Mageo, a user-friendly platform for agent-based modeling and simulation

https://sites.google.com/site/mageosim

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**Goals and principles**

**MAGeo = Modeling Agent Geography.** Mageo is a multi-agent geosimulation platform.

→ **User-friendly:** Graphical modeling

→ Based on the **AOC meta-model** (P. Langlois), that aims to represent any real situation, even multilevel, with social and spatial organizations, and relationships.

→ Small pieces of code are sometimes necessary: Mageo provides a **user-friendly language**. Some classic models are written with only 2 or 3 lines of code.
The platform

Modeling Window

→ Entities and relations

Simulation Window

→ Maps, Graphs, Cursors, …
Concepts: entities

Agents (the individual)

Examples: Humans, Cars, Homes, ...

Organizations (the collective)

Examples: Populations, Networks, Zonal Maps, Point Clouds...

Behaviors (the dynamics)

Examples: Working, Sleeping, Buying, …
An entity can be modified in its dialog box

**Agents** (the individual)
- Attributes
- Action program
- ...

**Organizations** (the collective)
- Topology
- Scheduling
- ...

**Behaviors** (the dynamics)
- Actions
- Pertinences
- Transitions
- ...
An agent can **contain** organizations

An organization **is composed** of agents

Agents may be located on other agents
Behaviors

Simple behaviors

Moves

Transitions diagrams

Infection
You use the **Mageo language** in
- behaviors (pertinences, actions)
- in other dialogs: init of attributes, graphs, …

To make an agent move 10 units forward in the *Ocean* organization:

```
Ocean: Forward(10)
```

Agent A gives 5 € to agent B:

```
Transfer(A.Money, B.Money, 5)
```

To randomly select an inhabited *House*:

```
ONE x of House WHERE x.Inhabited
```
A Grid on which mobile agents move and infect each other.

Three infectious states:
- Susceptible (S)
- Infected (I)
- Recovered (R)

→ Step by step construction
Step 1: The conceptual model
Step 2: Parameters of the Population

Step by step construction
Step 3: State attribute in Mobiles

Step by step construction
An enumerated attribute and its initialization expression
Step 4: Geographic data

**Importation of a Grid file** for the **Build** attribute of Mobiles.
Step 5: The *Infection* behavior

Transition rule:
(EXISTS x of Mobile FROM CityGrid:Neighbors(Self,2) WHERE x.State=1) And RandChoice(0.05)

Code of the transitions diagram:

- Transition name: R1
- State before: S
- State after: I

- Transition name: R2
- State before: I
- State after: R

Number of iterations in the state (before the transition): 50
Step 6: The *Move* behavior

```
Behavior
Description
Identifier: Move

Pertinence
State! = I

Action
Goto (ONE x OF Cell FROM CityGrid:Neighbors(Self, 2) WHERE Not x.Built)

Informations
Compilation succeeded
```

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Step 7: Action program of *Mobiles*

**Composition of behaviors**
- **Competition:** `Infection | Move`
- **Sequence:** `Infection ; Move`
- **SyncSequence:** `Infection ;; Move`
- **Random choice:** `Infection ? Move`
Step 8: Creation of a Map and a Graph
SIR Model: the simulation window
Applications

- For conceptual models, prototypes, or complete models.
- For people without programming skills.
- For formation, to make beginners discover multiagent simulation.
- For teamwork, collaborations (models are easily readable).

Work in progress

- Integration of real geographic data (Zonal maps and Networks).

To do

- Integration of social organizations and relationships.
- Integration of interaction behaviors.
- Testing various models from different research fields: multilevel, social relations, complex interactions, etc.
- ...
Thank you

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