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LTI - Laboratorio de Técnicas Inteligentes

Participatory Simulation: A Computer Support Perspective

Jaime S. Sichman

SimParc 2007
November, 2007
Rio de Janeiro, Brazil

● J. Sichman, 2007

Participatory Simulation: A Computer Support Perspective

Jaime Simão Sichman
LTI / EP / USP, Brazil

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Topics

1. NEGOWAT Project
2. GMABS Methodology
3. GMABS Architecture
4. ViP-GMABS Architecture
5. Discussion



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NEGOWAT Project

Facilitating negotiation on land and water management in upstream peri-urban catchments in Latin America : Combining multi-agent modeling with role-game playing.

Projeto INCO DEV 2002-10161
2003 - 2005

General management: Dr. Raphaële Ducrot (CIRAD, France, IEA/USP)

FAPESP The European Commission DFID



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NEGOWAT Participants

Brazil

- USP: PROCAM, POLI, FSP
- UNICAMP: IE
- POLIS
- IIE
- APTA

Bolivia

- UMSS: Centroágua, CEPLAG
- CERES

France

- CIRAD

UK

- NRI





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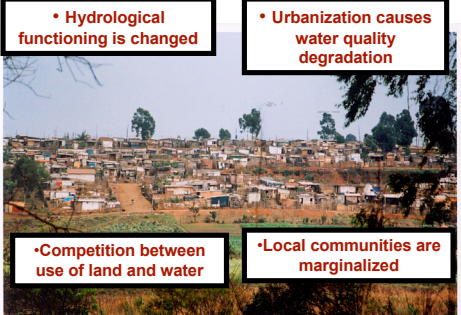
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Peri-Urban Catchments



- Hydrological functioning is changed
- Urbanization causes water quality degradation
- Competition between use of land and water
- Local communities are marginalized



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NEGOWAT Goals

- Design the conceptual modeling of water and land management in peri-urban catchments of huge cities en Latin America
- Investigate which are the social, economic, technical and institutional issues that regulate the social and hydrological functioning of these areas
- Build some computer based tools that could help actors to negotiate / solve / minimize conflicts
 - GMABS: combining RPG and MABS



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GMABS = MABS + RPG

- MABS (*Multi-Agent-Based Simulation*):
 - Computational simulation + multi-agent systems
 - Programming the individuals
 - Observing the collective
- RPG (*Role Playing-Games*):
 - Combination of games and theater
 - Actors play roles
 - Focus on **cooperation**, unlike in other games where exists competition

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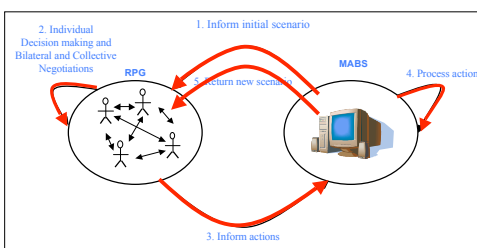
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GMABS Methodology



This methodology was first proposed by [Barreteau et al. 2001]

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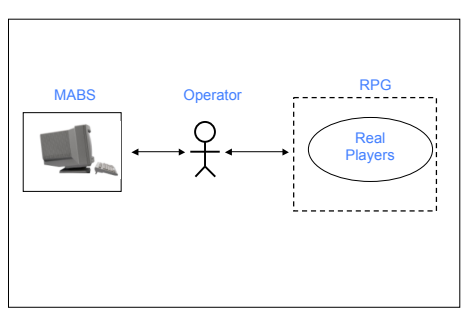
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GMABS Abstract Architecture



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JogoMan Prototype⁽¹⁾

- The JogoMan prototype simulates the management of a particular peri-urban catchments, located at Bacia do Alto Tietê, in São Paulo, Brazil.
- It represents a simplification of the real interaction between the several actors, used as a means of learning and analysis.

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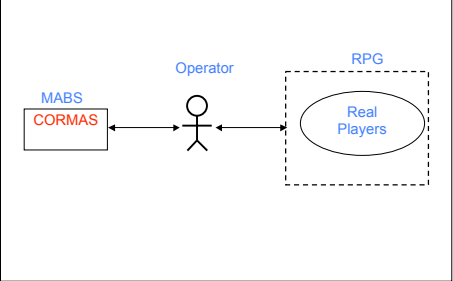
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JogoMan Prototype⁽²⁾



