Automated GEneralization New

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# Project AGENT

## Overview and results of an European R&D projects in Map Generalisation

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Presentation: A. Ruas

# Esprit Project

- 3 years: Dec 97 -> **Nov 2000**
- 21 man years

- **Expected results:**
  - Prototype implementation
  - which generalises topographic data
  - based on the Agent paradigm

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# Partners

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**Cécile Duchêne..**

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**SIG OODB**

**Generalisation**

**AGENT**

**Agent**

INPG
Yves Demazeau,
Christof Baeijs

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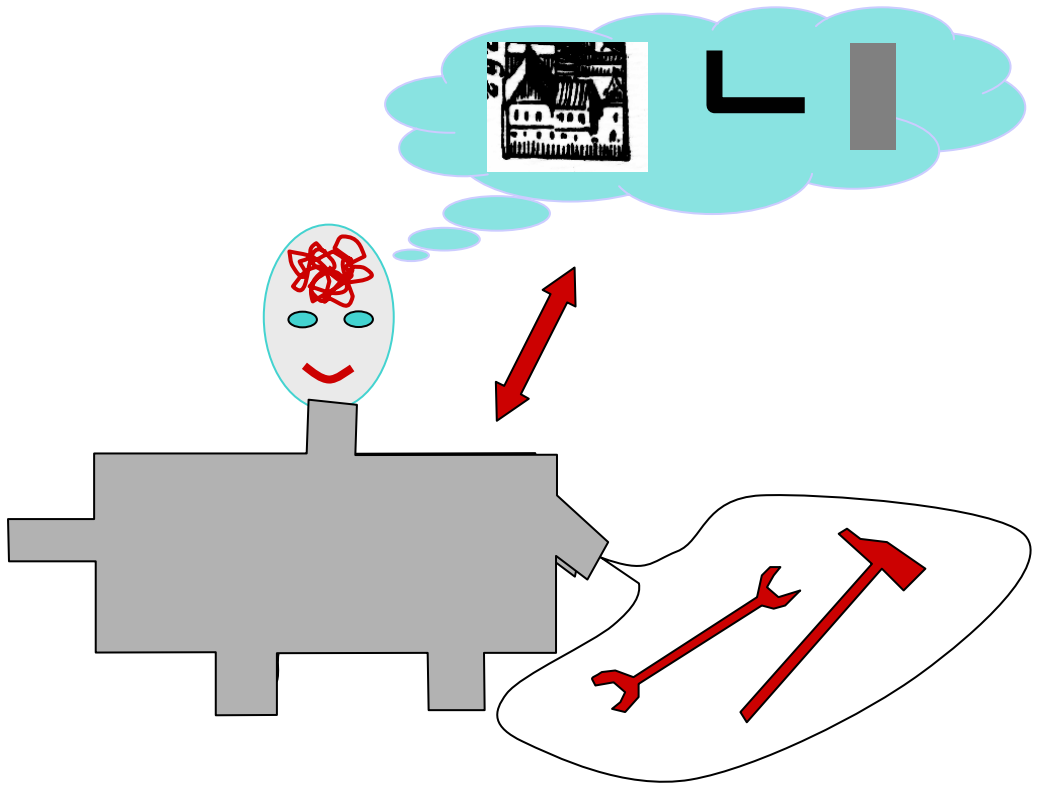
# Aims

- Create a SIG package
- which contains
  - a large set of algorithms
  - measures
  - **mechanisms**
- to automate generalisation process

# What is an Agent ?

- **Entity**
  - **with Behaviours**
  - **with Autonomy**
    - **Can use itself its own behaviours**
    - **To reach its own GOAL**
  - **with Perception**
    - **can 'see' other entities**
  - **which communicates**
    - **can exchange with other entities**

# A building agent



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# AGENT is a principle

**Many implementations are possible**

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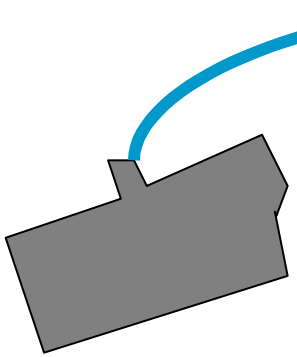
# How we have implemented Agent

