

# Reliability of participatory modeling and simulation tools

## The case of NewDistrict participatory simulation

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# Participatory modeling & simulation

**Participatory modeling:** having a group of person, with contrasted viewpoints about the object under study, participating to different steps of the modeling & simulation process



*Agent –based modeling*

*Stakeholder participation*

*Socio-ecological systems*

*Empirical rules*



- What is it used for:
    - Social learning
    - Reveal strategies
    - Organizational innovation (emergence of new rules)
    - Prospective thinking
  - Model aim : to serve as an intermediate object
-

## Validation & the concept of truth

Validation is the determination that the conceptual model is an accurate representation of the real system. Can the model be substituted for the real system for the purposes of experimentation? If there is an existing system, call it the base system, then an ideal way to validate the model is to compare its output to that of the base system. [Banks, 1999]

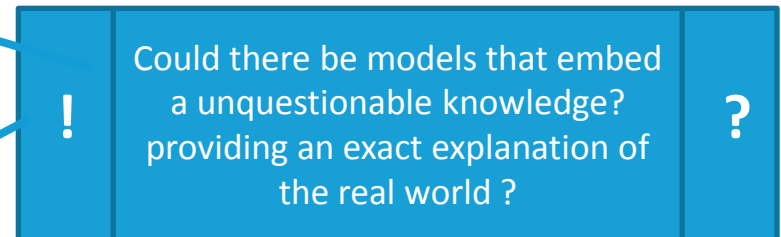
*A proof remains valid only until it is proven false [Karl Popper]*

A model, is never totally validated.  
But it can improve.

*It is satisfactory, if it provides a satisfactory answer to the modeling question [René Thom]*

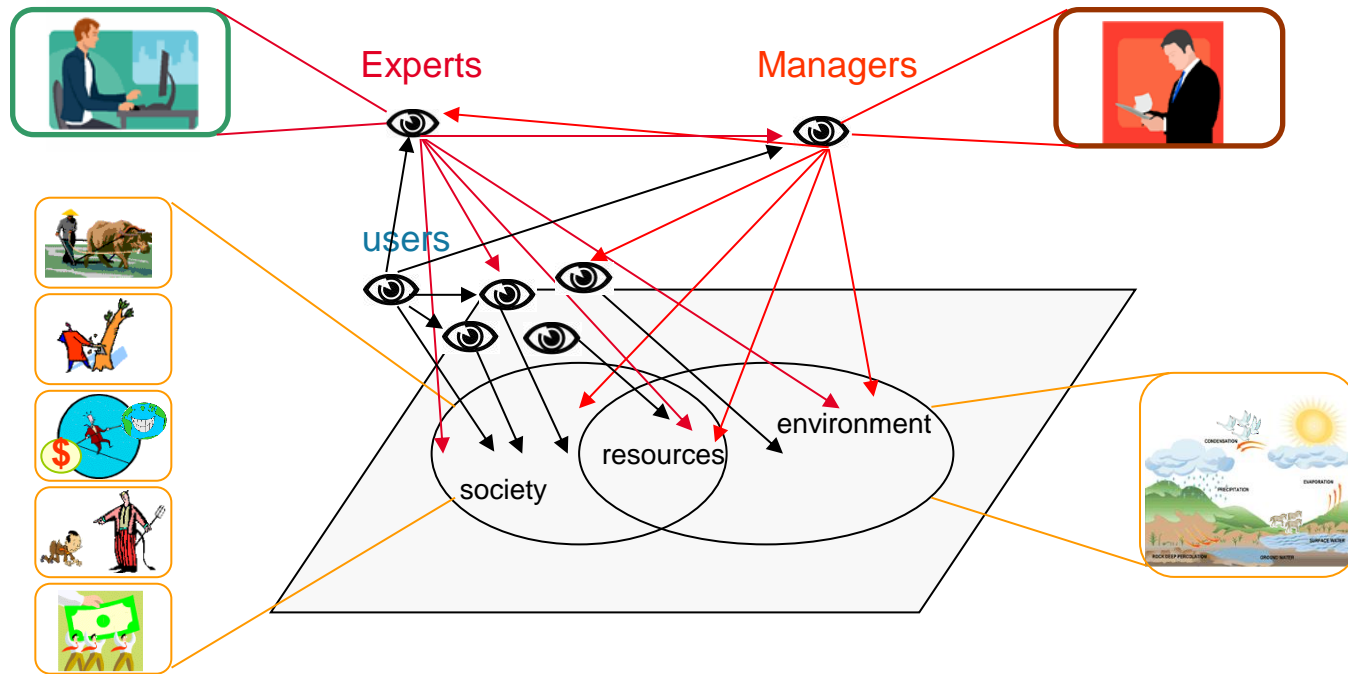
Soft validation, or likelihood, would be more appropriate

