LEIA
A reverse engineering form for Multi Agent Systems

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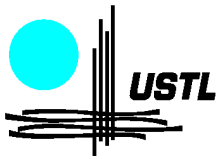

Introduction

What do we call reverse engineering for MAS ?

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I – SMAC team

- software engineering for MAS
- Model of the behaviour of agents
- Implementation of the behaviour
- Evaluation of the behaviour of agents
- Design of experimentation platforms

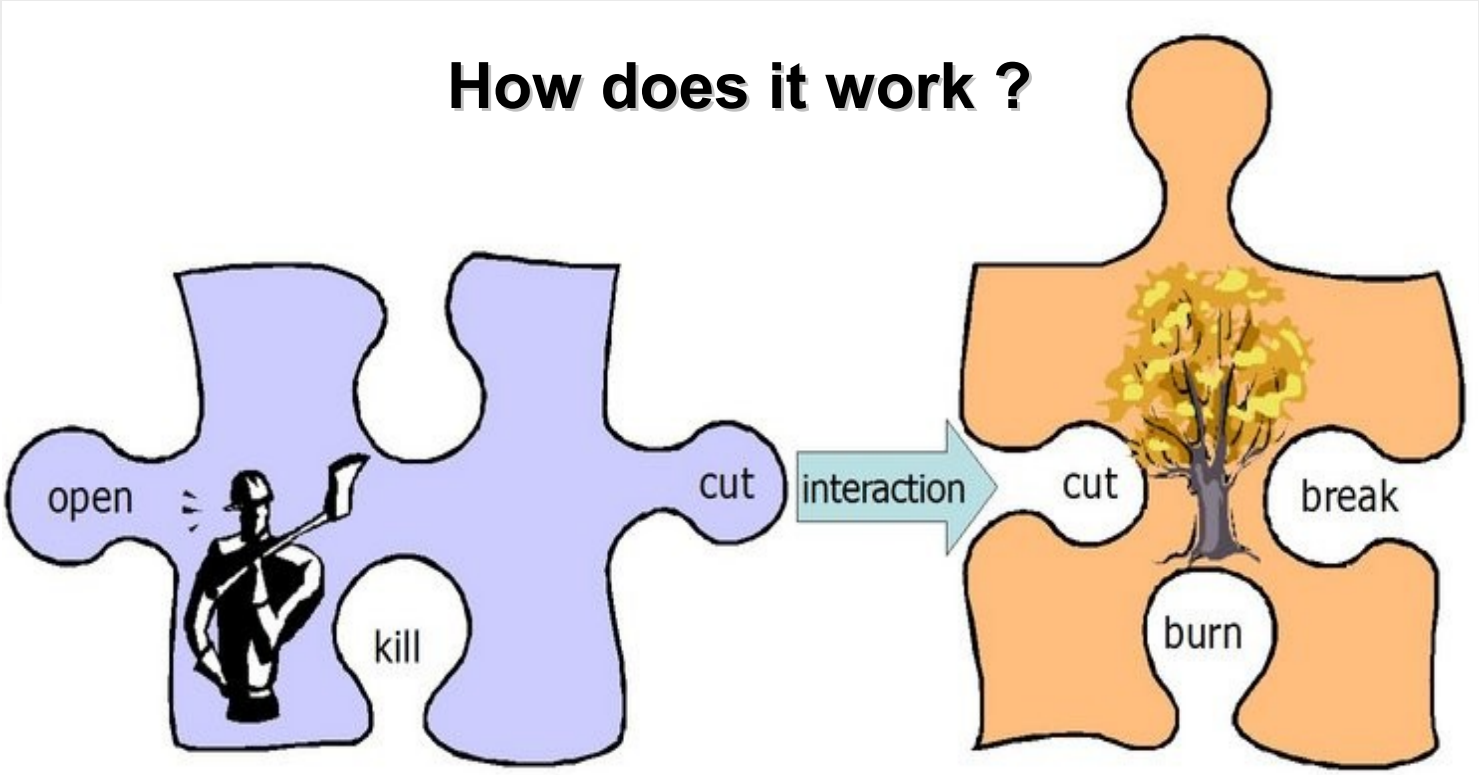
URL: www.lifl.fr/SMAC

II – IODA

Interaction **O**riented **D**esign of **A**gent simulation

Methodology centered on Interactions

[Mathieu Routier 01]