- **Object Oriented**
  - **class = one type of geographical object (including groups)**
  - **with Behaviours (= methods) :**
    - **generalisation algorithms**
- **with Autonomy**
  - **conception of specific engine**
  - **use knowledge, based on object type**
- **with control to activate agents**

# Examples



**Behaviours:**

- Simplification
- Dilation
- Squaring
- Change-to-rectangle

**Autonomy: rules & engine**

| If I AM | I USE |
|---|---|
| smaller than λ | Change-to-rect |
| too small | Dilation |
| too detailed | Simplification |
| not squared | Squaring |

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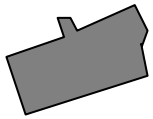
# How does it work ?

- generalisation knowledge is located at the class level
  - If XXX then use XXX or XXX
- An action is applied if certain conditions are fulfilled
- Conditions are constraints violation / user needs

# Characters and Constraints

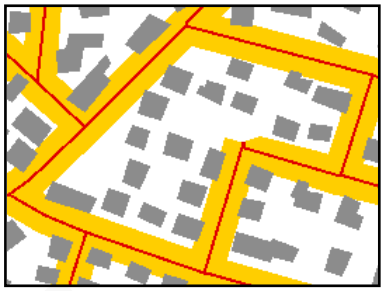


**Characters:**

- size
- granularity
- shape
  - elongation
  - squareness
- position
- orientation

**Constraints:**

- visual
  - Size > X1
  - granularity > X2
  - squareness MAX
- Maintenance
  - elon-fin ≅ elon-ini
  - pos-fin ≅ pos-ini
  - ori-ini ≅ ori-ini



**Characters:**

- density
- type
- proximity

**Constraints:**

- visual
  - density < X3
  - proximity > X4
- Maintenance
  - type-fin ≅ type-ini

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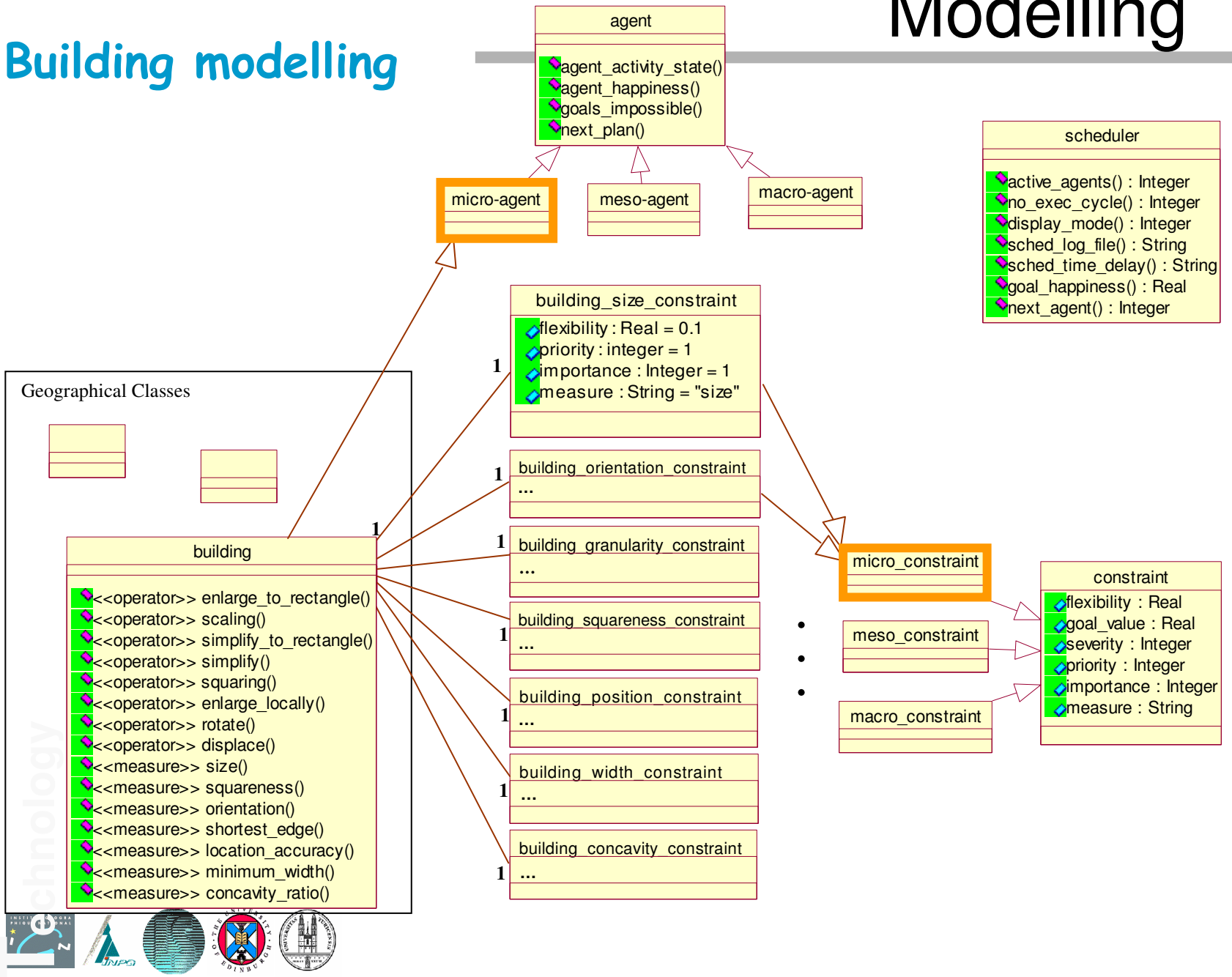
# Building modelling