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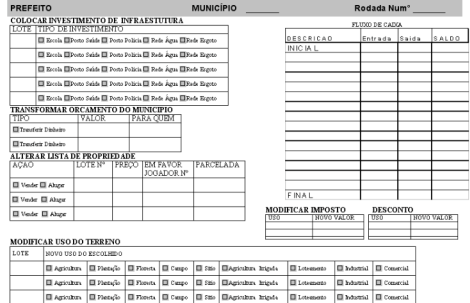
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JogoMan Prototype⁽³⁾





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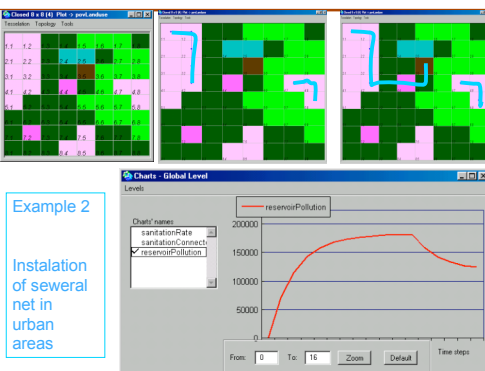
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JogoMan Prototype⁽⁴⁾



Example 2

Installation of sewer net in urban areas



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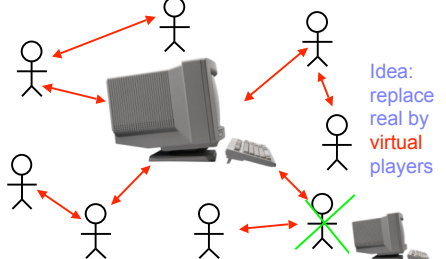
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JogoMan Prototype⁽⁵⁾

A problem with the prototype was the need of several actors to play the game



Idea: replace real by virtual players



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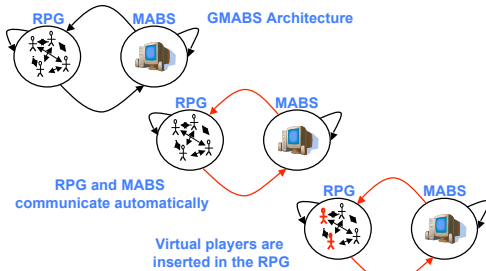
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Virtual Players and GMABS

- Idea:
 - Incorporate virtual agents in the RPG
 - Adequate the underlying architecture (interaction)



RPG and MABS communicate automatically

Virtual players are inserted in the RPG



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ViP-GMABS Abstract Architecture⁽¹⁾

- Requirements:**
 - MABS Element:**
 - Supplying the system data (ex: initial scenario)
 - Communication Layer:**
 - Communication between MABS and RPG Players (Real and/or Virtual)
 - Virtual Players:**
 - Communication between Real and Virtual Players
 - Decision-making capabilities



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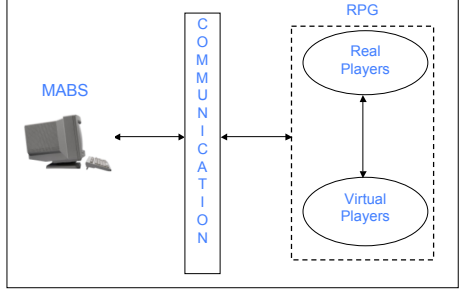
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ViP-GMABS Abstract Architecture⁽²⁾





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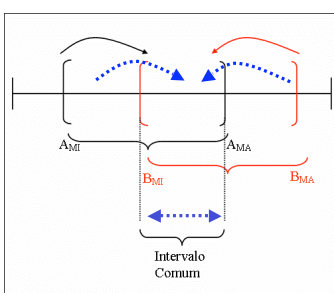
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ViP-GMABS Abstract Architecture⁽³⁾

- We have used Raiffa's negotiation protocol





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Vip-JogoMan Prototype⁽¹⁾

- The Vip-JogoMan prototype extends the Jogoman prototype:

 - Negotiation between real players is made via computer interfaces
 - Some roles can be fulfilled by virtual players
 - Information exchange between RPG and MABS is mediated by computer



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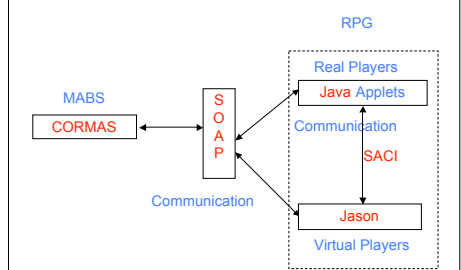
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Vip-JogoMan Prototype⁽²⁾