Separation between what an agent can do and how he will do it

II - IODA

How can an interaction occur ? [Kubera 08]

Declarative part

- Interaction
- Source/Target
- Distance Guard

Procedural part

- Order in the evaluation of the interactions
- Selection process

Interaction Matrix

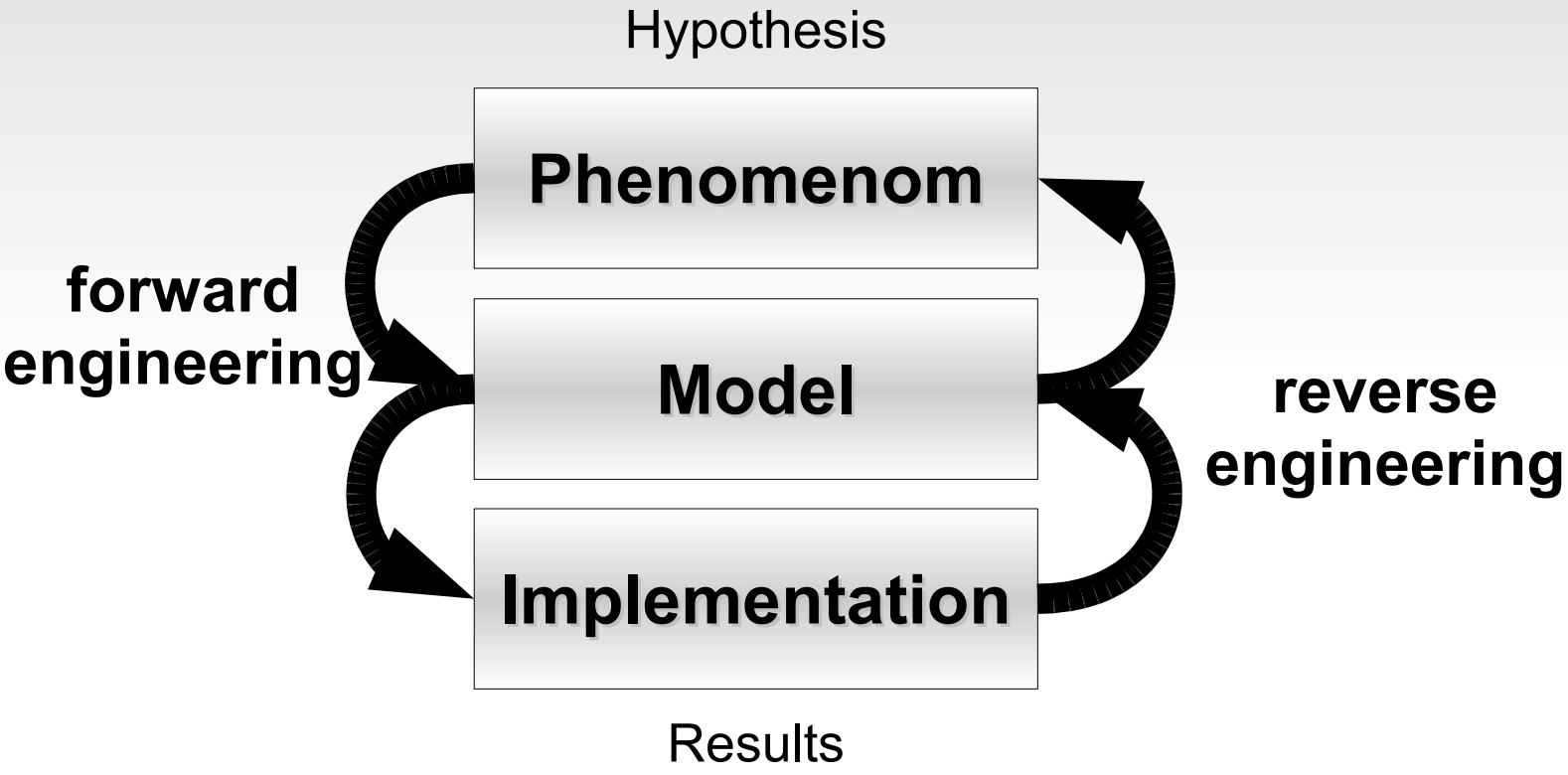
Source \ Target	Envir.	Red	Blue
Red		Follow 0 (4.0)	Run 2 (7.0)
Blue		Run 1 (5.0)	Follow 1 (2.0)

