



A generic model of interdependences between agents and water

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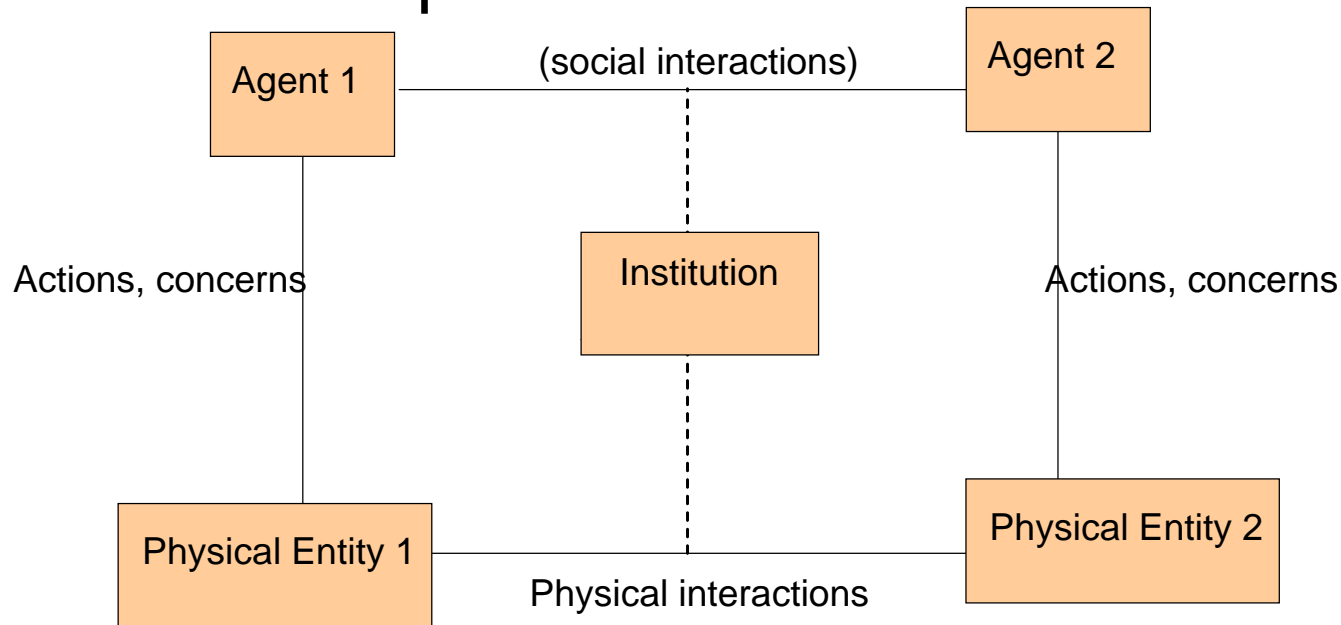
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*** Engref UMR TETIS , Montpellier, France



Context: rural-urban interdependences

- Matching water related interdependences and social interdependences?

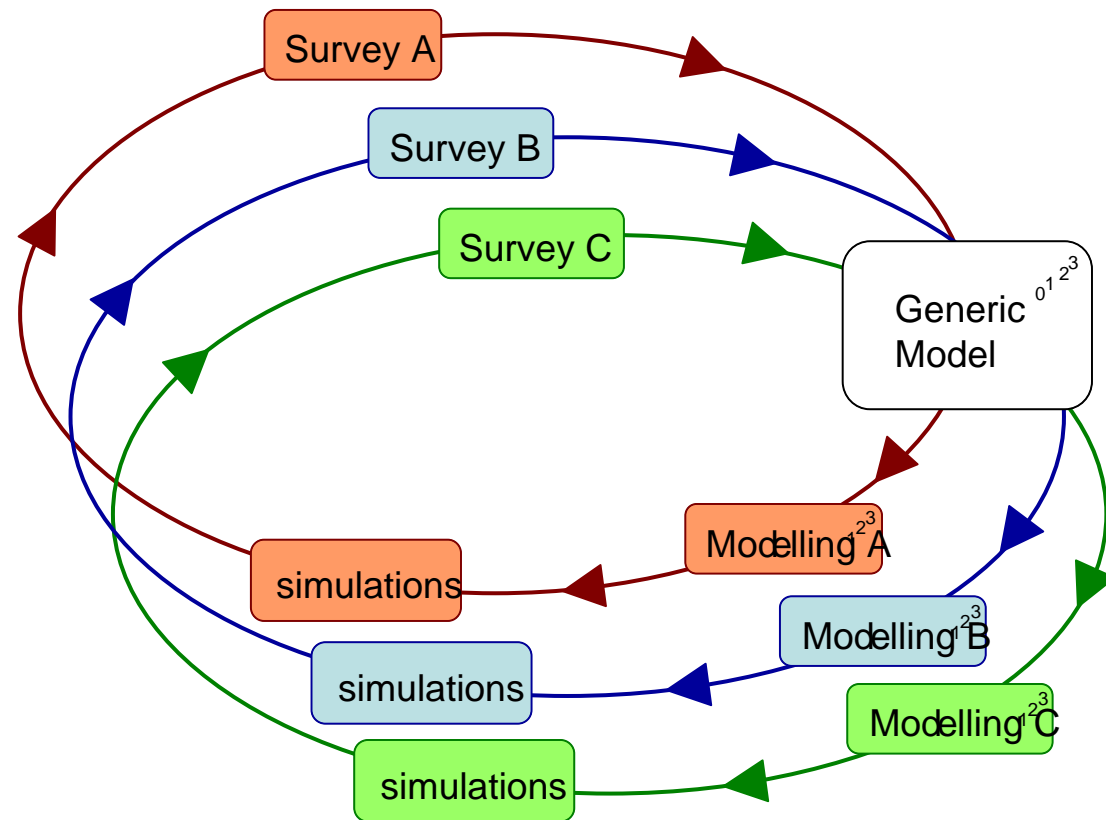


- Stakeholders oriented research :
 - Making interdependences explicit as a way to enhance water & territory collective management ?



A generic model as a common framework for the case studies

- Companion Modelling as a methodology for our case studies
- 1 case study = 1 series of specific models
- Generic Model
 - abstract description framework
 - Provide shared fundamentals
 - Speed up and ease model building
 - Principle of parsimony





The SURGE project – Case Studies

The image displays a central map of France with three regions highlighted in green: Caux, Erstein, and Thau. A red oval encircles the Erstein region and an associated water cycle diagram titled "Le cycle de l'eau".

Surrounding the map are several images related to the case studies:

- Caux:** Includes a flooded field, a road sign for "BOUE" (mud), a street view, and a water cycle diagram.
- Erstein:** Includes a street view and a water cycle diagram.
- Thau:** Includes a landscape view, a group of people at a table, and a city view.
- Quixeramobim:** Includes a river scene, a map of South America highlighting Ecuador with "Quito" and "Quixeramobim" marked, a dam, and a city view.



