Learning in a community of practice: an agent-based model

Widad Guechtouli

GREQAM, University of Aix-Marseille III

Knowledge and communities of practice:

- A community of practice is seen as one of the most efficient concepts to study the process of sharing knowledge in groups [Lave and Wenger, 1991; Brown and Duguid, 2000].
- It is defined as a collection of heterogeneous agents bounded by informal relationships and interacting in a coordinated way, to improve their competencies in a particular field, through the sharing of a repertoire of common representations, which changes as the practice of the community evolves.

Research objectives:

- The aim of this paper is to see how learning occurs within a community of practice, focusing on the impact of two parameters:

  - agents' availability;
  - agents' commitment to the community (agents' motivation).

- Our approach consists in addressing the learning of agents through the raise of their competencies in a specific practice. We build a multi-agent model, based on an empirical study made in June 2005.

The case study:

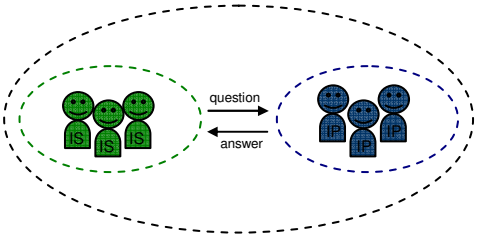
- The network we wanted to study through this model is the Cormas network, belonging to the CIRAD, a research centre in Montpellier, France. This network has some features that made us think of it as a community of practice. These features are:

  -Emerging informal network
  -The voluntary commitment of its members
  -The structure of the network
  -The practice that binds its members
  -The free access to the network

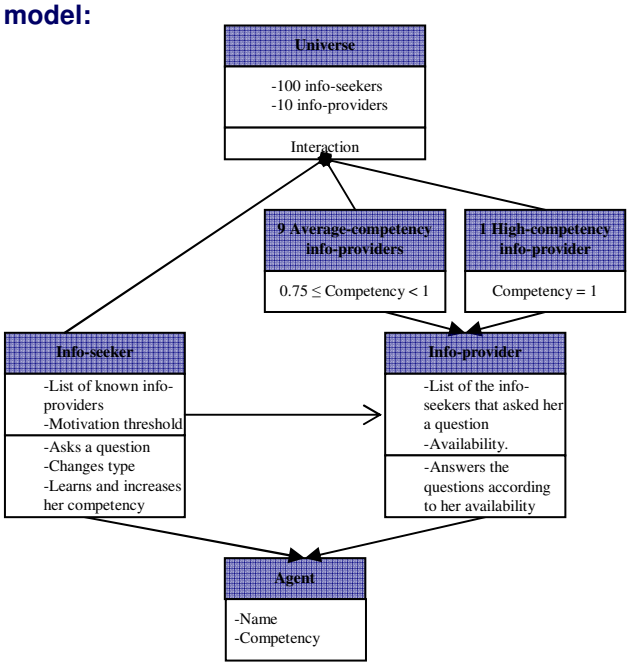
- Data were collected through interviews and questionnaires sent through the Internet. This model remains a bit abstract though; we'll give some insights to better represent this network in our future research.

Hypotheses:

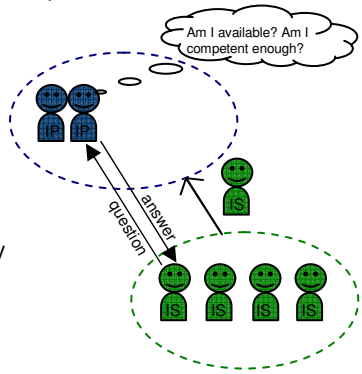
- A community divided in two populations:
  -Population of info-seeker agents.
  -Population of info-provider agents
- These populations interact through a question/answer mechanism.
- Each agent has a competency, given as the probability that this agent will answer a question correctly. An agent's competency defines her belonging to a specific population.
- Each agent has an availability. It is the number of questions that an agent is allowed to answer per time-step.