Interactions

Priority

Distance guard

III – LEIA: the exploration of simulations as a reverse engineering form

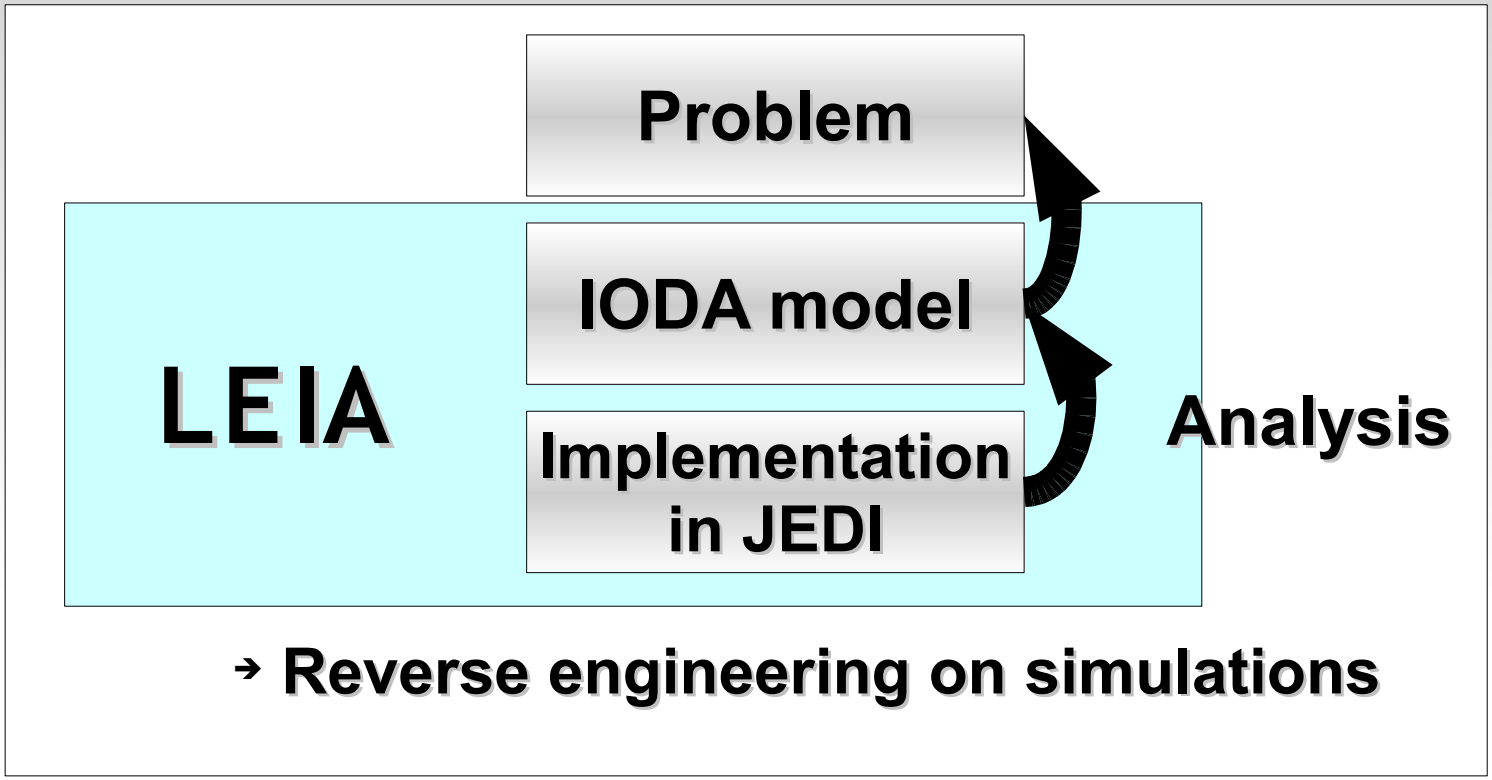


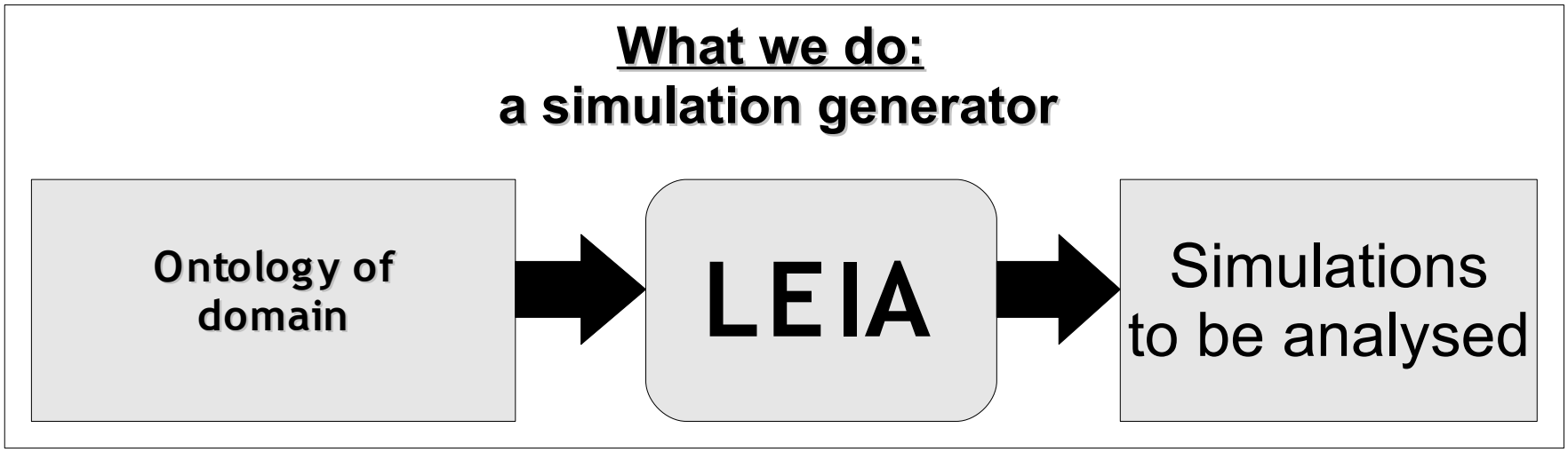
Why doing reverse engineering ?

- **Understanding the model**
