

Overview of MOISE⁺ framework

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Rich Cognitive Models for
Policy Design and Simulation

Outline

1 Context

- Organisation
- Norms

2 MOISE⁺

- Language
- Reorganisation

3 Infrastructure

- A&A
- ORA4MAS
- Agents

4 Summary

Reasons for organisation in MAS

'normative view'

- Multi-agent systems have two properties which seem contradictory:
 - a **global** purpose × **autonomous** agents

While the autonomy of the agents is essential for MASs, it may cause loss in the global coherence of the system
- The **organisation** of a MAS is used to solve this problem **constraining** the agents' behaviour towards global purposes
- For example, when an agent adopts a role, it adopts a set of behavioural constraints that support a global purpose

Constraining the agents' autonomy by **Norms** mechanisms

- **Regimented** norms: the organisation prevents their violation by the agents
 - e.g. messages that do not follow the protocol are discarded
- **Enforced** norms: agents decide to obey or not to them, the organisation lets the agents the possibility to violate them
 - e.g. a master thesis should be written in two years
 - ~~> Detection of violations, decision about sanctions

Reasons for organisation in MAS

'constitutive view'

- The organisation **helps** the agents to cooperate by defining **common**
 - global tasks
 - protocols
- For example, 'to bid' for a product on eBay is an **institutional action** only possible because the eBay defines the rules for that very action
 - the bid protocol is a constraint but it also **creates** the action.

MOISE⁺ framework – general view

- Organisation Modelling Language (OML)
 - ~~ allows the designer to specify the organisation of a MAS along three dimensions (structural, functional, deontic)
- Organisational Infrastructure
 - ~~ interprets the OML and then **constraints/supports** the agents in the specified organisation
 - by means of regimentation, enforcement, tools for cooperative tasks, ...
 - allows agents to interact with the organisation (agent programming issues)
- Conceived for reorganisation

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- Organisation
- Norms

2 MOISE⁺

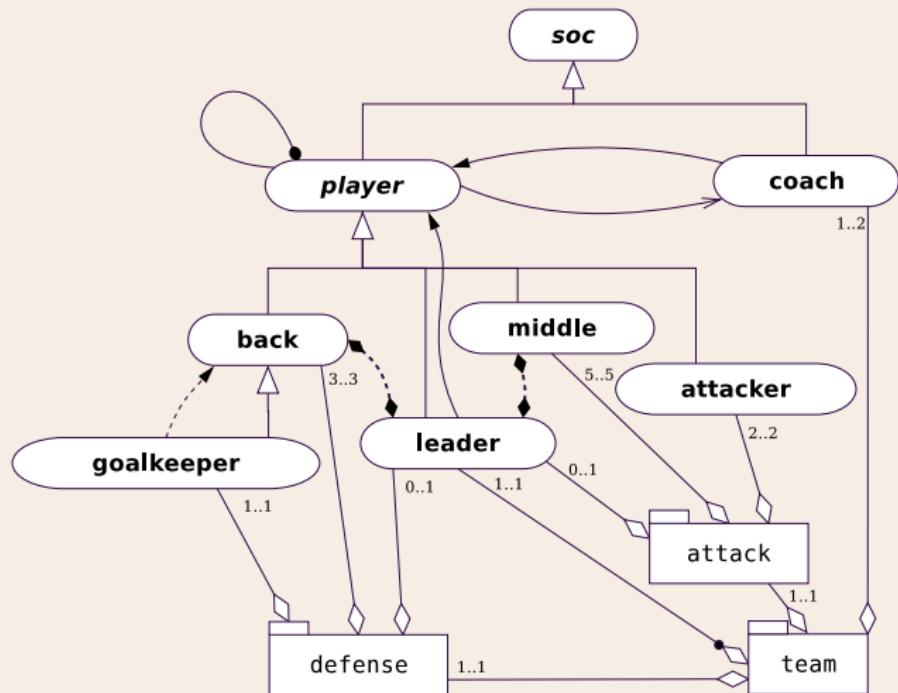
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OML — example of organisational structure



