



HAL
open science

Simulation of abstract autopoietic machine.

Pierre de Loor, Kristen Manac'H, Alexandra Fronville

► **To cite this version:**

Pierre de Loor, Kristen Manac'H, Alexandra Fronville. Simulation of abstract autopoietic machine.. 10th European Conference on Artificial Life (ECAL); ECAL2009 : Darwin Meets von Neumann, 2009, Budapest, Hungary. hal-00610910

HAL Id: hal-00610910

<https://hal.science/hal-00610910>

Submitted on 29 Jul 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Simulations of Abstract Autopoietic Machines

Pierre De Loor, Kristen Manac'h and Alexandra Fronville

UEB – ENIB-CERV – LISyC
Brest, France
{deloor,manach}@enib.fr
alexandra.fronville@univ-brest.fr

Keywords: autopoiesis, simulation, (M,R) System

According to [Maturana and Varela 1980], autopoiesis is at the basis of autonomy and cognition. Consequently, some artificial life works aimed at simulating artificial autopoiesis [Beer 2004, McMullin 2004]. Generally, the purpose is to maintain a topological organization of automata. At the opposite, we consider that simulation can override topological aspects because topology has no significance in the computational domain. More important is to preserve self-regeneration and resistance to disturbances of an *Abstract Autopoietic Machine (AAM)*. The long term goal of our work is to address the elucidation of the Rosen conjecture - i.e. *that a model of life defined as closure under efficient cause cannot be instantiated by a computer simulation* – which is called into question by [Stewart and Miosso 2007] – which say that *closure under efficient causation does not represent a theoretical problem for calculability* - [Letelier et al. 2003] showed that autopoiesis is less general but very close to (M,R) System. Nevertheless, we can't claim that we simulate (M,R) systems because our model lack on a full loop allowing the use of produced data as an executive code.

Formally, an AAM is a tuple $\{E,F\}$:

- E is a multiset (N,m) of abstract particles defined by an integer.
 $N \subset \mathbb{N}$. is the *underlying* set of E . It is representative of the self of the AAM
 $m: N \rightarrow \mathbb{N}_{\geq 1}$. is the multiplicity function, i.e the number of occurrence of x in E is $m(x)$.
- $F = \{f | f: E \times E \rightarrow E^2\}$ is a set of interaction functions. Each interaction function transforms a couple of abstract particles to another couple of abstract particle.

The dynamic of an AAM is executed into another multiset $Env=(N_{env},m_{env})$ representative of an abstract environment. It is defined by these principles:

- Env is initialized with E ($Env=E$)

- f in F are chosen randomly and applied indefinitely to couples of elements of Env which are also chosen randomly. The result is introduced in Env. If $N_{env} \subset N$ during this evolution, the AAM machine is stable and closed. Else, the AAM is unstable and elements of $N \cap N_{ew}$ are its nonself.

- A perturbation consists in introducing some elements in Env. The reaction of the AAM is the dynamic of the evolution of the set $N \cap N_{ew}$.

The presentation will show results of these simulations. More precisely:

- The influence of E and F on the resistance to different perturbations.
- The regularities on reactions coming from disturbances.

Acknowledgements: This work is supported financially by the Conseil Régional de Bretagne.

References:

- Beer, R Autopoiesis and Cognition in the Game of Life Artificial Life, 2004, 10, 309-326
Bourgine, P. and Stewart, J, Autopoiesis and Cognition. Artificial Life, 2004, 10, 327-345
Letelier, J.; Marin, G. and MPodozis, J. Autopoietic and (M,R) systems, Journal of Theoretical Biology, 2003, 222, 261-272.
Maturana, H. and Varela, F. Autopoiesis and Cognition: The realization of the living. Reidel: Boston, 1980
McMullin, B. Thirty Years of Computational Autopoiesis: A Review, Artificial Life, 2004, 10, 277-295
Rosen, R. Some relational cell models: the metabolism-repair system. Foundations of Mathematical Biology. Academic Press, 1972.
Stewart, J. and Mossio, M. Is "life" computable? on the simulation of closure under efficient causation. In ENACTIVE'07 : 4th International Conference on Enactive Interfaces, pages 271-276, 2007.