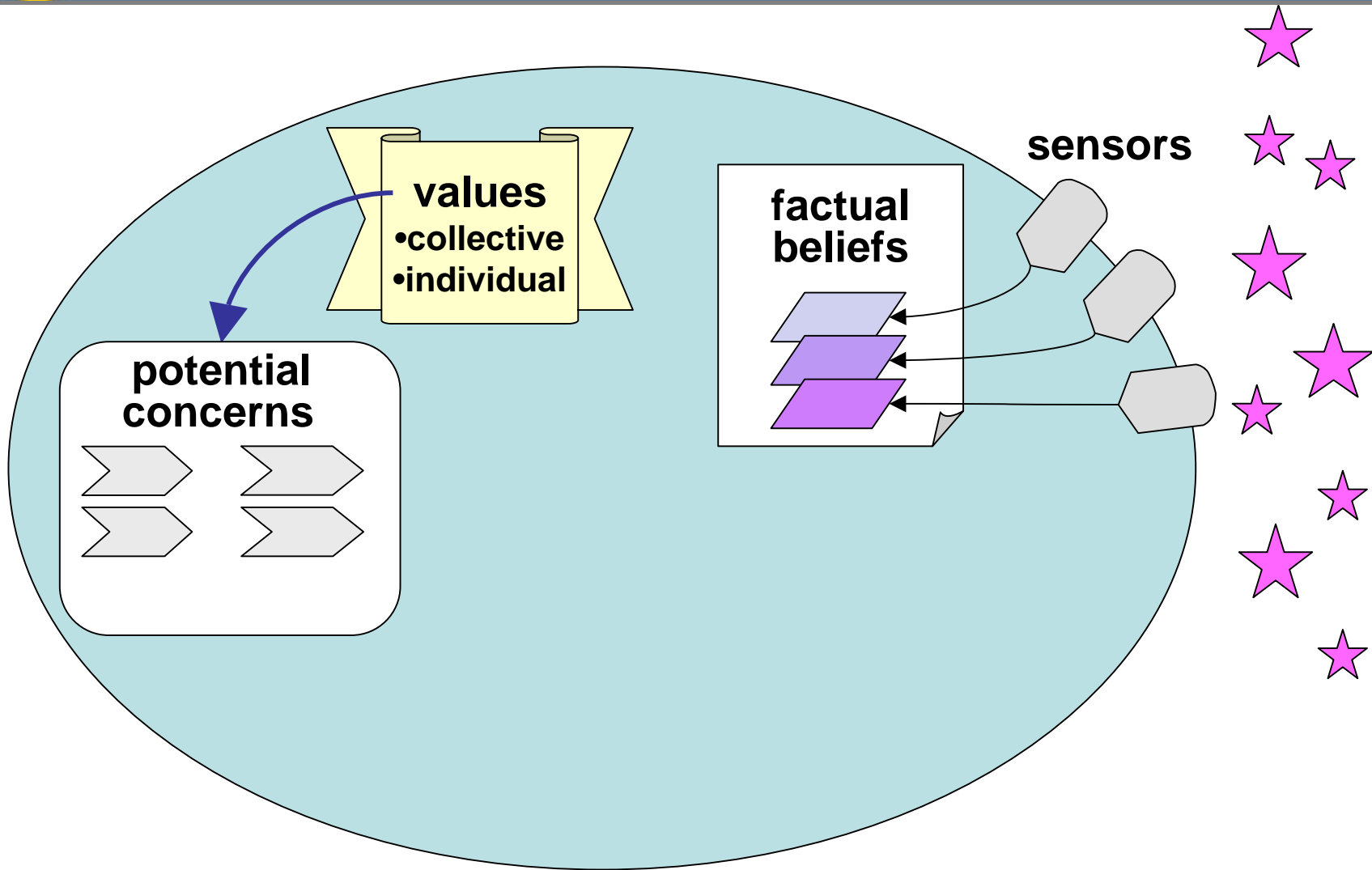
The ancestor : So-Si-So

- Developed as a prototype platform for formalizing research questions in the project
- Agents choose actions
 - that they believe will improve the state of some indicators
 - that they can afford
- Each agent has a set of indicators on
 - The state of the environment or his own state
 - The state of other agents' indicators
- The way he weights and chooses his indicators is based on own “values” and how he prioritize them
- Captures different modes of “solidarity”
- Limit : agents **only display a strategic rationality** :

???? state of others is like proche and state of environment is like values ?????