Refers to an exact truth



It seems true enough → needs social acceptance to reach such level of trust

- An iterative process
  - A satisfactory answer to the initial question
  - A social evaluation of the modeling process and its outputs
-



The complexity of evolving systems having multiple interactions, lead to contrasting viewpoints between local actors (users) and observers (scientists, managers) about how the system works [Edgar Morin, 80]

# Multiple representations about a same entity



Human beings construct their reality through language or other means of externalization of thoughts [Francisco Varela]

Simulation results are not normative, neither predictive. They are proposals aiming at questioning , enlightening, raising new thoughts.

Social representation: a system of values, ideas and practices, for providing:

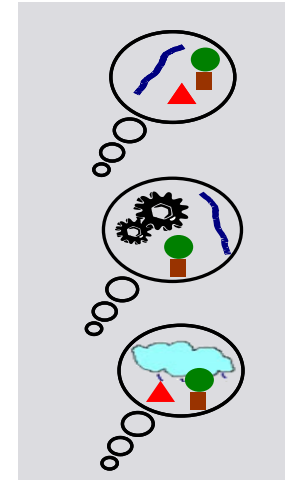
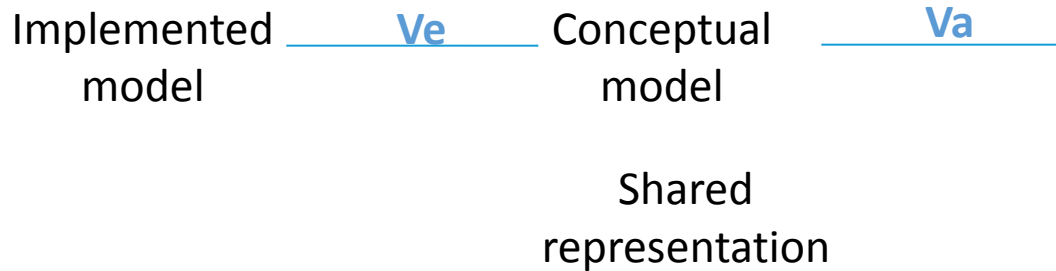
- an order for individuals to orient themselves in the social world;
- a code for communication and social exchanges. [Serge Moscovici]

Shared representations are there to set up and build a common "reality", a common sense which becomes "normal" [Serge Moscovici]

**Using the model as a shared representation**



## What about V & V in that case?



**Model reliability = capacity to make participants share representations**

## Can we talk about validation for participatory modeling?

- A social evaluation process
- Results are used for fostering reflection
- Sharing contrasted representations

→ Simulation results cannot be “validated”, but they can be legitimated by the consistency of the model construction process and by the use *a posteriori* of the knowledge collectively acquired during the process  
[ComMod 2011]

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- Consistency of the modeling process
  - Knowledge acquired through model use
-