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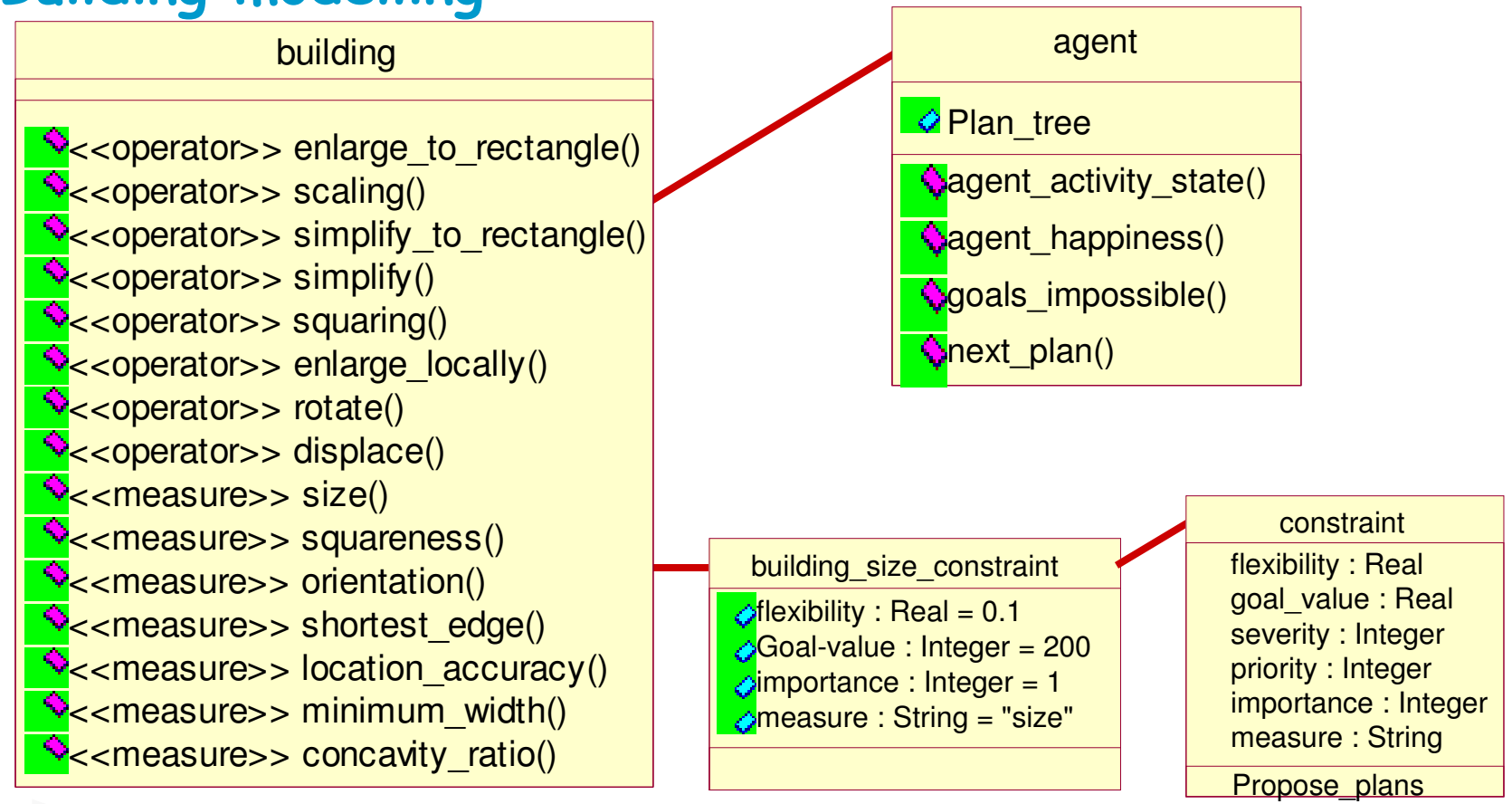
# Building modelling