The ancestor: So-Si-So indicators



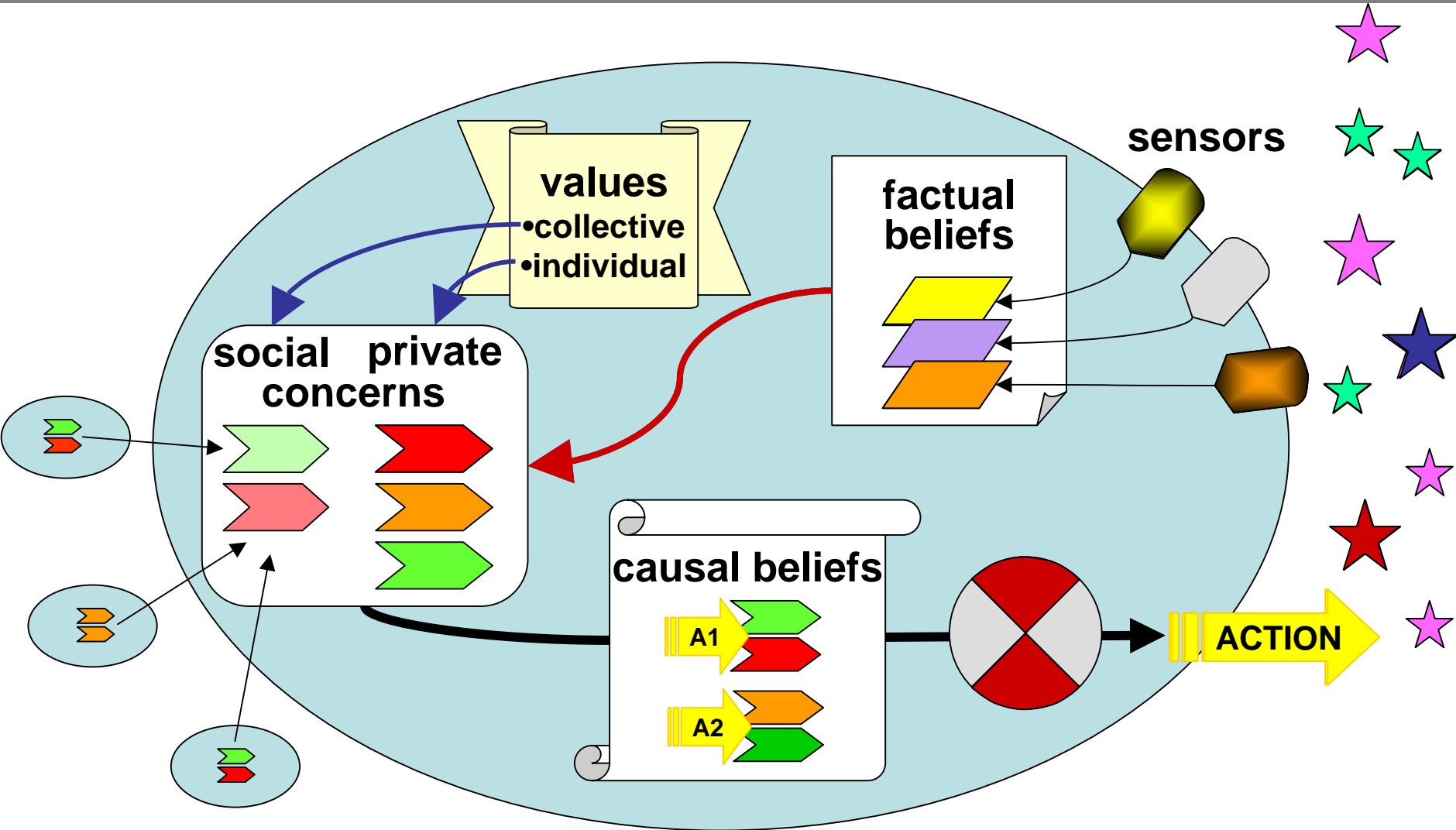


The ancestor: So-Si-So indicators





The ancestor: So-Si-So indicators



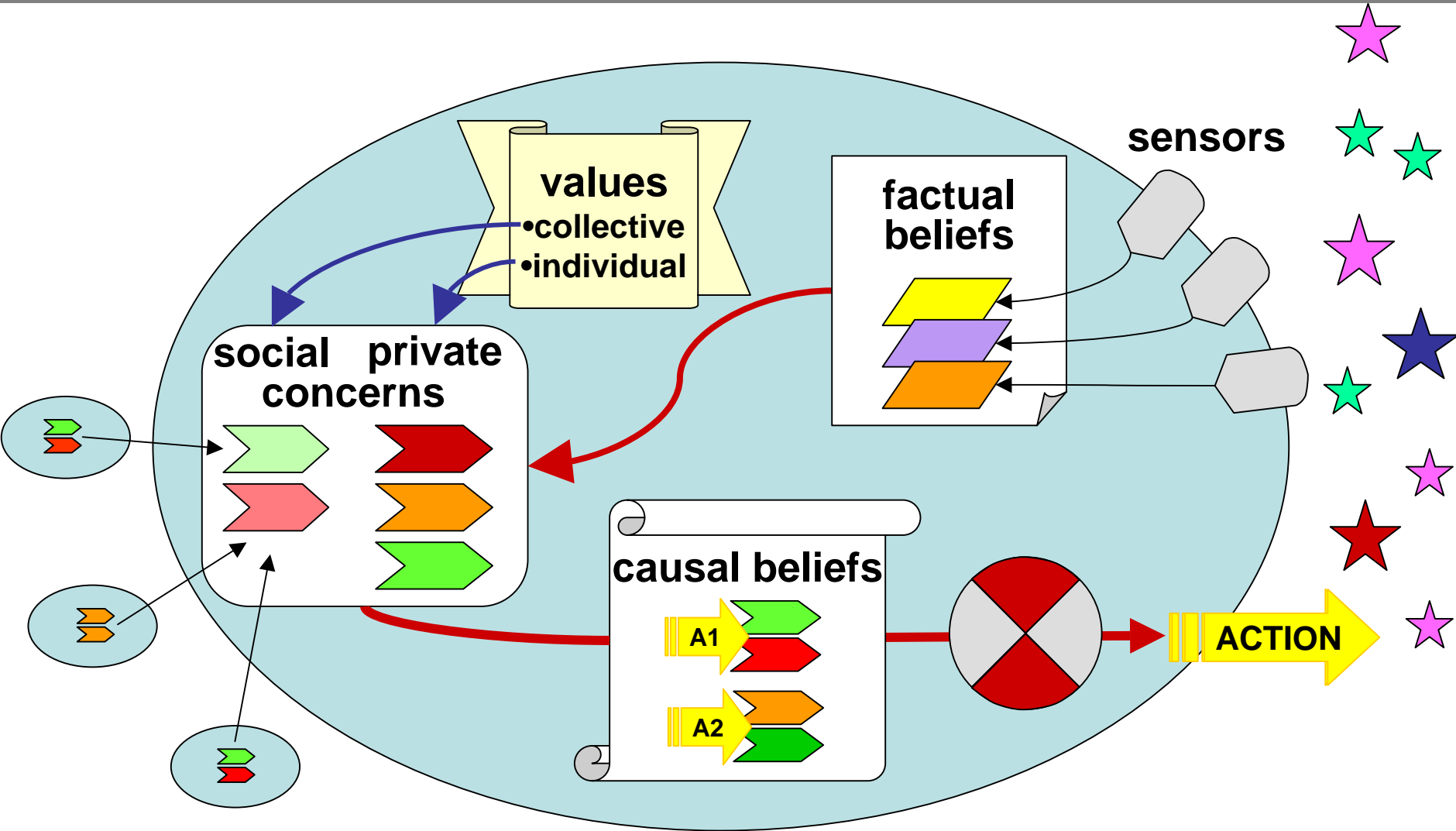
agents in social space

Landmod 2010, Montpellier, 03/02/10

agent chooses for **each** 'active' concern
the action (insofar available) that seems best



The ancestor: So-Si-So indicators


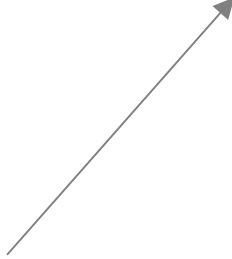


agents in social space

agent chooses for **each** 'active' concern the action (insofar available) that seems best etc.



Conception constraints

- How are water-related interdependancies between rural and urban parts of a territory balanced?

 - A society with
 - Interdependant entities
 - Constrained by various sources of localized interactions with water
 - Taking actions to improve what is important for them
 - Embeded in dynamic institutions which provides rules and incentives
 - Entities acting and interacting
 - Connections and flux exchanges
 - Actions categories
- 



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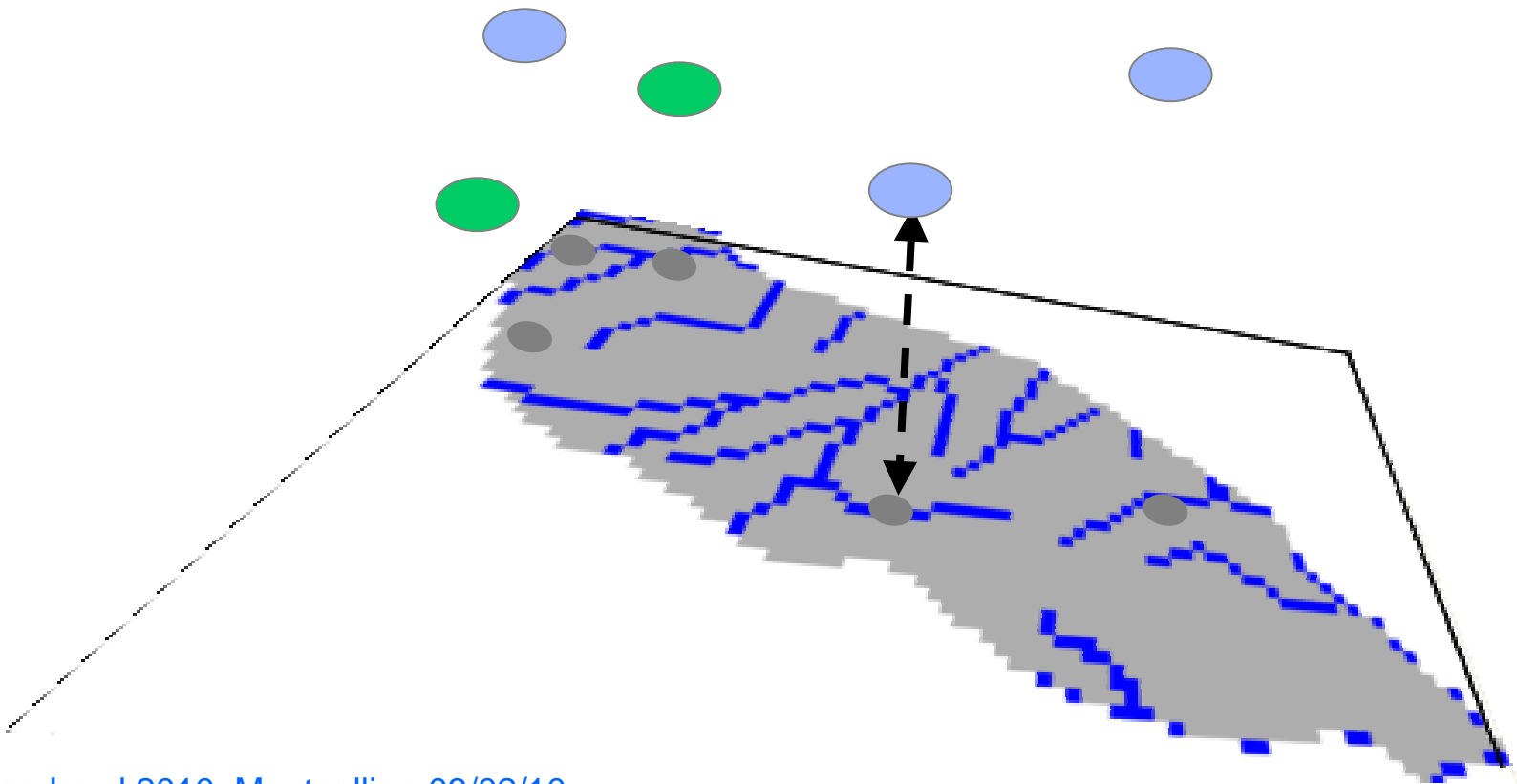
- Entities acting and interacting
 - Connections and flux exchanges
 - Actions categories

- Localisation of interactions : places and spatially induced connexions



Localisation of interactions

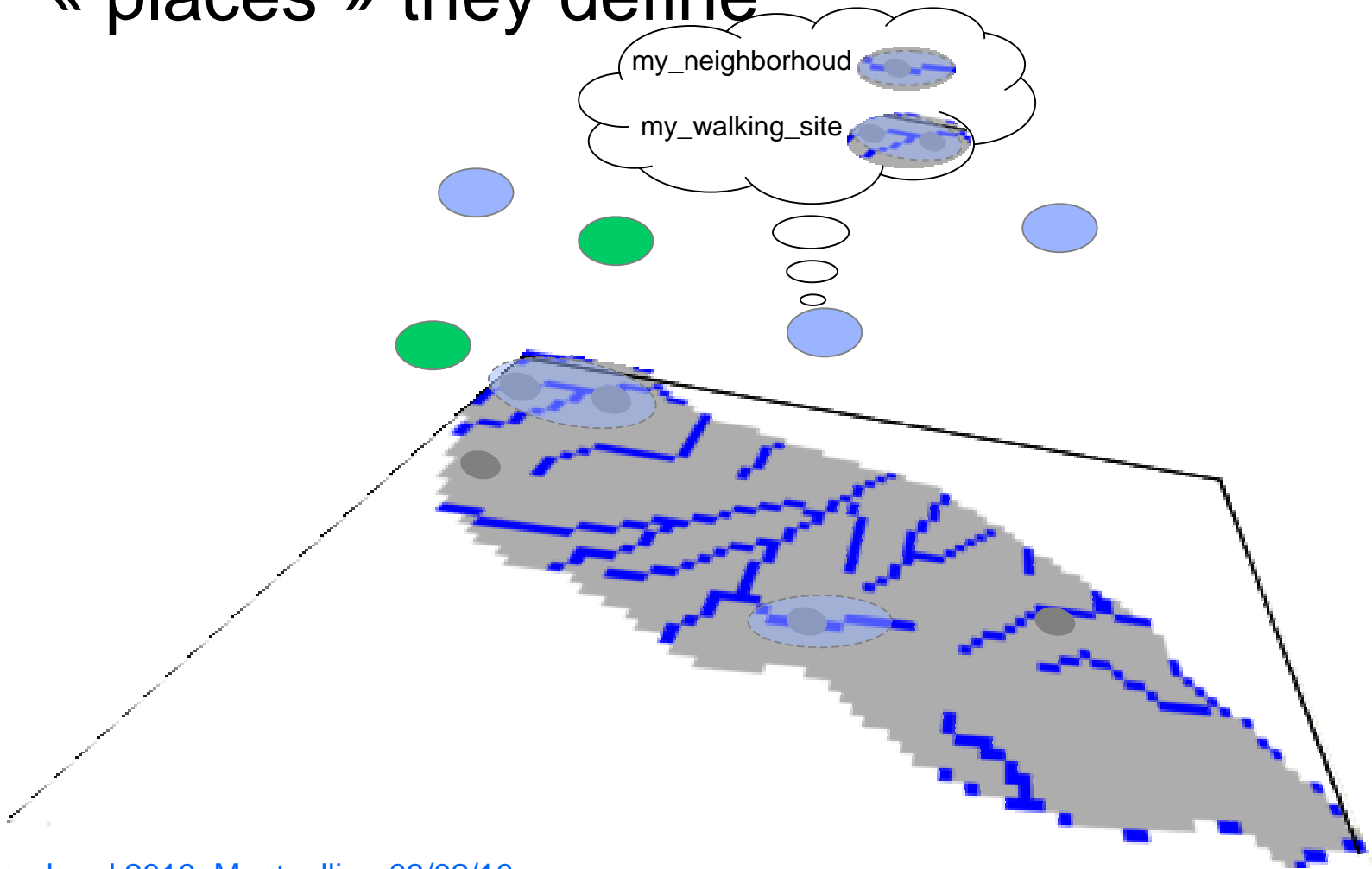
- The entities are localized on a geographical space equipped with spatial relationships