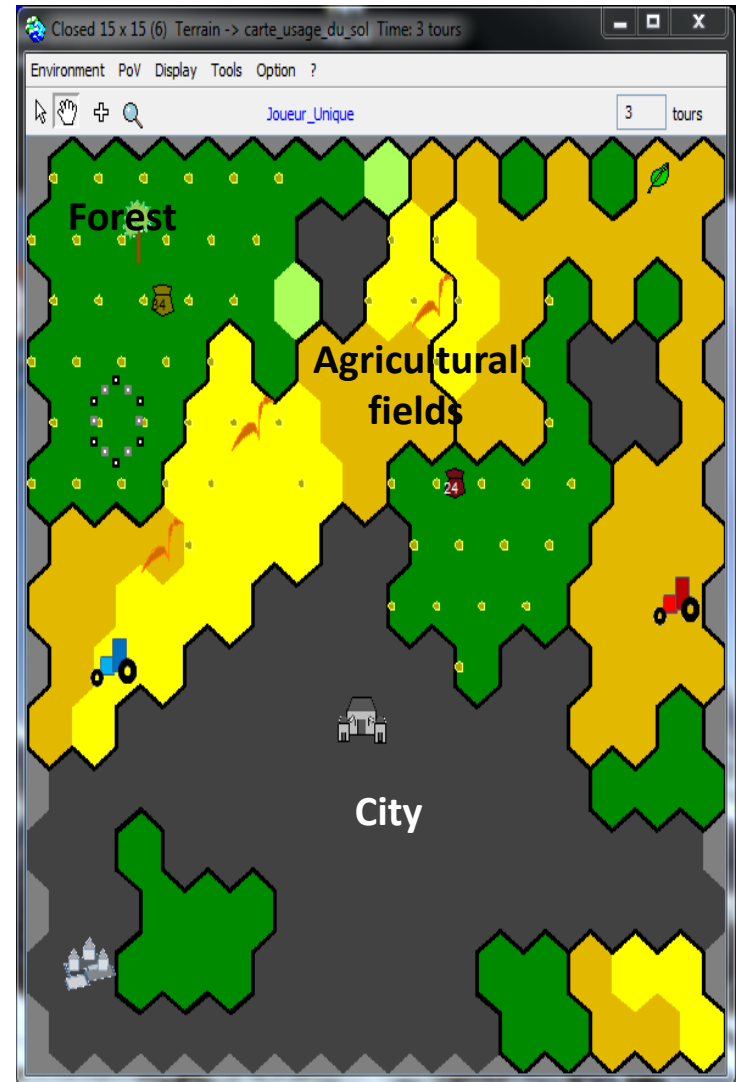
# **NEW DISTRICT PARTICIPATORY SIMULATION**