- **A brain stimulator [Pachet 07]**

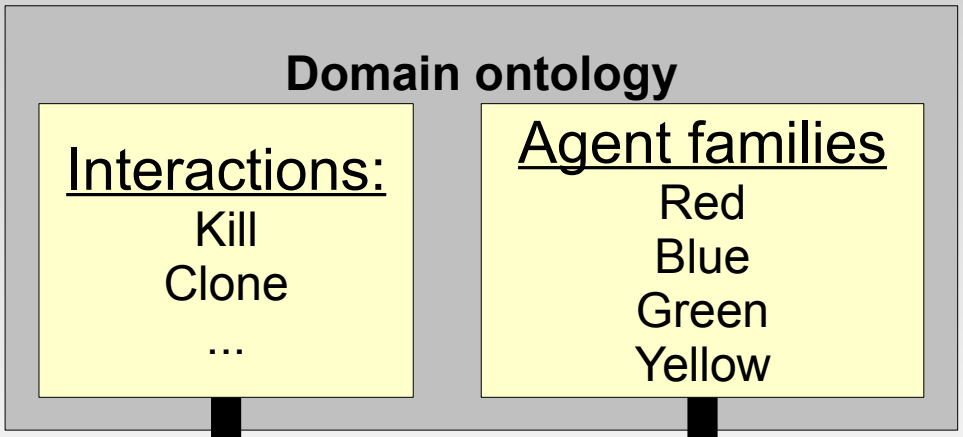
III - LEIA

LEIA lets you **E**xplore **I**nteractions for your **A**gents





III - LEIA – Automatized building of model



Source \ Target	Envir.	Red	Blue	Green	Yellow
Red					
Blue					
Green					
Yellow					