Localisation of interactions

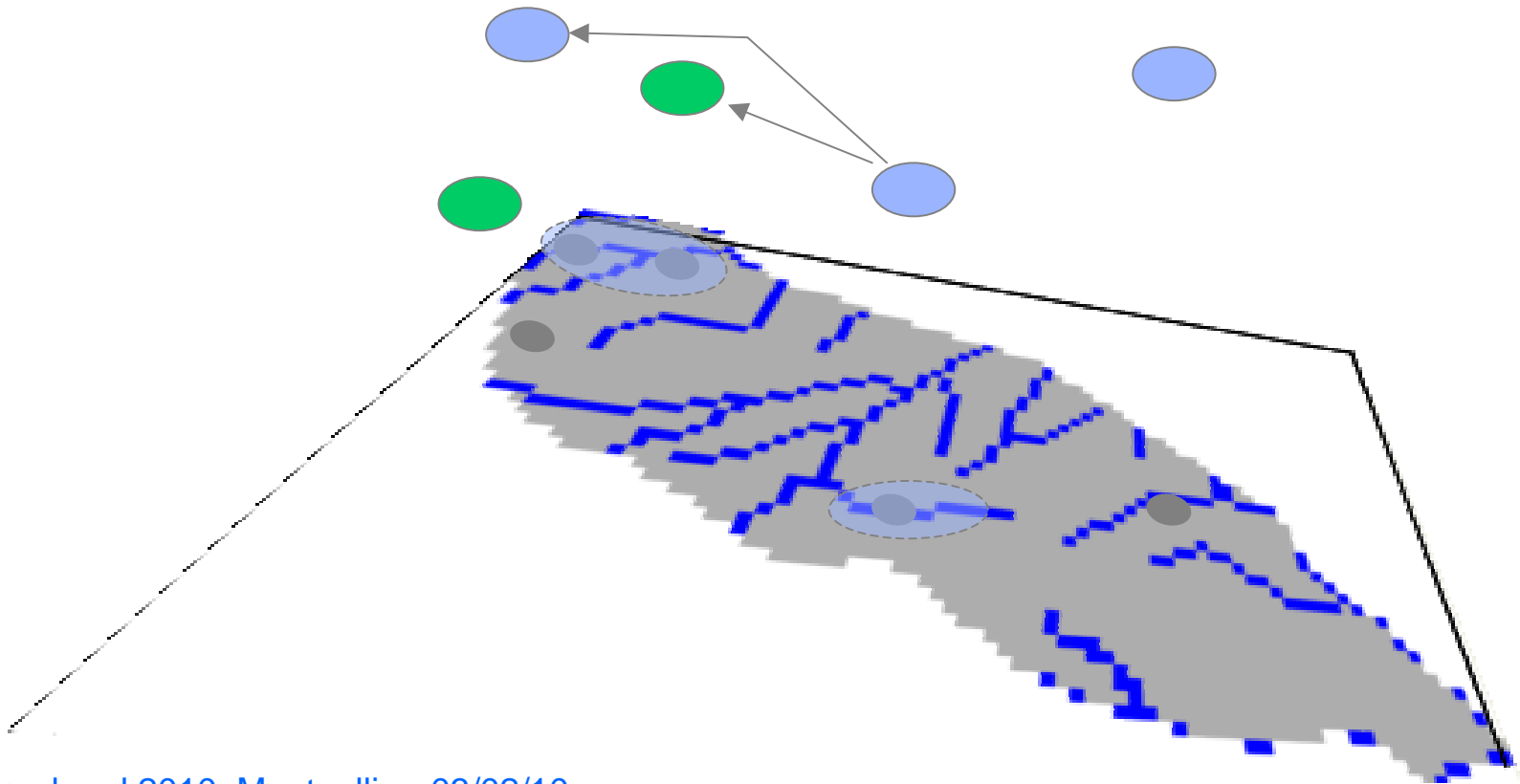
- The entities are also linked to different « places » they define





Localisation of interactions

- These places define spatially induced connexions between entities
- Other types of connexions may be defined, from initialisation or dynamically





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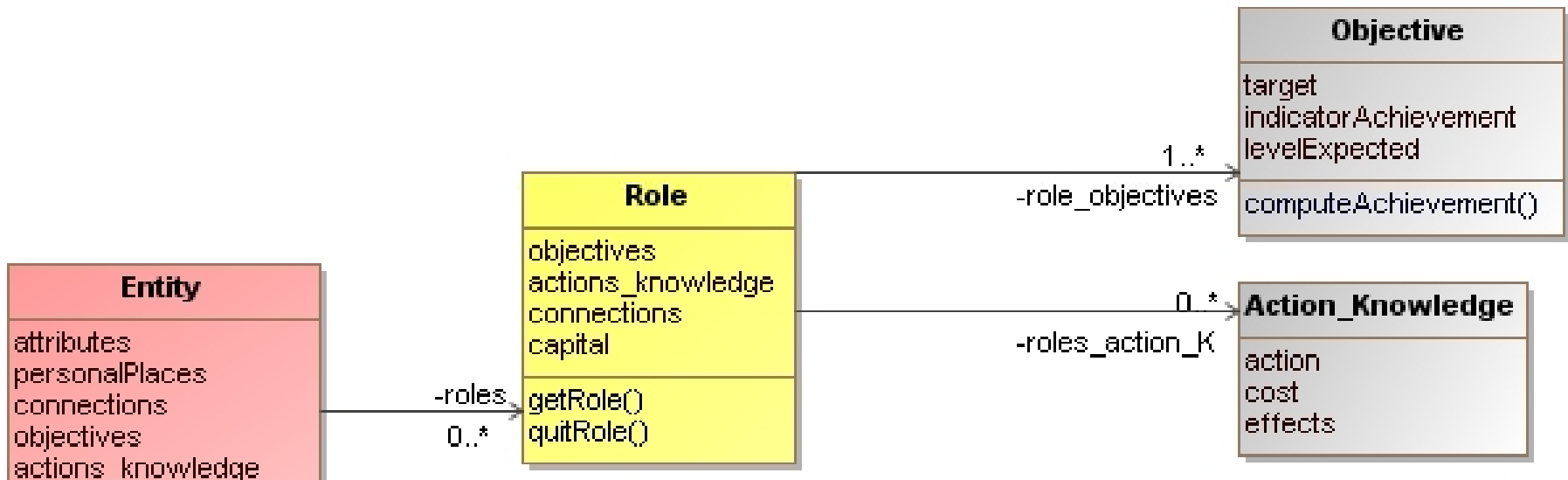
- Localisation of interactions : places and spatially induced connexions

- Action framing and dynamics
 - Accessible actions : roles
 - Choice of actions : engagement regimes
 - Dynamics : actions implementation