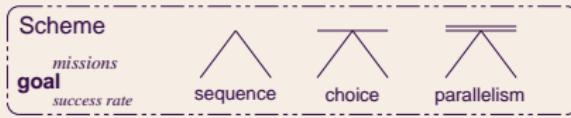
Organizational Entity

Dida	goalkeeper
Lucio	back
Juan	
Cafu	leader
Kaka	
Emerson	middle
Ze Roberto	
Ronaldinho	
Roberto Carlos	
Ronaldo	attacker
Adriano	

OML — example of organisational functioning



Key



Organizational Entity

Lucio	-----	m1
Cafu	-----	m2
Rivaldo	-----	m3

OML — example of organisational **obligations**

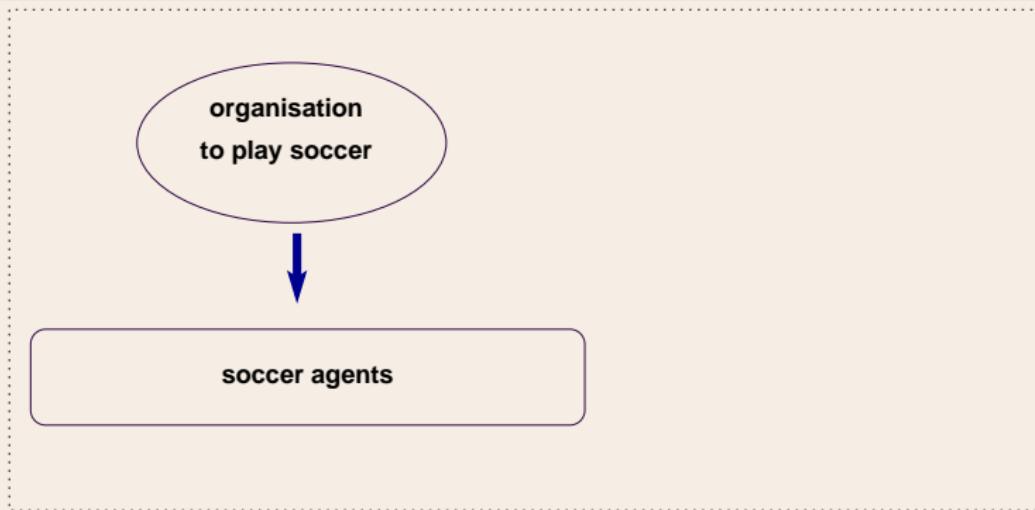
role	deontic	mission	
<i>back</i>	<i>obliged</i>	<i>m1</i>	get the ball, go ...
<i>left</i>	<i>obliged</i>	<i>m2</i>	be placed at ..., kick ...
<i>right</i>	<i>obliged</i>	<i>m2</i>	
<i>attacker</i>	<i>obliged</i>	<i>m3</i>	kick to the goal, ...

- This dimension links the other two, making them independent
∴ simplifies the reorganisation

Reorganisation — what to change?