**Severity** = 'distance' btw current value and goal_value

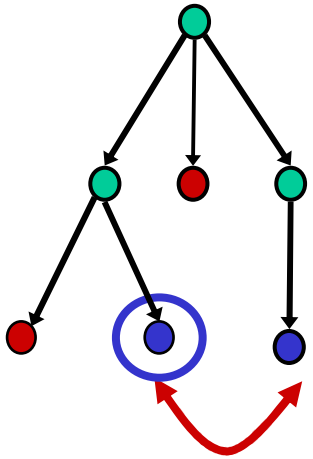
**Priority** = which constraint should be solved first

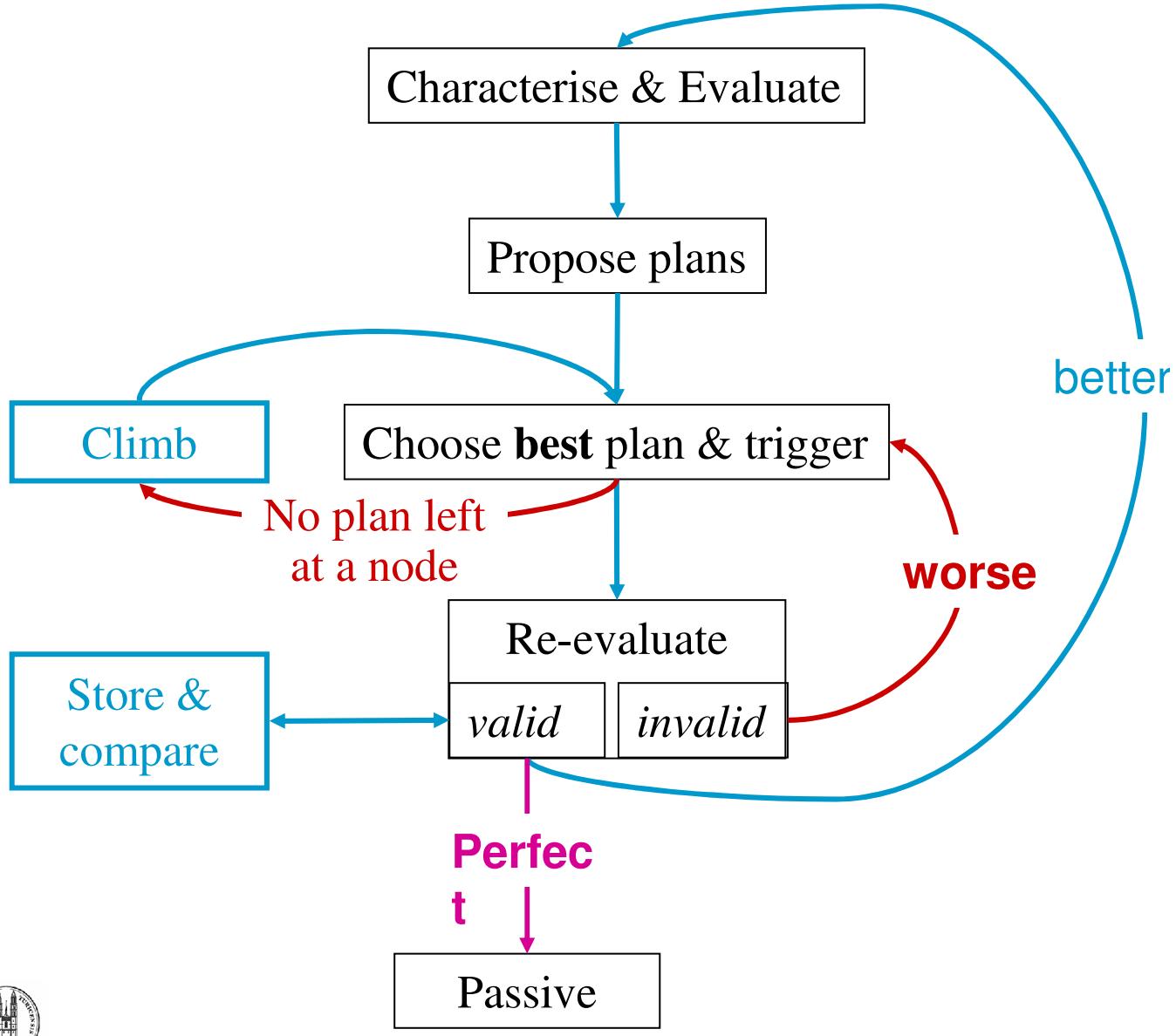
**Happiness** = 'Σ' of constraint severity

# AGENT Engine

- An agent can act only when it is active
- It consults its characters and its constraint violations
- It tries processes to improve itself & to reach a 'good' state
  - according to procedural knowledge
    - if … then
  - controlled by the evolution of its state

# The engine of one agent



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# Who activates an Agent ?

- **Another Agent which has a more global view (concept of meso agent)**
  - **a building is activated by its urban block,**
  - **a urban block is activated by its town**
- **A Map-Agent for upper level agents**

# Application field

- Road-network generalisation
  - road selection & displacement
    - Each road generalisation
      - with recursive line segmentation
- Town generalisation
  - street removal
    - Each urban block generalisation
      - buildings removal & displacement
        - Each building generalisation
          - dilation, shape improvement