Accessible actions : roles

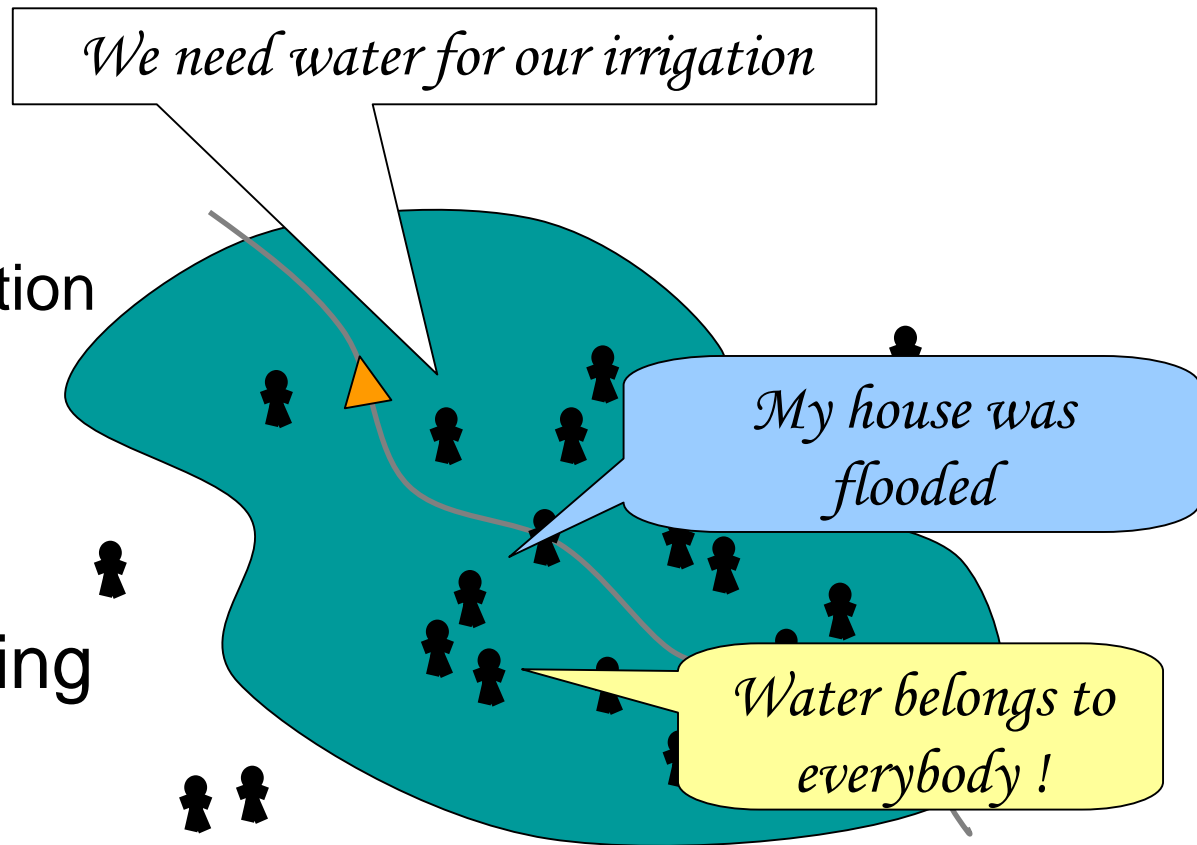
- Roles frame the actions of the entities
- May be : water provider, employee, father
- A role defines objectives and give access to connections, actions and capital
- Some actions and connections may remain even after the role is abandoned





Choice of actions : engagement regimes (1)

- Several regimes of relation with the world:
 - Justification
 - regular planned action
 - Familiarity
- Non exclusive
- Issue : understanding each other

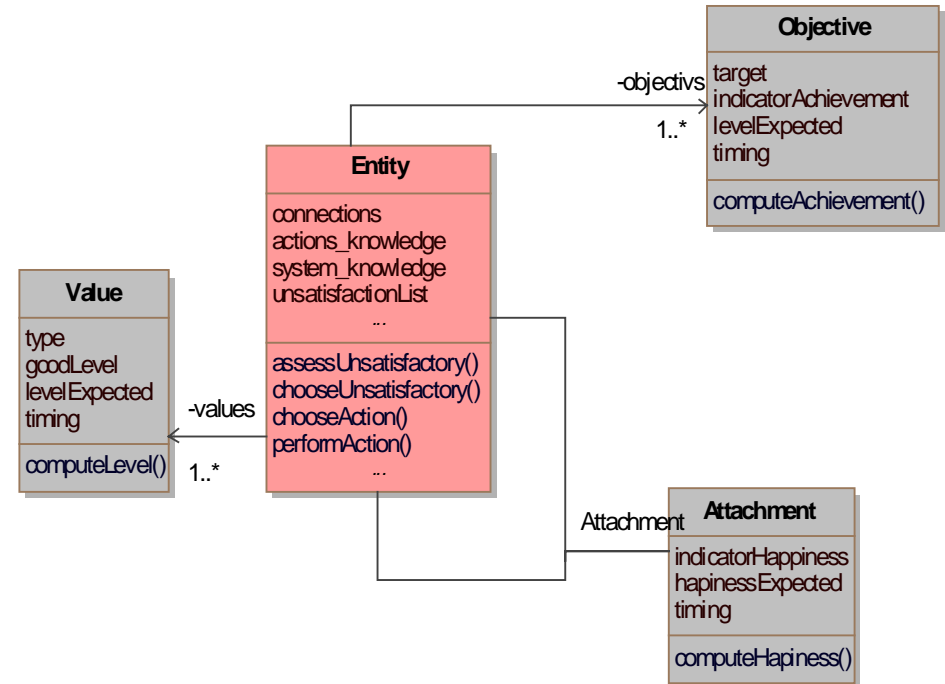


Adapted from Richard-Ferroudji, A., Personal Communication



Choice of actions : engagement regimes (2)

- Justification : values with a scope framed by entities connections
- Regular Planned actions : objectives achievements
- Familiarity : concern for entities attached
- Entities
 - assess their values, objectives and attachments
 - register unsatisfactory states, achievement or happiness
 - balance unsatisfactory to address first
 - Select the best action to address the unsatisfactory





Dynamics

- Discrete-time event
- Pro-actions : Only objectives, values and attachment assesment are scheduled
 - Selected actions that adress unsatisfactory are scheduled and fired
 - Knowledge updates may be part of these actions
- Reaction : reception of a flux
 - Update own state
 - Fire assesment



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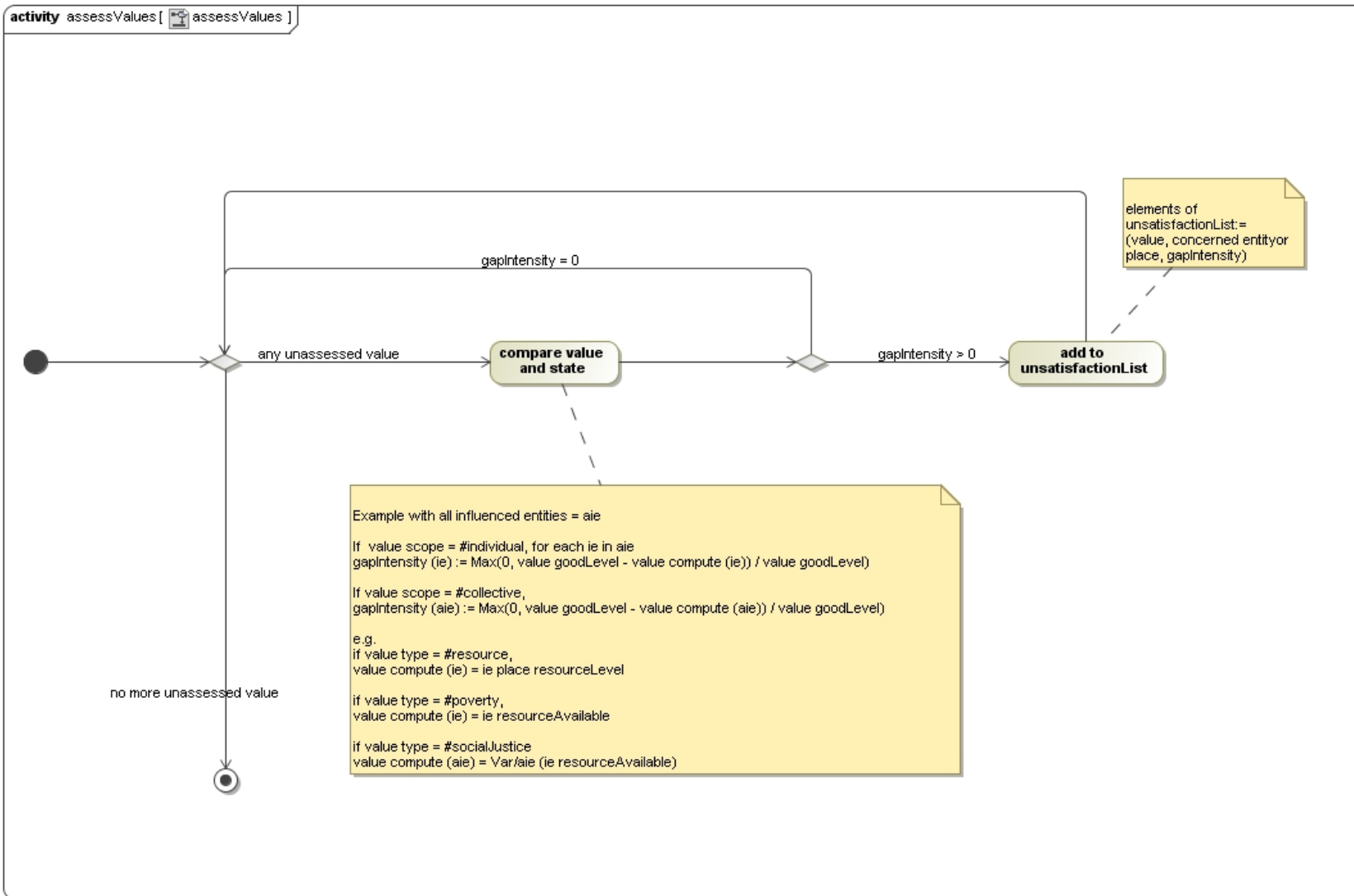


- Entities acting and interacting
 - Connections and flux exchanges
 - Actions categories
- Localisation of interactions : places and spatially induced connexions
- Action framing and dynamics
 - Accessible actions : roles
 - Choice of actions : engagement regimes
 - Dynamics : actions implementation
- Next talk!