The model:



- An info-seeker can only ask one question per time-step.
- An info-provider can respond in two ways: if she's available and competent enough, she will give a positive answer. If not, she will give a negative one.
- An agent's competency increases with 0.01 each time she gets a positive answer.
- When an info-seeker gets as competent as the least competent info-provider in the community, she gets the ability to answer questions and becomes an info-provider.



The model indicators:

- Global learning indicator: it is measured by the evolution of the number of info-providers in the community.
- Duration of simulations: to see how fast learning happens.

Simulations:

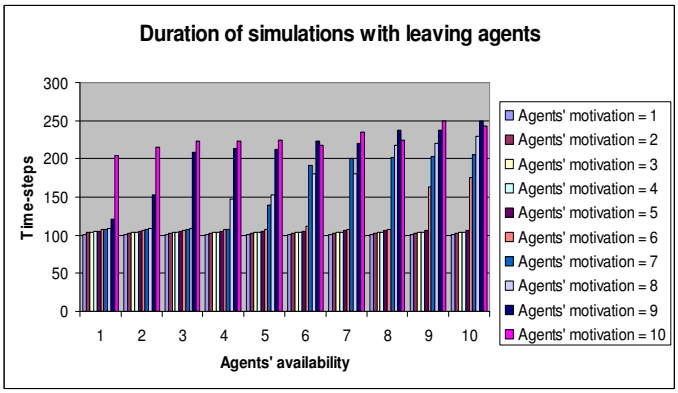
Simulations with leaving agents:

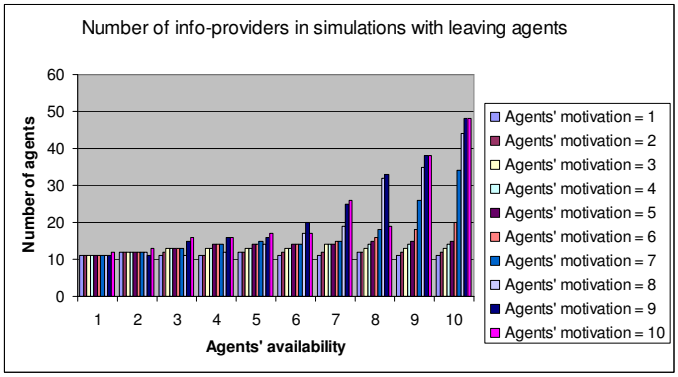
- Info-seekers leave the community when there are no more info-providers they can ask questions to.
- Simulations will run until the info-seekers population gets empty.

Simulations with patient agents:

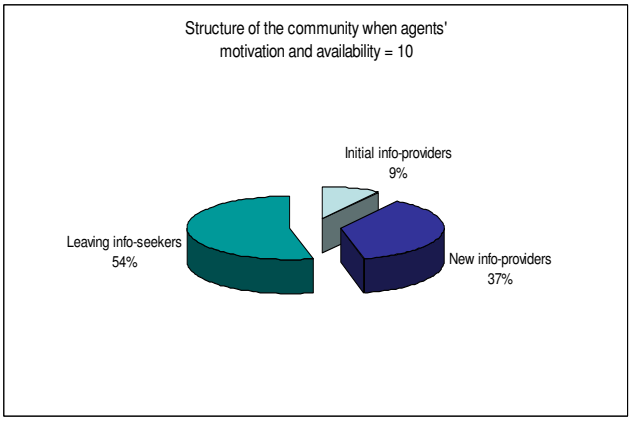
- Agents don't leave the community but wait for a new info-provider to emerge.
- Simulation will run until there are no more questions asked in the community.