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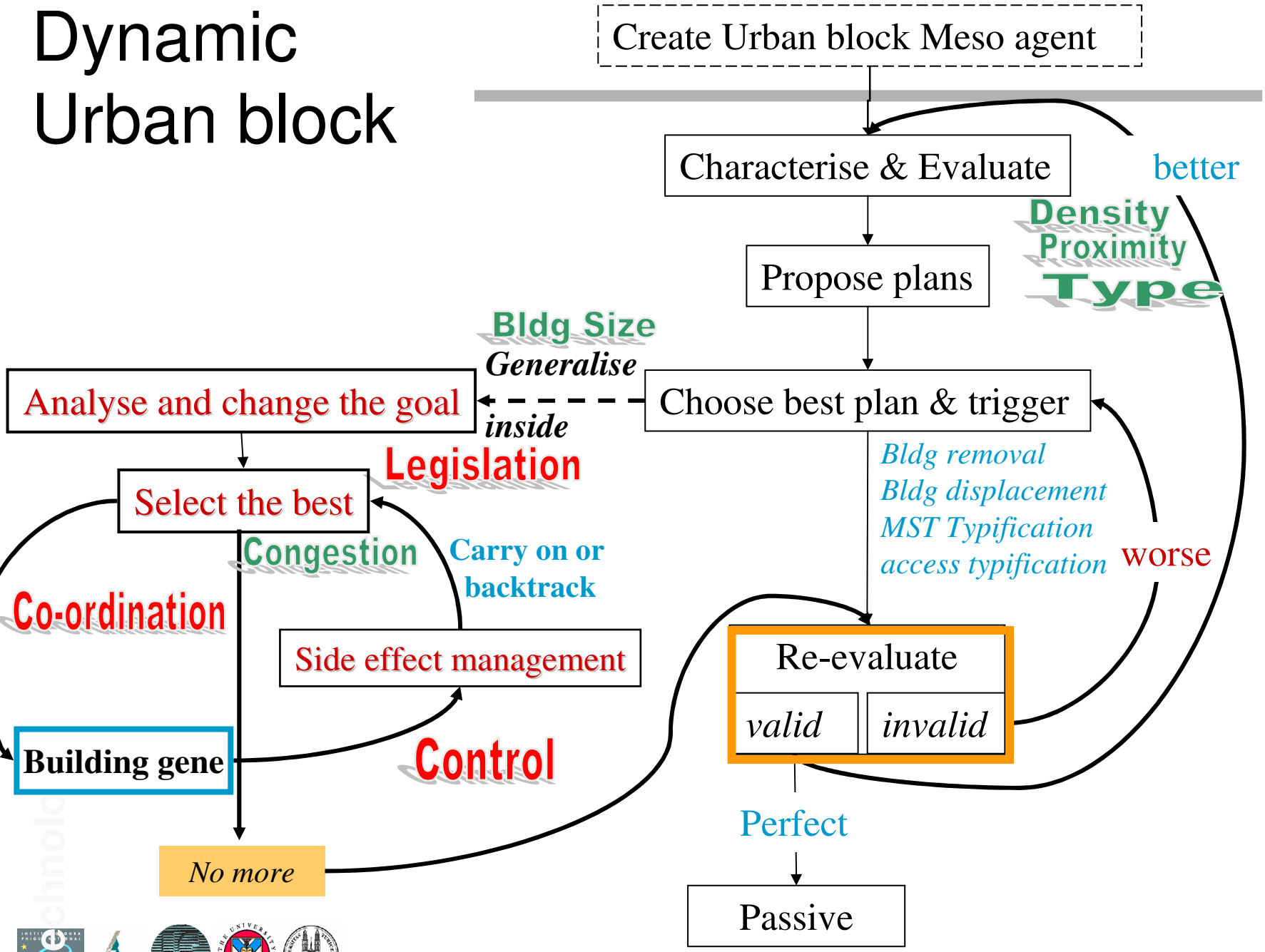