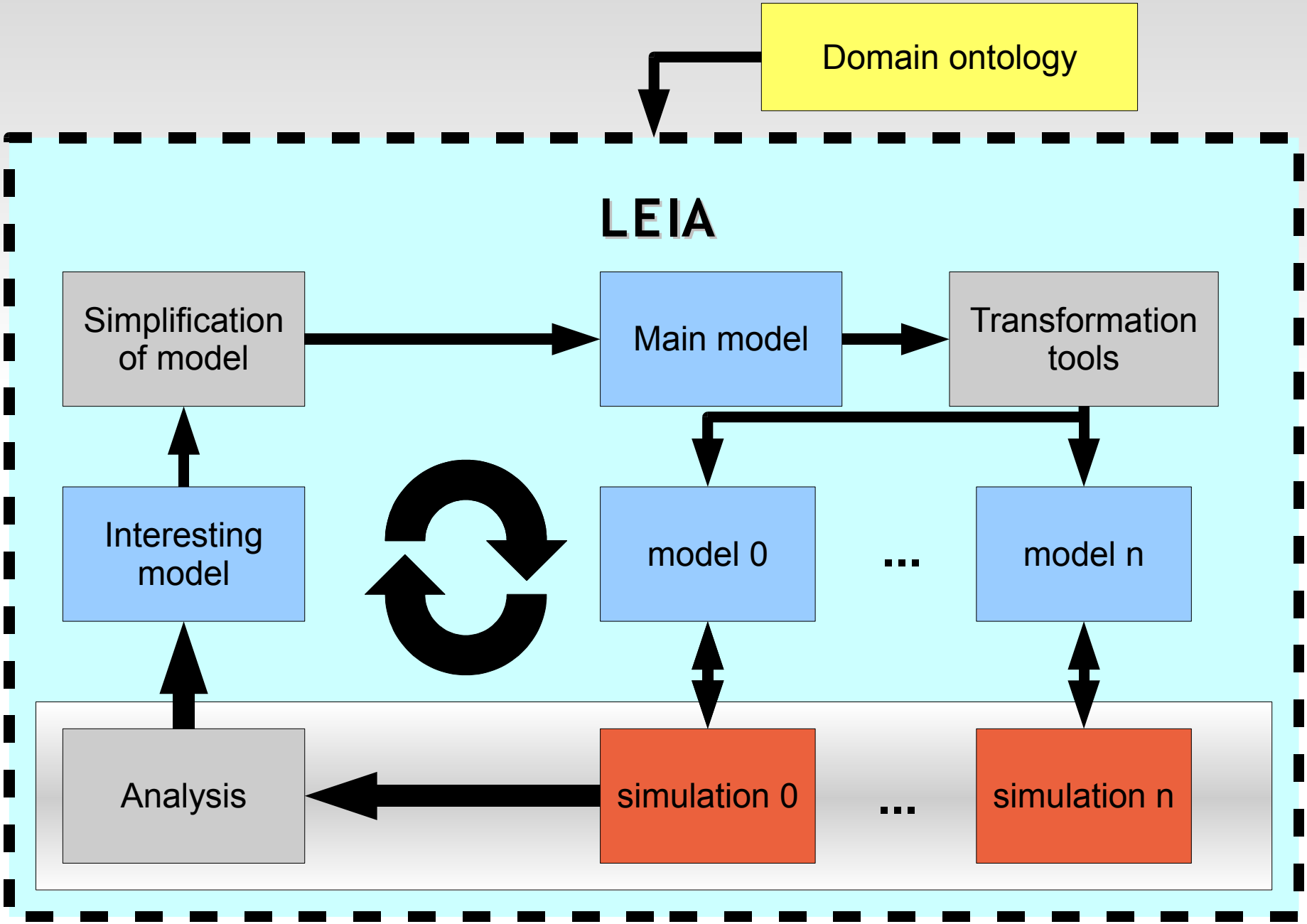
Fill with interactions

Source \ Target	Envir.	Red	Blue	Green	Yellow
Red		Run			Infect
Blue					
Green				Follow	
Yellow		Kill			

We can do it thanks to IODA methodology !