Results of simulations with leaving agents:





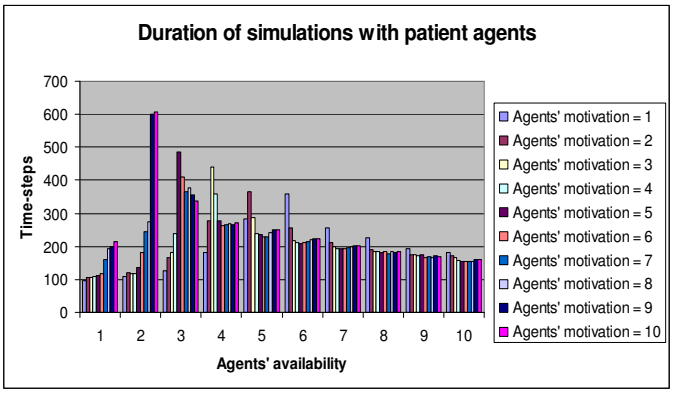
- A learning process occurs.
- One expected result: availability and motivation foster agents' learning.
- Since all info-seekers know the competencies of all info-providers, they will all ask the most competent info-provider first.
- According to info-providers' availability, only a few of them will have positive answers to their questions.
- It seems it is always better for info-seekers that the agents getting positive answers from the most competent info-provider in the community are initial info-seekers, not info-providers.
- In this case, simulations are longer but a larger number of initial info-seekers are able to become info-providers.
- Still, not all info-seekers are able to become info-providers.
- Most info-seekers are not able to learn fast enough and decide to leave the community with very low competencies.

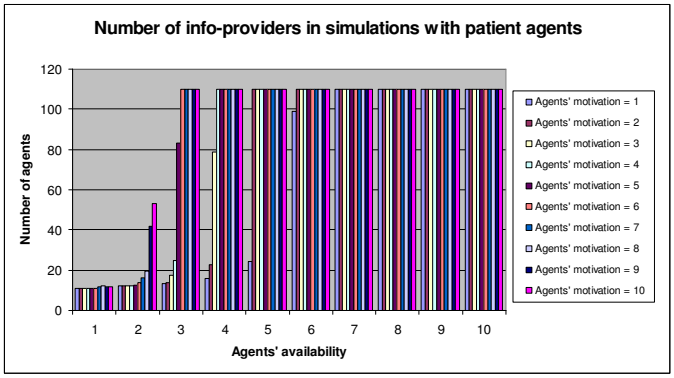


- After the learning process, a congestion effect emerges.
- This phenomenon, which is often observed in an environment with strategic rationality, appears in a non-strategic environment with procedural rationality.

➔ Some features of interactions with strategic rationality can also be observed in interactions with procedural rationality.

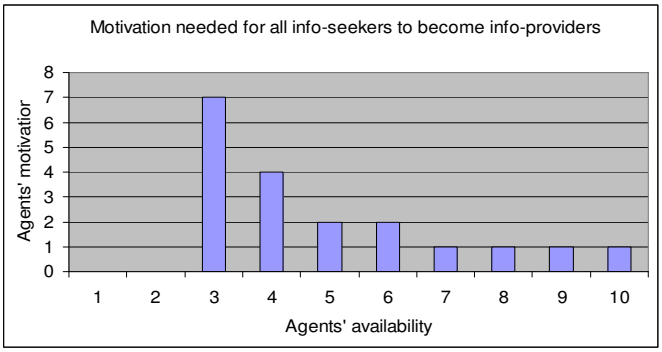
Results of simulations with patient agents:





•The bigger agents' availability and motivation are, the shorter simulations are.
•For all info-seekers to become info-providers, it is necessary that info-providers' availability is at least equal to 3, and info-seekers' motivation equal to 6.

•The problem of the congestion effect can be solved by adding a new algorithm giving more patience to the agents.
•When adding this new algorithm, a certain equilibrium between agents' availability and motivation must be reached for all agents to learn and become info-providers



Future research:

Future development of the model should include some new algorithms to better represent the Cormas network, such as a variable size of the community to represent the free access to the network; non-directed interactions (blackboard) to better represent the most common type of interactions in the Cormas network; differentiation of the several types of knowledge exchanged in the community.

References:

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