Justification

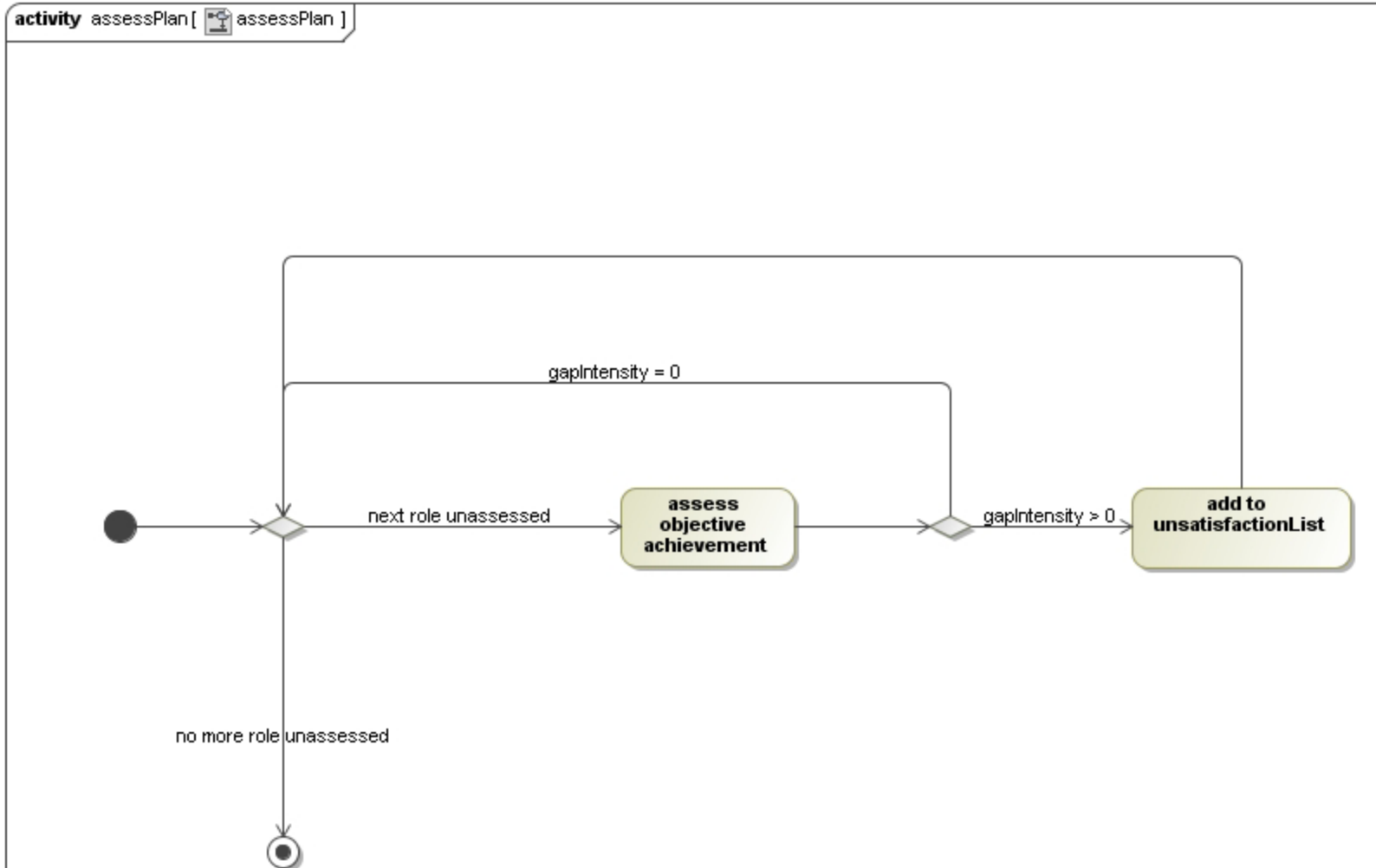
- A few values on all the scope of perception





Regular planned action

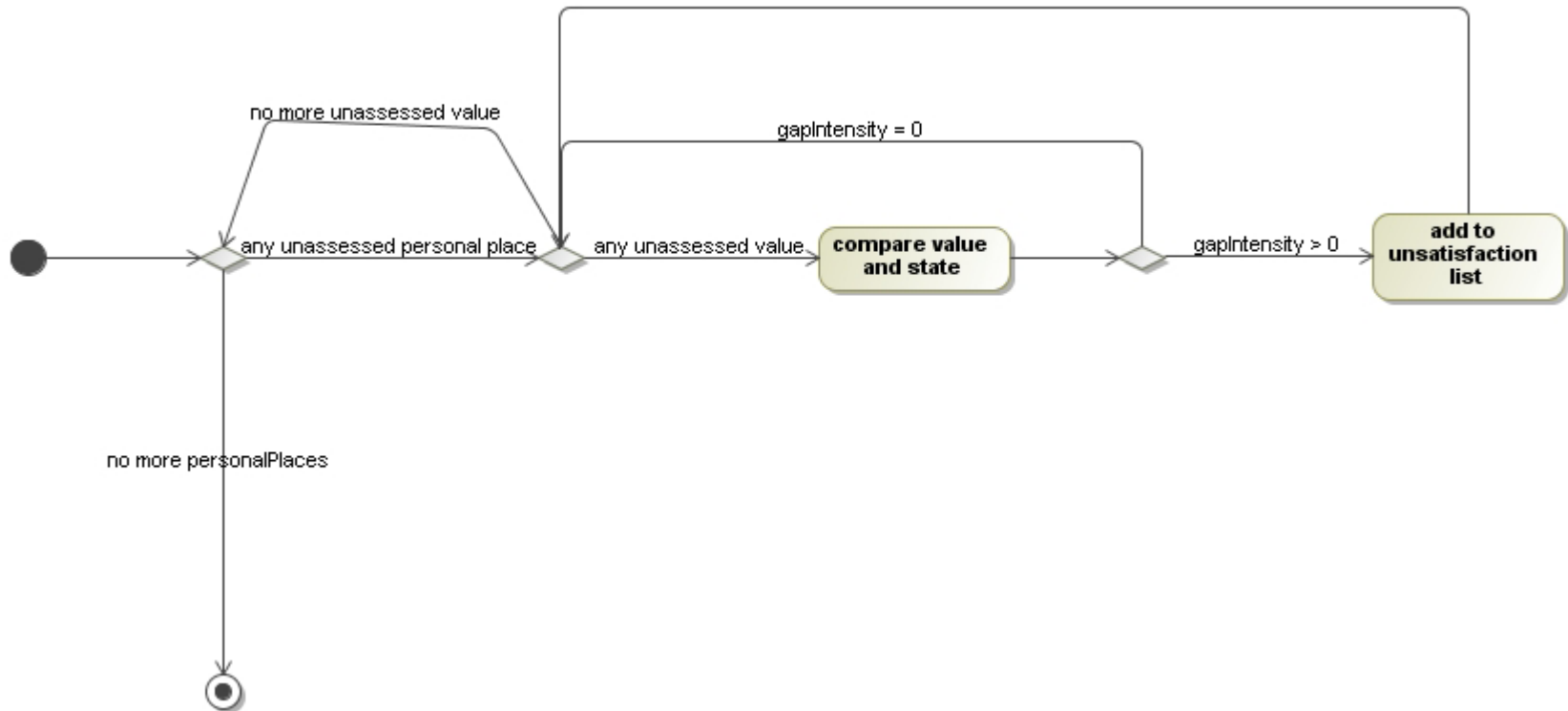
- Close to SO-SI-So





Familiarity

- Few key places, and large scope of values





Conclusion – discussion

- A new heuristics for action
- A simple representation of interdependences
- Need to include a representation on knowledge about actions
- Dealing with the different types of connections ?
- Prototype to be implemented on MIMOSA
 - Discrete time events simulation support
 - Test of the platform and collaboration
- To be fed by on-going case study work
- Further developments
 - Collective actions : recruiting other agents when actions are too costly
 - Institutions : actions are defined with an heuristic which can fit with institutional analysis frameworks (ADICO)



- ADICO :
 - E. Ostrom, *Understanding Institutional Diversity* , Princeton University Press, Princeton, NJ (2005)
 - Smajgl, A., L. R. Izquierdo, and M. Huigen. 2008. *Modeling endogenous rule changes in an institutional context: The adico sequence*. *Advances in Complex Systems* **11**:199-215.
- Engagement regimes :
 - Laurent Thévenot, *L'action au pluriel*. Sociologie des régimes d'engagement, Paris, La Découverte, 2006.
 - Richard-Ferroudji, A. 2008. L'appropriation des dispositifs de gestion locale et participative de l'eau. Composer avec une pluralité de valeurs, d'objectifs et d'attachements Doctorat de l'Ecole des Hautes Etudes en Sciences Sociales, Spécialité : Sociologie, EHESS, Paris.
- Other communications about this work
 - Bots, P., O. Barreteau, and G. Abrami. 2007. Measuring solidarity in agent-based models of resource sharing situation. *Advances in Complex Systems* **11**:337-356.
 - Abrami, G., F. Cernesson, and O. Barreteau (2009). *Supporting case studies comparison with a generic model of urban-rural water related interdependencies*. *Modelling Spaces, Modifying Societies*, Darmstadt.
 - Barreteau, O., G. Abrami, F. Cernesson, R. Ducrot, P. Garin, P. Le Goulven, P. Maurel, A. Richard-Ferroudji, and V. Souchère (2010). *Cities and their "water socio-footprint": bilateral and dynamic interactions*. *Cities of the Future*, Boston.