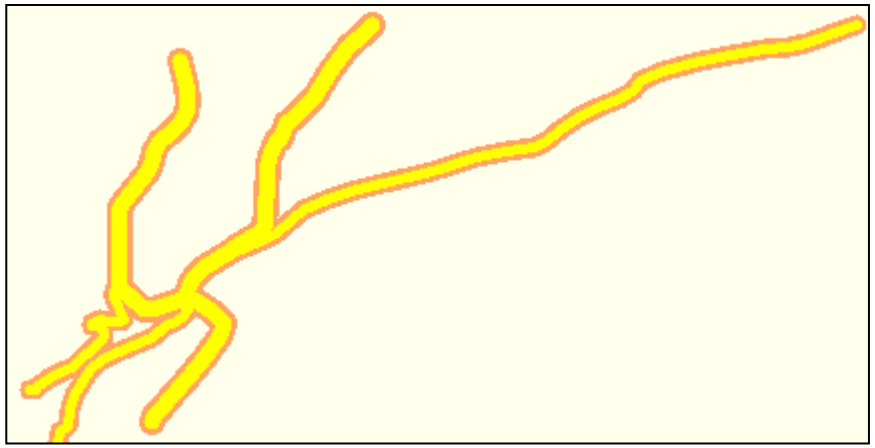
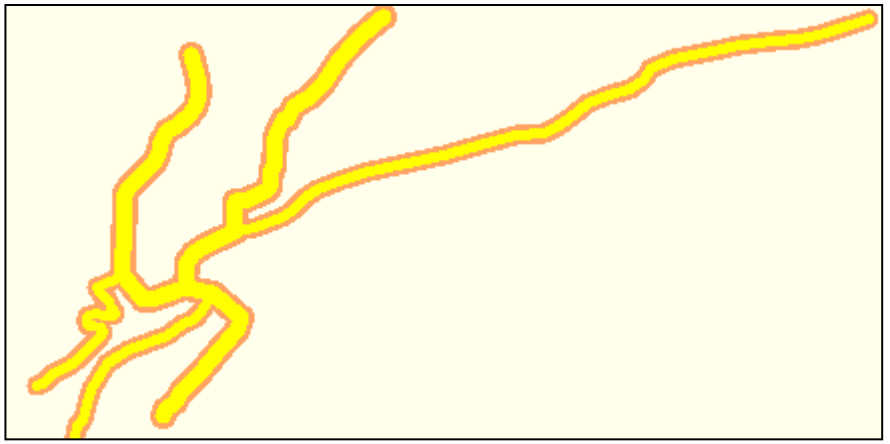
# Dynamic Urban block