10 km<sup>2</sup> peri-urban area

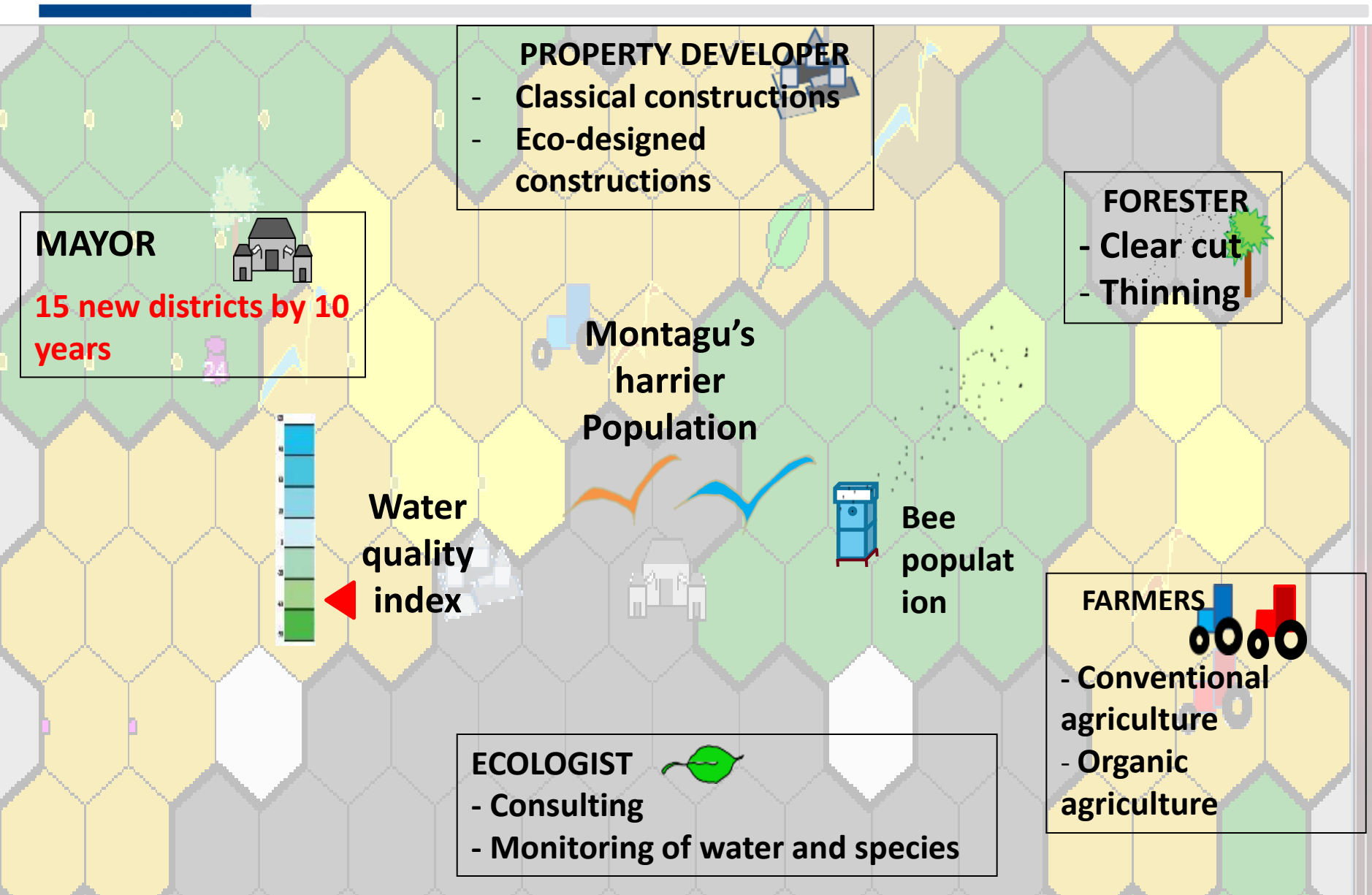
12 years of development are  
simulated in 6 rounds

