

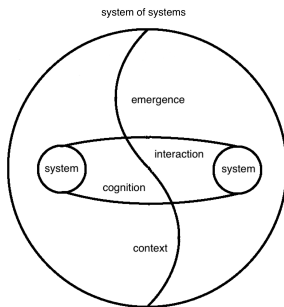
Reflexive Economics and Categorical, Coalgebraic and Domain Theoretical Modelling

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Content

Macroeconomics

Microeconomics



Agent Based Modelling

Endogeneize, Unify and Semantify Economics

... the agents in the model should be able to forecast and profit-maximize and utility-maximize as well as the economist - or should we say the econometrician - who constructed the model.

T. Sargent

Paradigmatic change,

Nonreductionistic social sciences beyond physical analogies

- modeller in the modelled system, look from within system
- endogenize control, self-organization
- content - context (institutional genesis, dynamics)
- unify different mathematical approaches
- formal semantics for modelling language
- behavioral versus state based modelling

What is money?

What is decentralized self-organization?

Macroeconomics

Difference and differential equations

$$V_0 = \sum_{t=0}^{\infty} \beta^t U_t = U_0 + \sum_{t=1}^{\infty} V_t$$

$$\Rightarrow f(s_t, x_t, Eh(s_{t+1}, x_{t+1}, e_t) = 0 \Rightarrow x^*(s_t)$$

$$\Rightarrow s_{t+1} = g(s_t, x_t, e_t) \Rightarrow s_{t+1} = g^*(s_t, e_t)$$

- recursive dynamics, bubbles (infinite period?)
- state is density
- parallel processes
- stock-flow problem (differential / difference equations)
- hierarchical / emergent properties
- rational expectation / anticipation

Coalgebraic stream calculus, domain theory, category theory

Microeconomics

There is thus a back-coupling or feedback between the theory and the object of the theory, an interrelation which is definitely lacking in the natural sciences.

O. Morgenstern

Interactive game theory

- beliefs of beliefs
- modal logic
- Brandenburger paradox ($AbBaAbBa \perp \Rightarrow ? AbBa \perp$)
- rules to change rules (Rawl's theory of justice)
- games over games (institutions)
- preferences over preferences (habit / culture formation)
- ...
- extensional / intensional functions

Coalgebras, domain theory, game semantics

Agent Based Modelling

The problems which [the social sciences] try to answer arise only in so far as the conscious action of many men produce undesigned results, in so far as regularities are observed which are not the result of anybodys design. If social phenomena showed no order except in so far as they were consciously designed, there would indeed be no room for theoretical sciences of society and there would be, as is often argued, only problems of psychology.

F. Hayek

Agent Based Modelling

Emergent properties

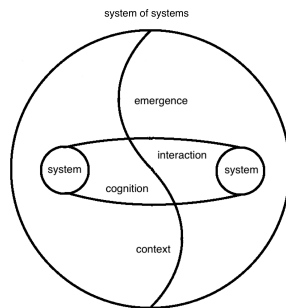
- object orientation (without semantics)
- system behavior by induction from simulated data
- formal behavior of parts and system
- epistemic and ontological states
- path dependency (infinite history)
- endogenous grid = context dynamics
- integrate with difference equations + modal logic

Coalgebras, domain theory, category theory, parallel semantics

System

Biological autopoiesis (self-production, self-repair, reproduction)

- what is organization (closure)?
- Kleene's intentional fix point
- system's model of itself
- anticipation, adaptation
- systemically important units
- theory of firm / institutions by complexification



Category theory, self-participating universals,
Hierarchies, dynamic reference frames, properties by embedding

Monetary Theory

What is money? What is economic value?

- no units in economic models, type theory
- double accounting: measure parallel processes
- early process logic
- money: accounting in space and time
- expectation / trust
- value: sequential / parallel independence
- value: emergent network property

Monetary theory, currency unions, world financial system

Beyond: theory of self-organization: democracy