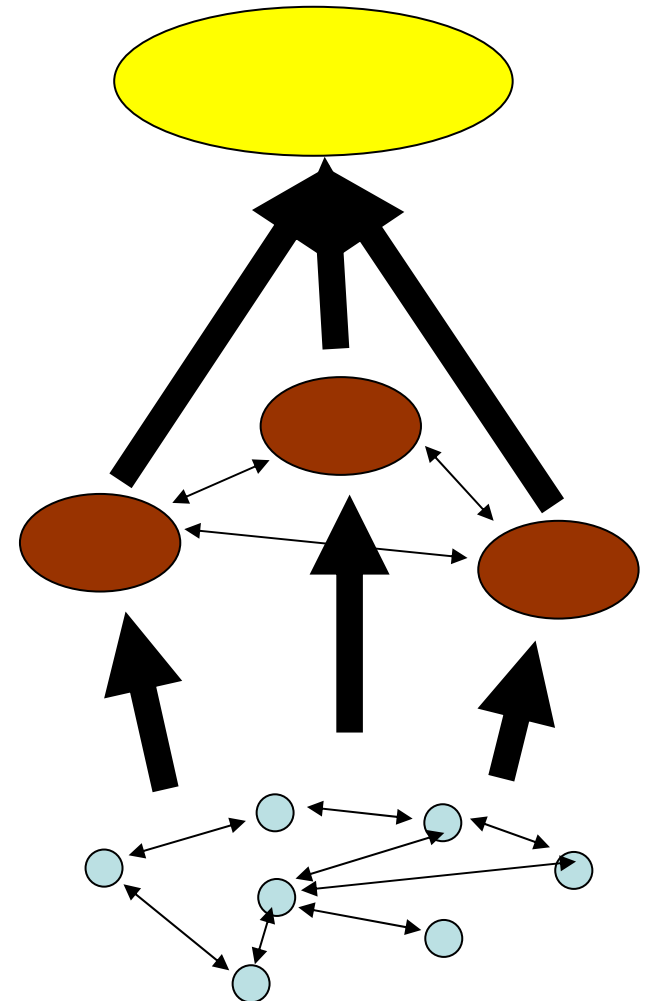


# Complexity and Reductionism

- Prohibitions against reductionism are outdated, “The Whole is greater than the sum of its parts”
  - $W > p_1 + p_2 + \dots + p_n$
  - $W = p_1 * p_2 + p_3^2 - (p_3 * p_2) \dots$
- Following Holland, “reduction has much to do with our exploration”
- Ideally, computational methods can start with hard-programmed entities and interactions, which generate emergent entities and unforeseen interactions among them, and so on...
- Need the entities, otherwise exposed to danger of:
  - Alchemy
  - Ecological fallacy

# Genuine Emergence

- Bridging the Micro-macro gap
  - Need simulations that:
    - Generate higher-order structures
    - Higher-order structures have their own behaviors
    - Behaviors are NOT pre-coded
- Desiderata from the beginning of social science:
  - Herbert Spencer 1860: “peculiarities of society: That commencing as small aggregations, they insensibly augment in mass....continually-increasing complexity of structure....their parts gradually acquire a mutual dependence.... “
  - Franz Boas 1930: “individual can be understood only as part of the society to which he belongs, and that society can be understood only on the basis of the interrelations of the constituent elements”



# KISS $\leftrightarrow$ Hi-Fi

- Axelrod – KISS (Keep It Simple Stupid) Approach
  - Useful for exploring logical implications of theory
  - Useful for generating theory deductively
  - Provides insight – but what is insight?
  
- However, where does the rubber hit the road? Cannot Predict with KISS
- Being able to make an assertion *ceteris paribus* when the *ceteris paribus* holds most factors constant is simply not helpful to the commander in the field – A commander cannot hold everything equal on the battlefield!
  
- HiFi Approach
  - Realism
  - Vastly Compounds the Validation Problem

# Things vs. Processes

- Are we predicting actual form of social phenomena, or the processes that produce them?
- Analogy with Evolutionary Theory
  - Can microevolutionary processes actually predict “the dog?”
    - Given complexity, no 2 runs of history will be the same
    - Non-regularities (stochastic phenomena and Black Swans) almost guarantee that the dog would not evolve twice



- Relevance to Military/IC Applications – Could we have predicted bin Laden and where he is today?

# Causality

- Deductive-Nomological (Covering Law, generalizations) vs. Causal Mechanical (Process Tracing, Ideographic, Historical) Explanation Continuum



- Computational Models favor CM
- Computational Models also provide for Counterfactual Reasoning
- However, rules and methods are assumed generally true – no resolution to causality dilemma
- Ongoing empirical research on social phenomena, military operations, casualty rates, etc. necessary – modeling does not exempt traditional social science

- Earlier Science was Naïve – One theory, one model, one world
- Theories never innocent – they are many models
- Complexity → Need to produce many possible worlds that could have been
  - How do we test theories like this?
  - Bankes Exploratory Modeling
- Nightmare: What if this world is only one of many that could have been?
  - How do we test many worlds against many worlds? (Now my brain hurts)
- Must have metrics – “Viewgraph Validation” is not enough!