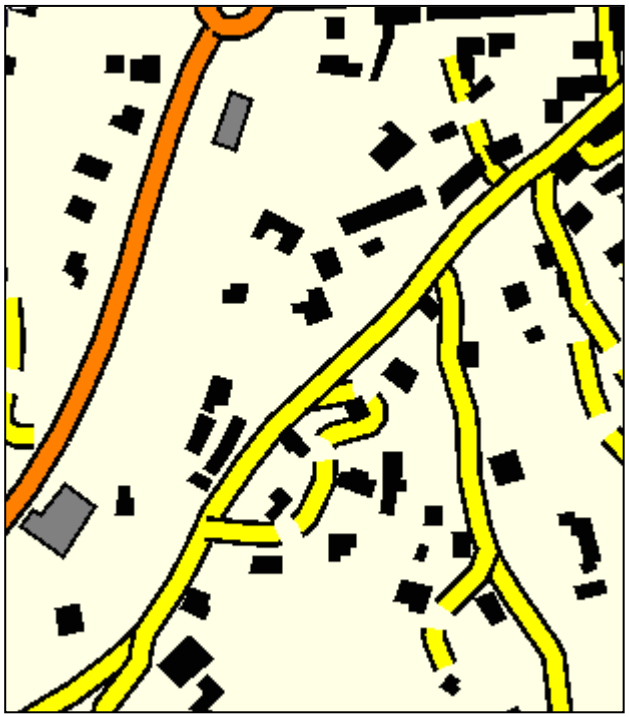


# Some examples of results (1)





# Some examples of results (2)



# Convergence towards a solution

- **The convergence depends on the completeness and the quality of**
  - **the algorithms**
  - **the measures to qualify object's characters**
  - **the procedural knowledge**

# Conclusions

- **Possibility to introduce**
  - **Knowledge & user needs**
- **Algorithms library:**
  - **~ 30 Generalisation algorithms**
  - **~ 20 measures**
  - **easy enrichment**
- **Proof of the AGENT paradigm**
  - **convergence towards solution**
- **Usable in production line**

# Next Steps ...

- **Research**
  - Include results coming from machine learning
  - Introduce negotiation mechanisms to improve objects choice / context
  - Enrich side effect management
    - new algorithms?
- **Production**
  - tune / each generalisation



# HOW TO IMPROVE COMMUNICATION ?