III - LEIA – Let's explore the simulations space

Iterative construction of models by exploring the simulations space



III - LEIA – our measurement tools

Our aim: analysing a simulation during the runtime

Activity of the agents

The evolution of the population

Density of population

Number of modification of the environment

Mix and Cohesion

An example: a battle simulation

Main points:

- Using the separation Interactions/Agents
- Working with any JEDI simulation and any ontology of domain
- Data from each families of agent and interactions

III - LEIA – Let's explore the simulations space

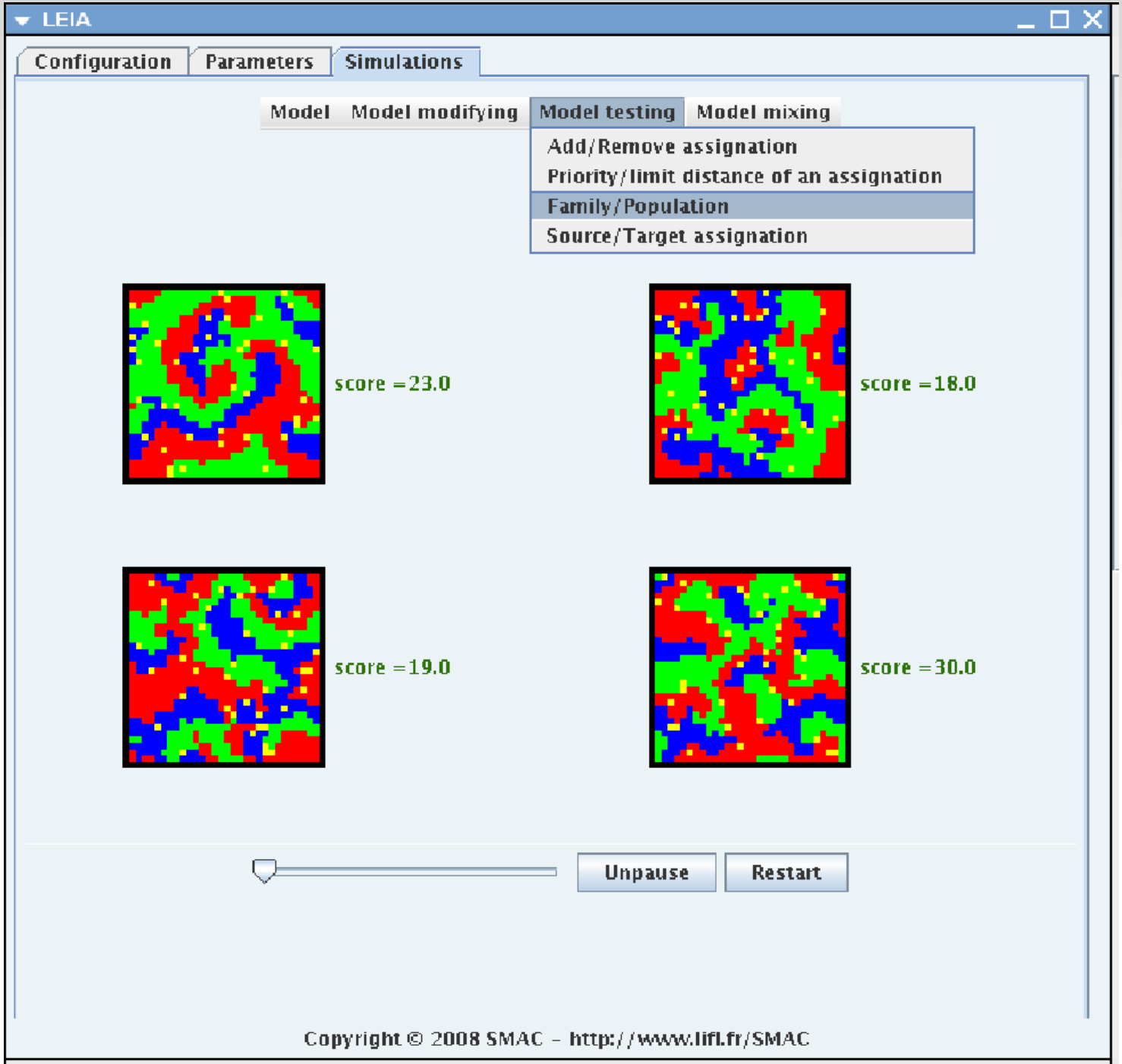
Our aims:

