TALKATIVE AGENTS
FOR AUTOMATED GENERALISATION
OF RURAL AREAS

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CONTEXT & OBJECTIVES

PROBLEMATIC APPROACH

PRINCIPLES COMMUNICATION SPATIAL ENVIRONNEMENT

RESULTS CONCLUSION

CONTEXT - AGENT PROJECT principles

• Geographic objects \[\rightarrow\] Geo. agents | goal autonomy of action

\[\Rightarrow\] generalisation: constraint driven
local/conflict analysis
step by step

• Hierarchical multi-level model

\[\text{MESO AGENT}\]

\[\text{MESO AGENT}\]

\[\text{MICRO AGENT}\]

I'm an agent

So am I

MESO AGENTS (GROUPS) DO ORCHESTRATE THE
GENERALISATION OF THEIR COMPONENTS

Levels initially not present in
the database
Limits of the AGENT model

- Good results on urban spaces
- Multi-level hierarchical model not adapted for rural spaces
Objective

• Maintaining/exaggerating relationships
  - Topological relationships
  - Relative positions

To ensure the respect of explicited relational constraints

• Non-overlap of symbols
  - Flexibility / efficacy

• Maintaining/exaggerating relationships

ICA Workshop on Progress in Automated Map Generalization
Problematic

AGENT

OBJECTIVE

flexibility / efficacy
complexity

+ 

Relational constraints ⇒ Dependencies between agents' actions

⇒ How can the agents coordinate themselves?
Approach: agents 'see' and communicate

Perception of the environment

The building is overlapping me. I have free space above myself.

Communication by sending messages

I'm overlapping the dead end. I'm stuck because of the red road.

Communication model

Modelling the environment of an agent

Move away!

I cannot!

Hm. It is stuck. I'll try and move myself...
Communication model - Objectives

- Agents need to exchange information
- An agent needs to
  - begin with a task
  - interrupt its task to send a message
  - send a message in a language understood by the other one
  - interpret any received message
  - go on with its activity depending on the received messages and tasks in progress
- Only 2-agents conversations considered (dialogs)
Key elements of a communication model

- **A common language**
  
  - gblafg!
  
  - Move away!
  
  - What?
  
  - OK. It is asking me to displace myself

- **A common logic for chaining messages**
  
  - Move away!
  
  - I can answer 'yes' or 'no'

- **A logic for acting in response to a received message**
  
  - Move away!
  
  - To know what to answer, I should first seek for free space around myself
Communication language

• Messages structure: AskToDo(Move away) [Ferber 95]

• Speech Act Theory
  – An utterance = Performative + Argument
    Ask-to-do
    Deny
    Inform
    Accept
    etc.

• Interest:
  – Small number of performatives
  – Domain-dependant arguments
  – Conversation scenarios based on performatives only
Pre-established scenarios - example

Scenario « Request of action »

Graph for the initiator

Graph for the respondant
Proposed approach

- Principles

- Model for agents communication

- Modelling the spatial environment of an agent
Modelling the spatial environment of an agent

• Objective: each agent has a representation of its spatial environment
  – the agents with which it will possibly interact
  – the relational constraints with these agents
Differents kinds of geographical objects

"Small compacts"
- building
- touristic symbol

"Network linears"
- hydrographic segment
- road segment

"Independent linears"
- embankment
- hedge

"Partition areas"
- landuse
Search neighbours, then relationships

- "Neighbours": 
  Agents with which a relational constraint might exist
  ⇒ Environment zone of an objet = buffer

- Relational constraints with each neighbour

   - Superposition, proximity
   - Bypass
   - Parallellism
Relationships do constrain the space

For an object, relational constraint => constrained zone

- I should not be overlapping the road symbol
- I should maintain the wall alignment with the big building

Spatial relation

- My centroid should not be inside the blue zone
- My centroid should remain on the green line

Topologic relation point/constrained zone
Use of the "Constrained zones"

- Find a position that optimises the constraints satisfaction
- Know which constraints, shared with which agents, are not satisfied
Results

44 agents (8 roads, 36 buildings) - Scale 1: 25 000
Results (2) - scale 1:25 000
Results (2) - scale 1:25 000

Initial
Results (2) - scale 1:25 000
Results (2) - scale 1:25 000

Initial + Result
Other results

Simple situation

1: 25 000 - initial
Other results

Simple situation

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CONCLUSION
Other results

Simple situation

1: 50 000 - initial
Other results

Simple situation

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Other results

Situation of intermediate complexity

1: 25 000 - initial
Other results

Situation of intermediate complexity

1: 25 000 - final
Other results

Situation of intermediate complexity

1: 50 000 - initial
Other results

Situation of intermediate complexity

1: 50 000 - final
Conclusion

- Problematic: cartographic generalisation of low density areas

- Propositions:
  - Communication model
  - Model for the representation of an agent's spatial environment
  - System based on these models

- Encouraging preliminary results
On-going work

• Introduce
  – other relational constraints
  – other generalisation actions
  – other geographical themes

• Better study the dynamic of the system:
  – In which order should we activate the agents?
  – In which order should an agent perform the actions it has to perform?

• More deeply combine the system with the AGENT prototype
  – management of over-constrained situations using groups
  – interface urban/rural
THANK YOU !