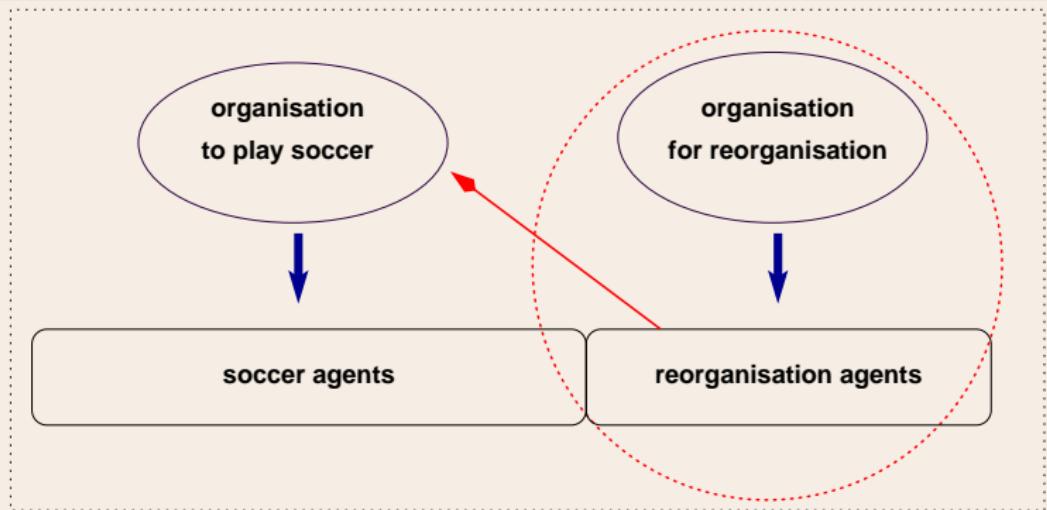
- Organisational Entity
 - who plays which role
 - how many groups are created
 - ...
- Organisational Specification
 - which roles are defined
 - which role can be enacted in a group
 - which role has authority on other
 - ...
 - which goal should be fulfilled
 - ...

Our approach to reorganise



- i) Create a special group of agents specialised in reorganisation
- ii) This new group is also organised
- iii) Since the soccer agents follow the organisation, the **new** organisation is easily deployed

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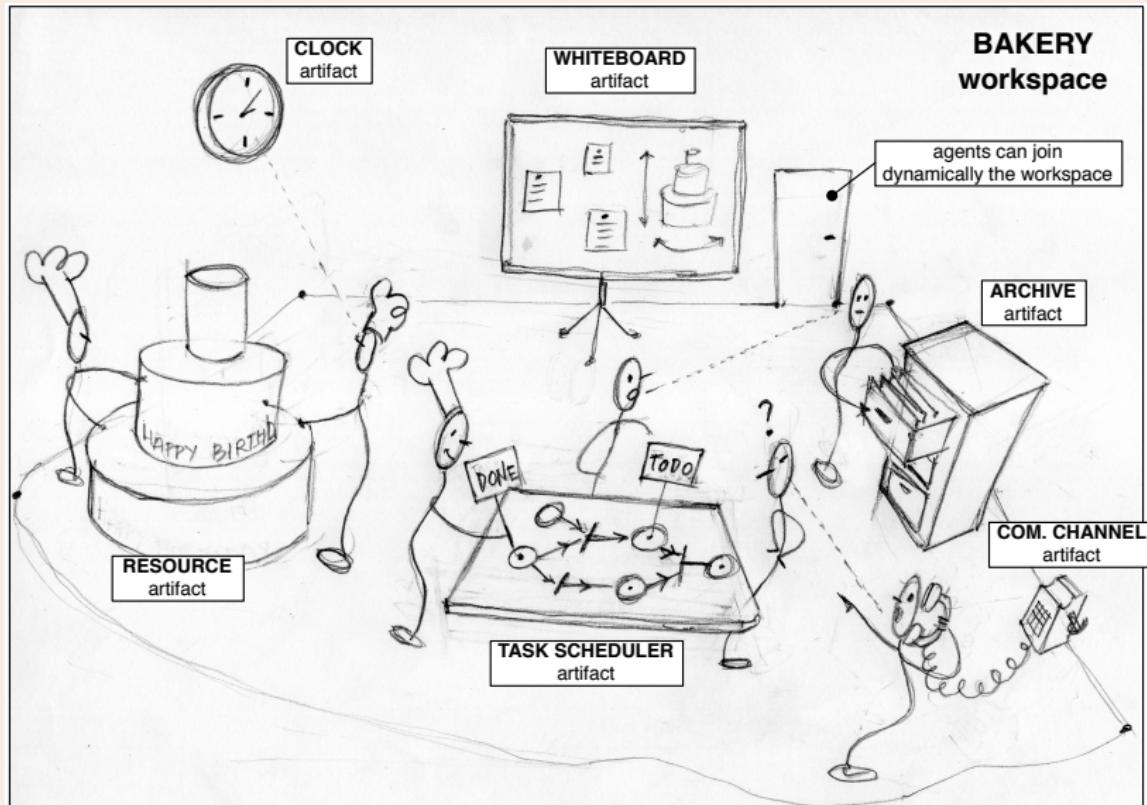
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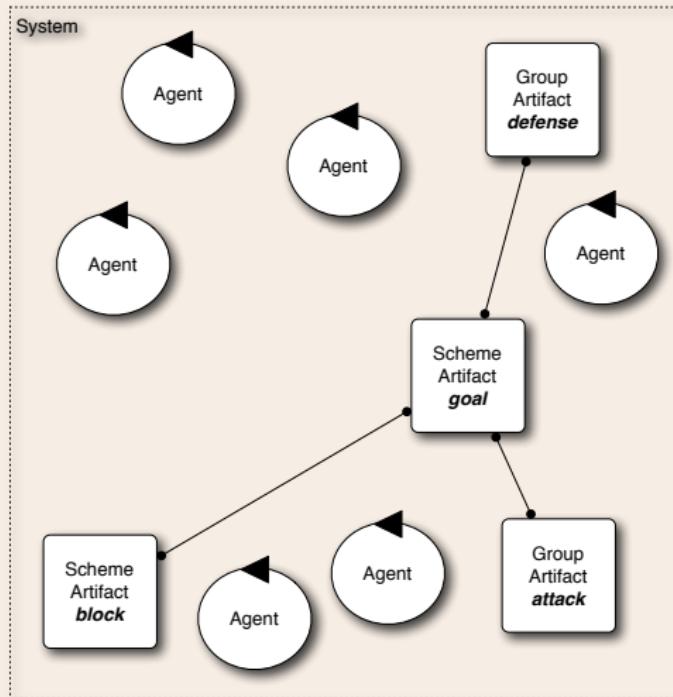
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A&A Model