- Find new models
- Test the robustness of existing models
- Test an ontology of domain

Our model transformation tools:

- Test on the beginning number of agent
- Add/Remove random interactions
- Modification of the distance guard/priority
- Derivation of an interesting model into new models
- Play with several interaction matrices at a time

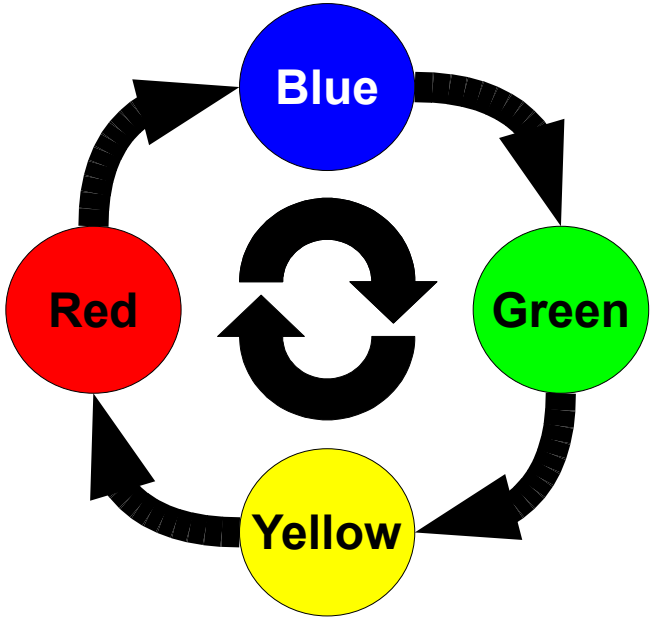
III - LEIA – Let's explore the simulations space



IV – An interesting result from LEIA

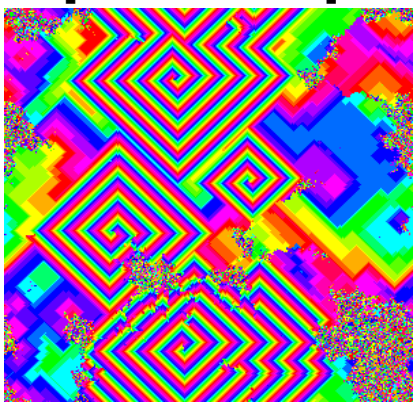
an infection model

Source \ Target	Envir.	Red	Blue	Green	Yellow
Red			Infect		
Blue				Infect	
Green					Infect
Yellow		Infect			



Excitable medium

Cyclical cellular automaton
[Griffeath 93]



Belousov-Zhabotinsky reaction
[Belousov 59, Zhabotinsky 50]

V – Conclusion

→ A simulation generator without any code generation
→ Made thanks to **IODA** methodology
→ The **user is implied** in the iterative process of exploration of the simulations space in order to create new models
→ guide lines to improve simulations following several metrics
→ **Reverse engineering** by analysis of simulations

→ Take place in a whole framework from the conception of interactions to their implementations using IODA, JEDI, JEDI Builder and now LEIA
→ **Exploration** of an ontology of domain with genetic algorithm

Let's visit www.lifl.fr/SMAC/LEIA/

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