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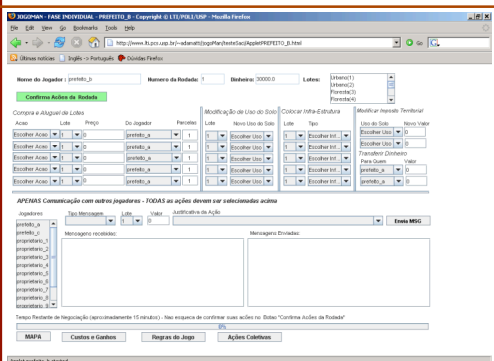
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Vip-JogoMan Prototype⁽³⁾





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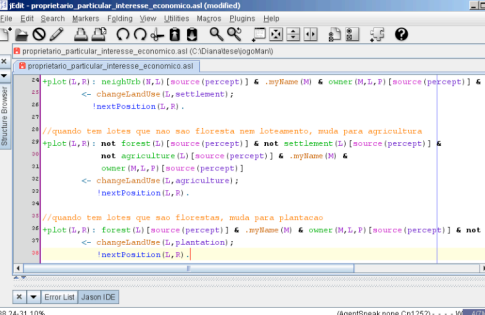
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Vip-JogoMan Prototype⁽⁴⁾

Jason is an AgentSpeak interpreter written in Java



```

14 plot(1, 0) :- neighbor(0, 1) [source(percentage)] & .myName(0) & owner(0, 1, 0) [source(percentage)] &
15 <- changeLandUse(1, settlement);
16 nextPosition(1, 0).
17
18 //quando tem lotes que nao sao floresta nem loteamento, muda para agricultura
19 plot(1, 0) :- not forest(1) [source(percentage)] & not settlement(1) [source(percentage)] &
20 not agriculture(1) [source(percentage)] & .myName(0) &
21 owner(0, 1, 0) [source(percentage)] &
22 <- changeLandUse(1, agriculture);
23 nextPosition(1, 0).
24
25 //quando tem lotes que nao floresta, muda para plantacao
26 plot(1, 0) :- forest(1) [source(percentage)] & .myName(0) & owner(0, 1, 0) [source(percentage)] & not
27 <- changeLandUse(1, plantation);
28 nextPosition(1, 0).
  
```

38 24-31 10% (AgentSpeak.name.Cpl.252) - - - W



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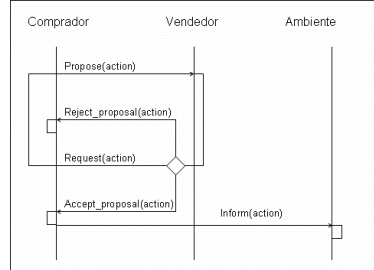
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Vip-JogoMan Prototype⁽⁵⁾

- We have used FIPA ACL



```

sequenceDiagram
    participant Comprador
    participant Vendedor
    participant Ambiente
    Comprador->>Vendedor: Propose(action)
    Vendedor->>Comprador: Reject_proposal(action)
    Comprador->>Vendedor: Request(action)
    Vendedor->>Comprador: Accept_proposal(action)
    Vendedor->>Ambiente: Inform(action)
  
```



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Designing the Game

Differences between ...

- participative simulation (project ends)
- participative design (software engineering)

Participative design of participative simulation!

- different research cultures
- different description levels

Negotiat experience

- modeling sessions
- UML as modeling language



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Designing Virtual Players

- Run JogoMan sessions
- Try to identify possible roles profiles from the "negotiation log"
- Develop virtual agents strategies based on the role profiles
- Run ViP-JogoMan with virtual players incorporated



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How to evaluate such an approach?

Ideally:

- Stakeholders participate in the game
- Stakeholders participate in real negotiations
- Results "better" than it was in the past ...

Timing involved is not feasible for current development and research metrics

Which are the metrics?



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Vip-JogoMan Evaluation

- JogoMan
 - Pre-questionnaires
 - Pos-questionnaires
 - Non-computational monitoring and analysis
- ViP-JogoMan
 - Pre-questionnaires
 - Pos-questionnaires (including virtual agents)
 - Analyses of the MABS variables (profiles)
 - Automated monitoring and analysis
 - logs of message exchanges
 - concluded and inconcluded negotiations

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Conclusions

- From a computer support perspective, we need several integrated technologies:
 - MABS tools (ex: CORMAS)
 - Negotiation protocols and tools (ex: FIPA)
 - Human Computer Interfaces (ex: Applets)
 - Agent languages (ex: Jason)
 - Communication middleware (ex: SOAP)
- From both a computer support and social perspective, we need to define:
 - Metrics to evaluate negotiation learning
 - More detailed analytical tools

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