Modeling of biodiversity processes

Interactivity with 6 types of role s



# NewDistrict participatory simulation



# Consistency of land use combinations on biodiversity

Analysis based on more  
than 120.000 simulations

Consistency of emerging patterns

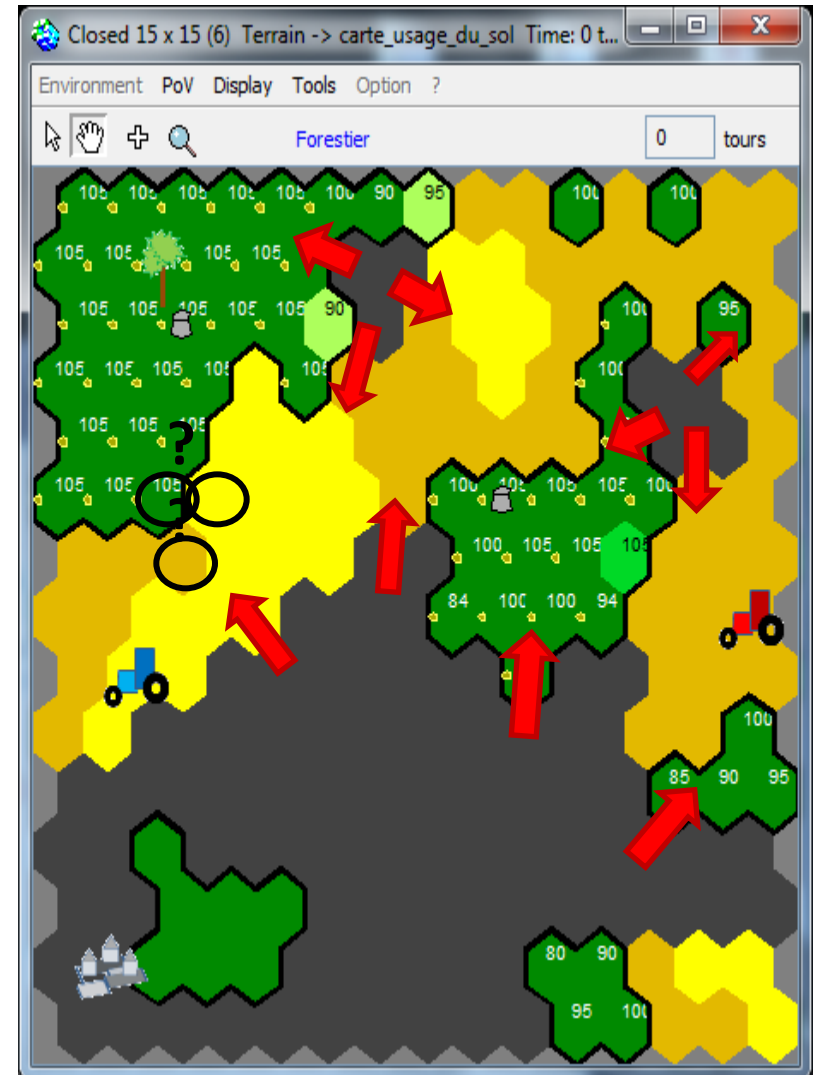


# Consistency of land use combinations on biodiversity

Analysis based on more than 120.000 simulations

Consistency of emerging patterns

- **Spatial distribution can influence biodiversity**
  - It is less impacting for water quality and for Montagu's Harrier to build around the city.
- **Spatial location can influence biodiversity**
  - It is less impacting for water quality and for bee population to build on agricultural plots.





Analysis based on more  
than 12 sessions  
(> 180 participants)

Consistency of emerging  
strategies

Stakeholder	Name of the strategy
Property developer	“wait and see”
	“wait and see” but calculated
	Bargainer
Mayor	Populist
	Environmentalist
	Manager
Land owners	Holding to the land
	Environmentalist
	Opportunist
	Optimalist
Ecologist	One service/species oriented
	Subsidies advisor

Analysis based on more than 12 sessions (> 180 participants)

## Most important aspect learned for each participant

Types of learning (Daré et al. classification)





Analysis based on more than 12 sessions (> 180 participants)

## Most important aspect learned for each participant

### Types of learning (Daré et al. classification)

Learning about urban development impacts	21%
Learning about biodiversity	12%
Learning about others representation	12%
Learning about communication	44%
Learning about organizational options	10%

Analysis based on more than 12 sessions (> 180 participants)

	Did you change strategies during the course of the game?	Did you change opinion about the other roles after the game?
Mayor	74% 	72% 
Building contractor	25% 	56%
Conventional farmer	58%	37% 
Organic farmer	55%	44%
Forester	47%	48%
Ecologist	48%	52%

% of positive answers

- Validation cannot be processed in the same way in the case of participatory modeling & simulation
- The model is an intermediate object and the social process around the model is as important as the model itself
- Reliability is a continuous social evaluation process
  - Emerging ecological processes are consistent with ecological complementation concept (Colding 2007)
    - land use combination permit to limit negative impact on biodiversity in urban sprawl process.
  - NewDistrict sessions foster reflection and allow sharing representations
  - Participants learn about biodiversity and communication differentially
  - Research questions evolve and new opportunities for investigation emerge

# Thank you for your attention

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website



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