Artifacts, Agents, Workspaces [Ricci *et al.* 07]

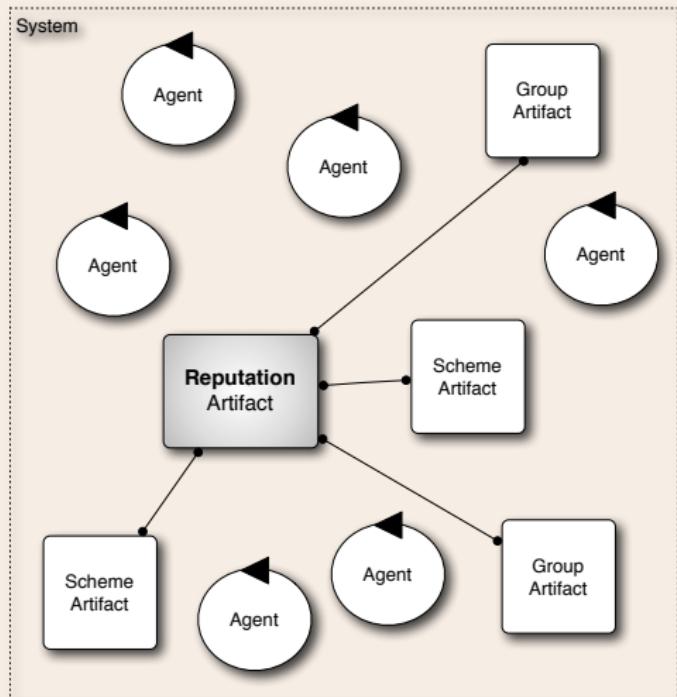


Organisational artifacts in ORA4MAS



- based on A&A and MOISE⁺
- agents create and handle organisational artifacts
- artifacts in charge of **regimentations**, detection and evaluation of norms compliance
- agents are in charge of decisions about sanctions

