Slavery in Material Agent Societies

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Overview

Previous works:

- ▸ Agent Societies
- ▸ Material Agent Societies
- ▸ Elementary Economic Systems in Material Agent Societies

General goal:

- ▸ To show that the conceptual model we call *agent society* supports the specification of *formal semantical models* for social theories (developed in social sciences).
  - ▸ By showing that some particular *theorems* of social theories are valid for some particular *types* of agent societies.

The current work targets theories of *slavery*.

Main Concepts in the Present Paper

- ▸ Masters and Slaves in Chattel Slavery
- ▸ Master-Slave Property Relationship
- ▸ Master-Slave Economic Exchange
- ▸ Slavery-Based Elementary Economic Exchange
- ▸ Slavery-Based Elementary Economic Process
- ▸ Slavery-Based Elementary Economic System
- ▸ Slavery-Supporting Legal System
- ▸ Slavery-Based Material Agent Society
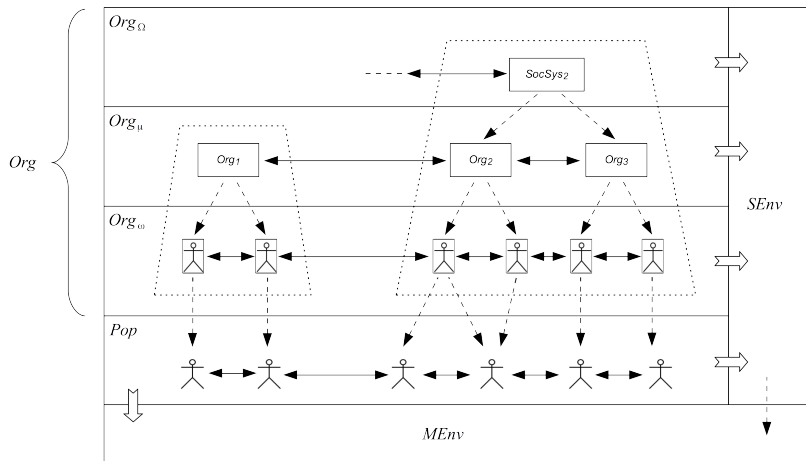
Agent Societies

An *organizational model* for multiagent systems:
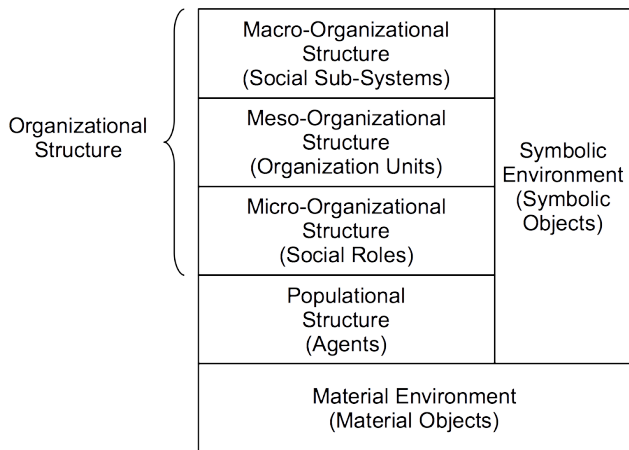
▸ supporting core aspects of *social structuration*.

Agent Societies

An *organizational model* for multiagent systems:

Material Agents and Material Agent Societies

- **Material agent**:
  - an agent that has a *material body*, requiring *energy* for its operation.
- **Material agent society**:
  - an agent society whose agents are all material agents.
- **Energy producer**:
  - a material agent that can *gather energy* from the material environment of the society;
  - possibly producing energy for delivery to other agents.
- **Energy consumer:**
  - a material agent that does not produce energy for itself.

- Material agent society **energetically autonomous**:
  - energetically self-sufficient and capable of managing itself the use of energy by its material agents.

Masters and Slaves Chattel Slavery

In a slavery-based material agent society:

- *MatObj*: the set of *material objects*;
- *MatAg* ⊆ *MatObj*;
- *Master* ⊆ *MatAg*;
- *Slave* ⊆ *MatAg*.

For simplicity, we take that:

- *Master* ∩ *Slave* = ∅;
- *Master* ⊆ *EnergCons*;
- *Slave* ⊆ *EnergProd*.

Master-Slave Property Relationship

The *property relation* between masters and slaves:

$$owns \subseteq Master \times Slave$$

If $owns(master_i, slave_j)$ then $master_i$ can:

- $sell(slave_j, master_k)$
- $lend(slave_j, master_k)$
- $rent(slave_j, master_k)$
- $kill(slave_j)$
- $free(slave_j)$
- $command(slave_j, cmd)$
- $punish(slave_j, cmd)$

And $slave_j$ is supposed to comply with:

- $mustexec(slave_j, cmd, master_i)$

Master-Slave Economic Exchange

Economic exchange with an individual slave:

$$master_i$$

$$<master_i / \perp>$$

$$<slave_j / obj_j>$$
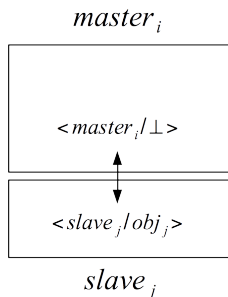
$$slave_j$$

Also possible, economic exchange with a *group* of slaves.

Slavery-Based Elementary Economic Process
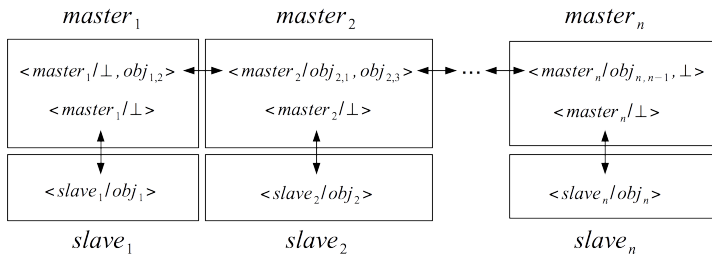
Slavery-Supporting Legal System

The fundamental authorizations:

1. $owns(master_i, slave_j) \Rightarrow$
   $Auth(master_i, command(master_i, anyact, slave_j))$

2. $owns(master_i, slave_j) \wedge mother(slave_j, slave_k) \Rightarrow$
   $Auth(master_i, owns(master_i, slave_k))$

3. $autorized(mag_i, slavecapture) \wedge captured(mag_i, mag_j) \Rightarrow$
   $Auth(mag_i, owns(mag_i, mag_j))$

Slavery-Based Material Agent Society

- $AgSoc = (Pop, Org, MEnv, SEnv, IMP, ACC)$

where:

- Pop is the *population* of $AgSoc$;
- Org is the *organizational structure* of $AgSoc$;
- $MEnv$ is the *material environment* of $AgSoc$;
- $SEnv$ is the *symbolic environment* of $AgSoc$, where the society's system of *legal norms* is embedded;
- IMP is the collection of *implementation relations* between Pop and Org;
- ACC is the collection of *access relations* between $Pop \cup Org$ and the environments $MEnv$ and $SEnv$.

Case Study

The theorem examined in the case study:

- ▸ There are *economic conditions* under which it is rational for a society to adopt a slavery-based economic system instead of a free labor-based one.
  - ▸ North, D. C. and Thomas, R. P. (1971). The rise and fall of manorial systems: A theoretical model. *The Journal of Economic History*, 31(4):777–803.

The goal of the study:

- ▸ to formally capture such *economic conditions* within the model of *agent societies*.

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