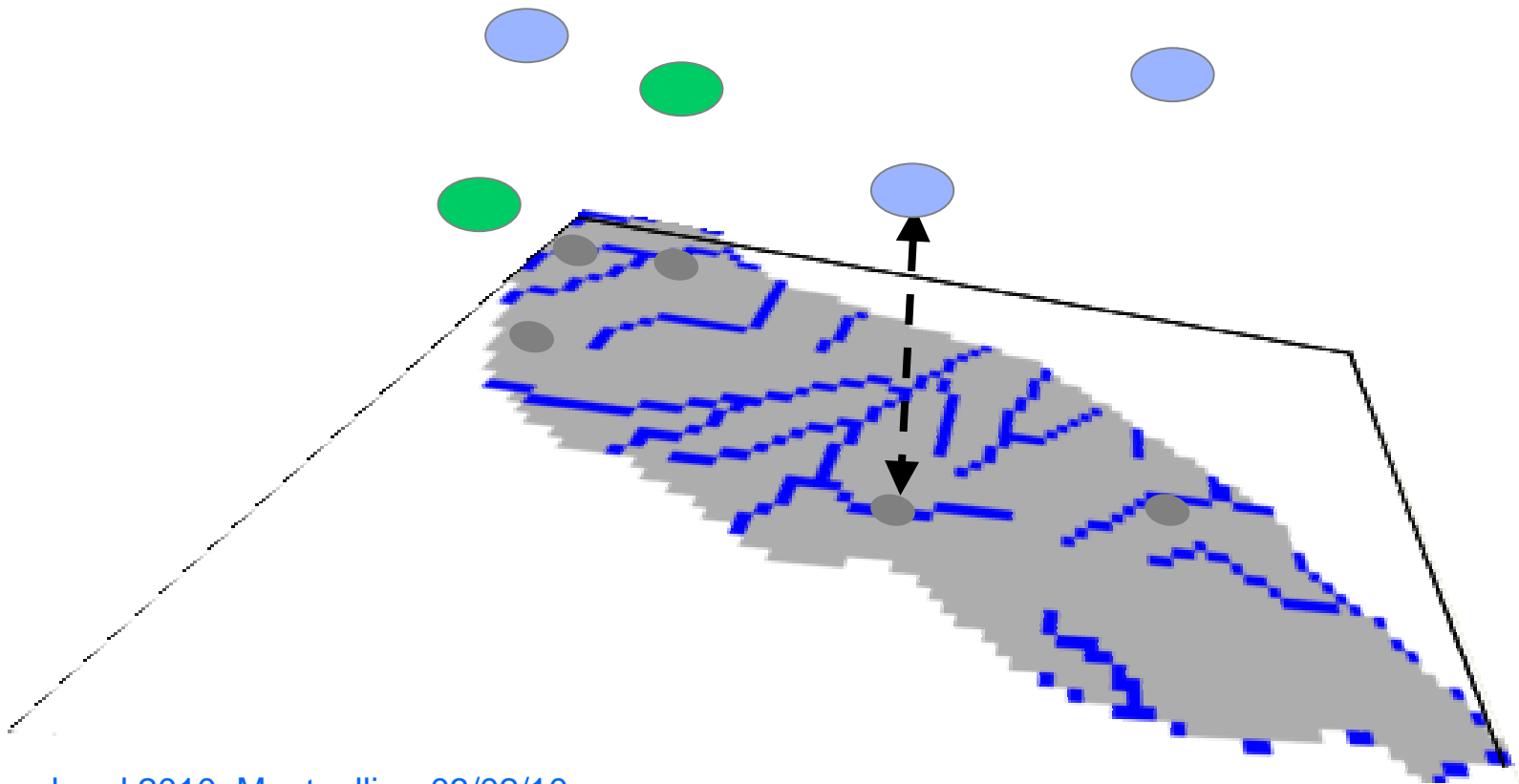






Localisation of interactions

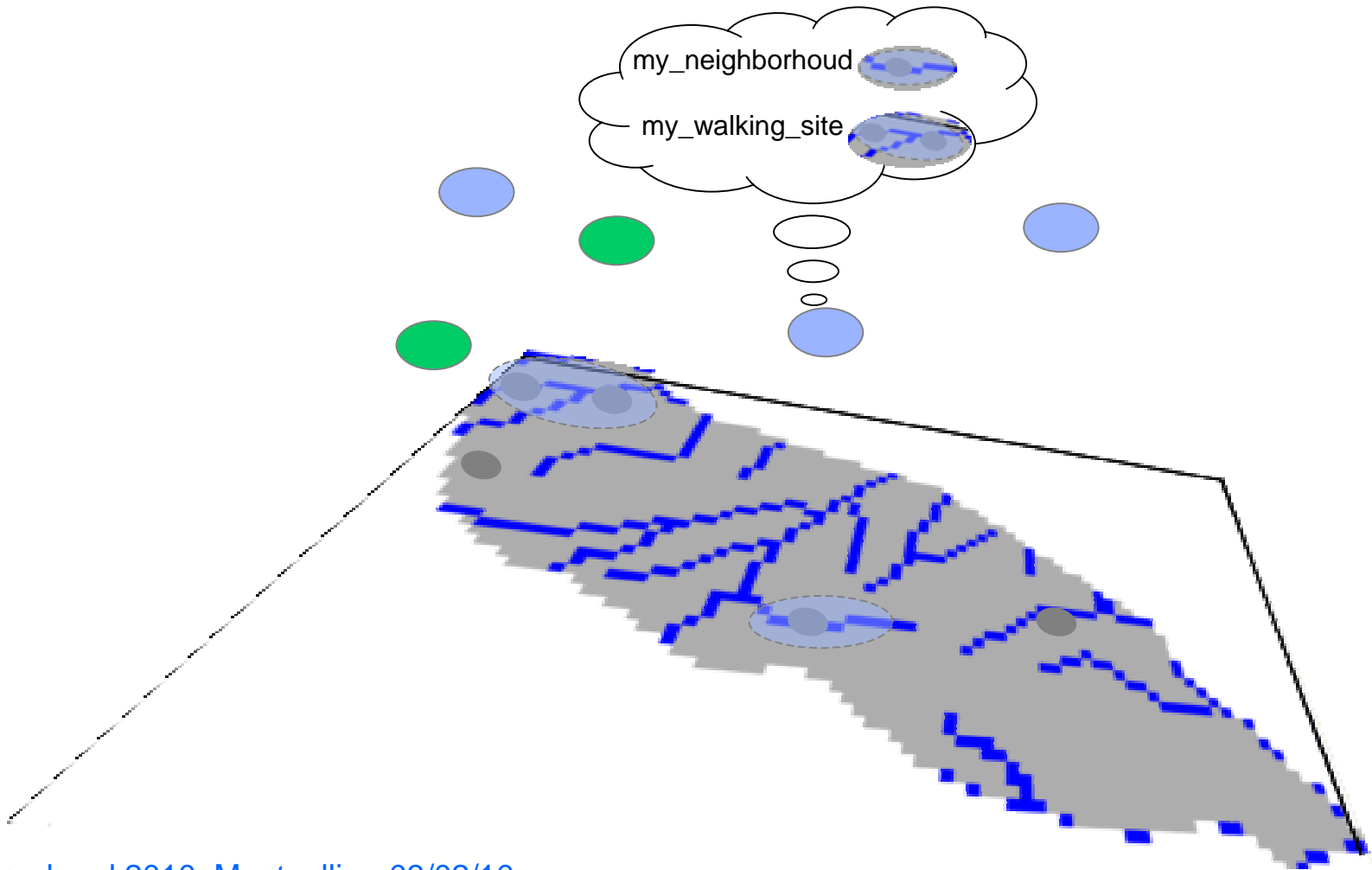
- Entities of different kind are situated on a geographical space





Localisation of interactions

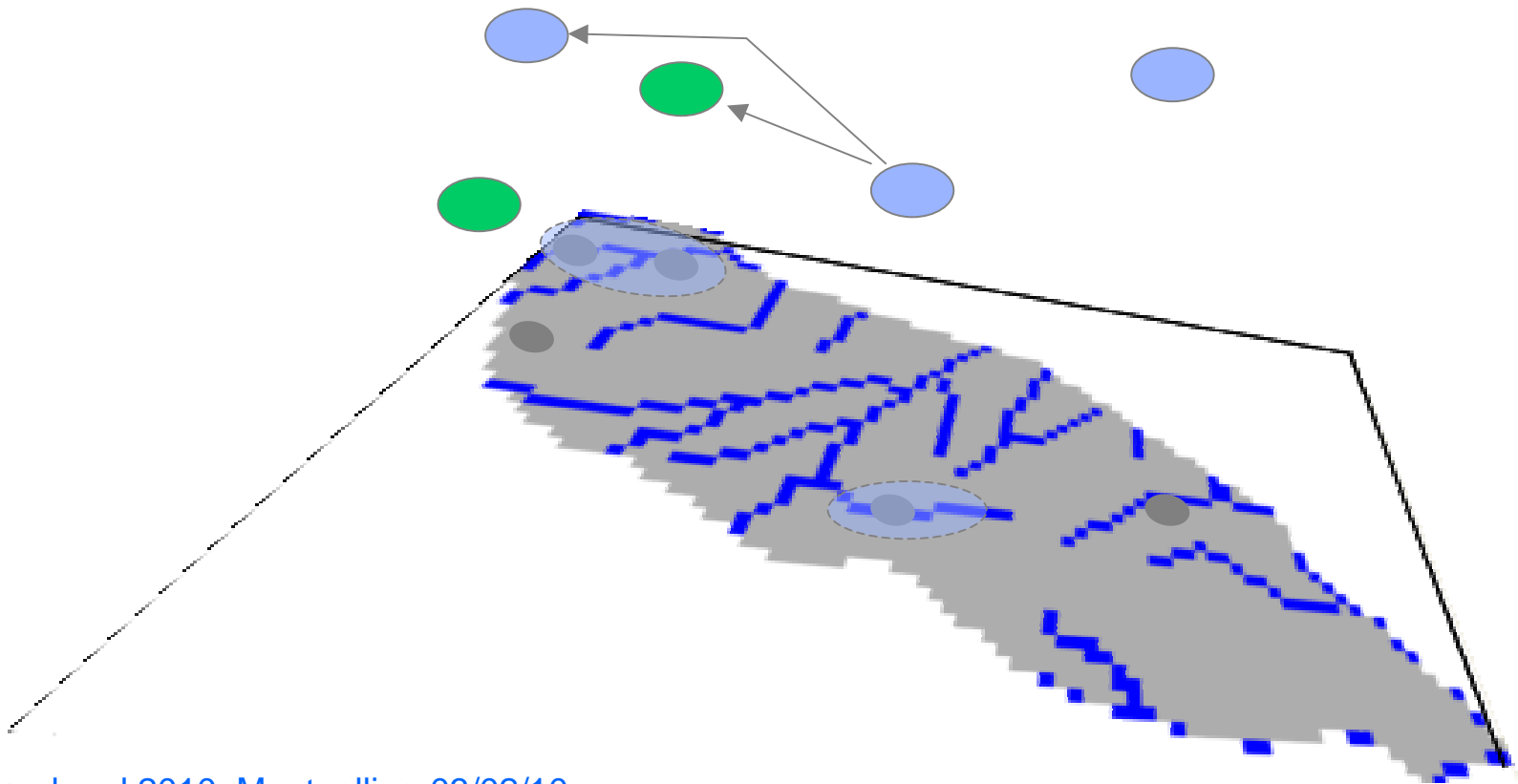
- Each social entity knows several places





Localisation of interactions

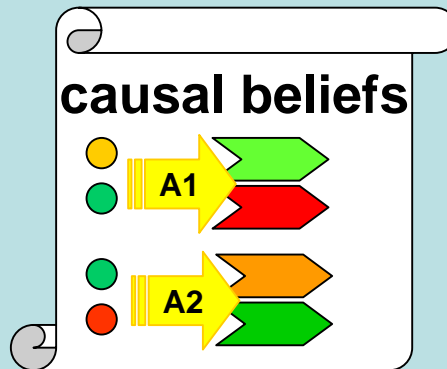
- Each entity has place_relations with the entities localized within its places
- Relations are used for supporting interactions





Deliberation

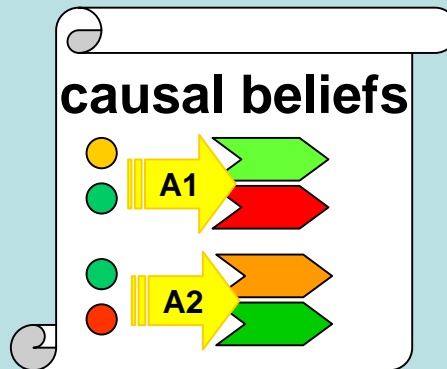
Each entity has causal beliefs about actions they know about :
requirements + impacts





Deliberation

Justification Regime : Each entity refers to some public good values. Each values is linked to an indicator.





Institutions

- Shéma montrant les institutions
-
- Exemple

Collective actions : actions that are too expensive :
mobilize others



Dependances

- Dependance between entities
 - Means:
 - state of entity 1 affects state of entity B
 - Translated in:
 - Influence fluxes between entities
 - Water
 - Money
 - Information
- exemple



- Schéma montrant tout
- Exemple montrant tout ?



Context

Objective

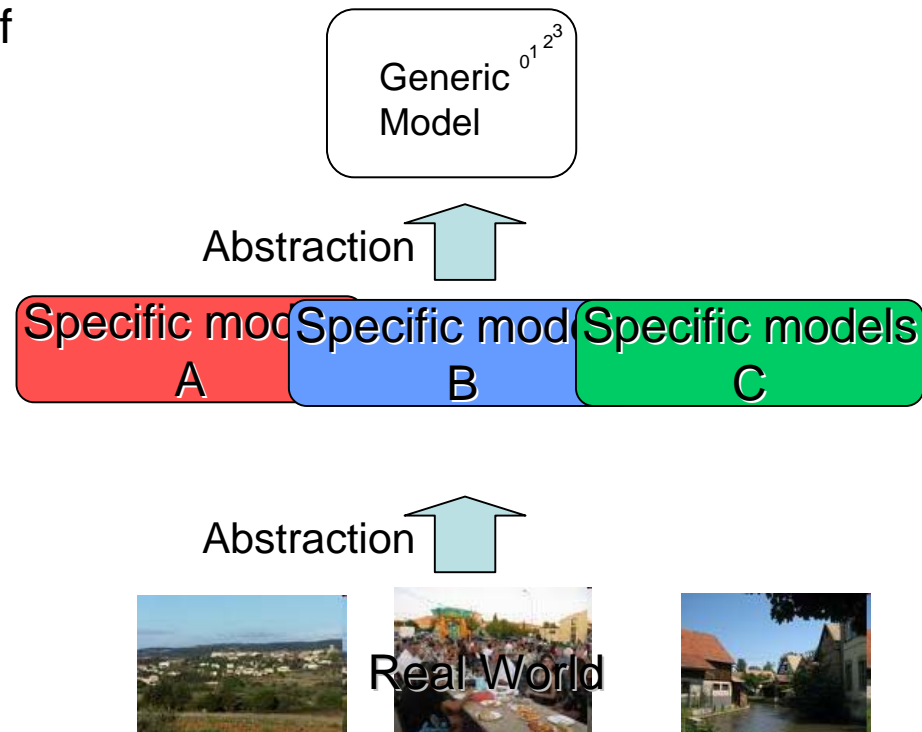
Methodology

Results

Discussion

Potential benefits

- abstract description framework
 - Specific model as instances of the generic model
 - Comparing models parts that share abstractions
 - Enhance analysis
 - Suggest inputs
- Provide shared fundamentals
 - Common vocabulary
 - Common hypotheses
- Speed up and ease model building
 - design patterns
 - Definitions and terminologies





Context

Objective

Methodology

Results

Discussion

- Where are the interdependences ?
 - Interdependence = how is an indicator for an entity affected by another one
 - Which interdependences = Which indicators ?
 - Access to a resource / Vulnerability reduction /...
 - Who is interdependent = how are groups defined ?
 - Urban / rural definitions
 - Communities : boundaries
 - Opposition to a third party
 - How to measure interdependences ?
 - Indicators are affected by fluxes reception and emission
 - Fluxes are affected by space & equipment
 - Space & equipment are affected by morphogenic activities ..