Reputation Artifact in ORA4MAS



- Instrument to help in the **enforcement** of norms
- Indirect sanction system
- Considers the public character of the reputation process
- Publish an evaluation of the agents from the organisation point of view

Agent Programming

- Artifacts provide perception and actions to the agents
- They can be used in the following languages
 - **Jason** (BDI programming)
 - Jadex (BDI programming)
 - Java (OO programming)
 - (others on development)

~~~ Agents can perceive and act on organisational artifacts

- We still do not have models of how the agents reason about the organisation and its artifacts

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# Summary — MOISE<sup>+</sup> & ORA4MAS

- Ensures that the agents follow some of the constraints specified for the organisation
- The organisation is **interpreted at runtime**, it is not hardwired in the agents code
- The agents 'handle' the organisation (i.e. their artifacts)
- It has a synchronisation mechanism for coordination of scheme execution
- It is suitable for open systems as no specific agent architecture is required
- More information and an implementation are available at <http://moise.sourceforge.net>

# Discussion

- It is possible to simulate the same system under different organisations
  - we only need to change the specification of the system
- There is an explicit description of the institutionalised organisation available to the agents
  - Agent can thus
    - read it (done)
    - reason about (not done)
    - act on it (done)

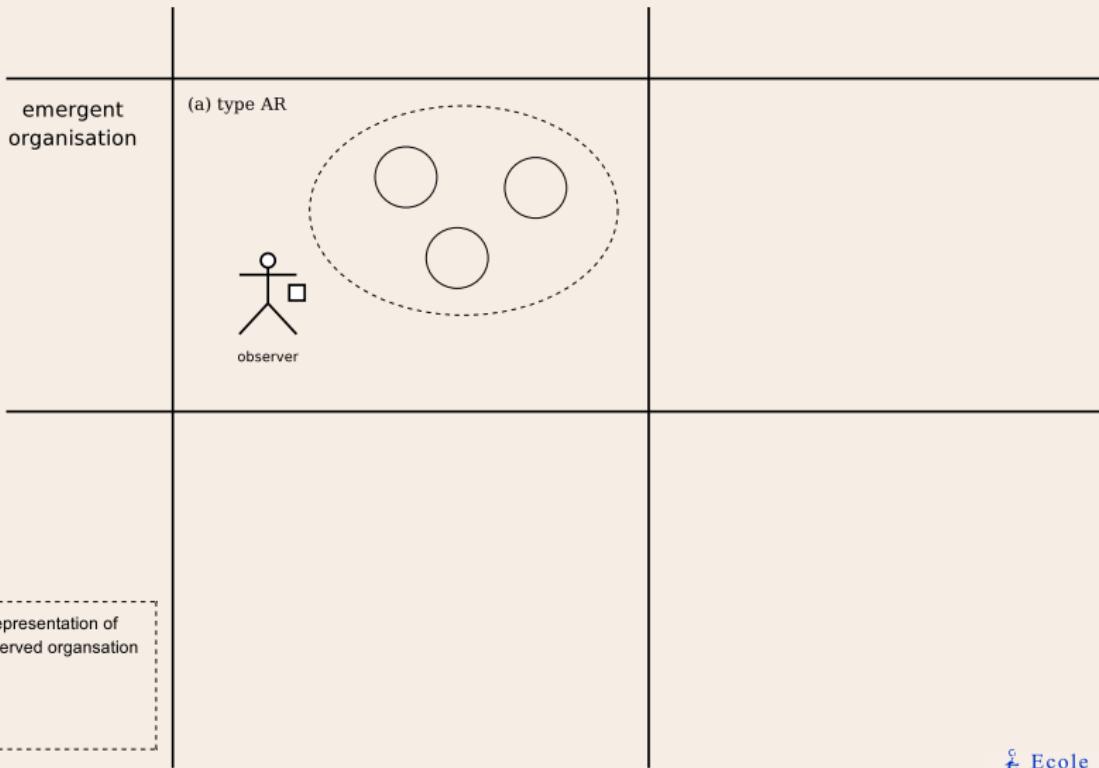
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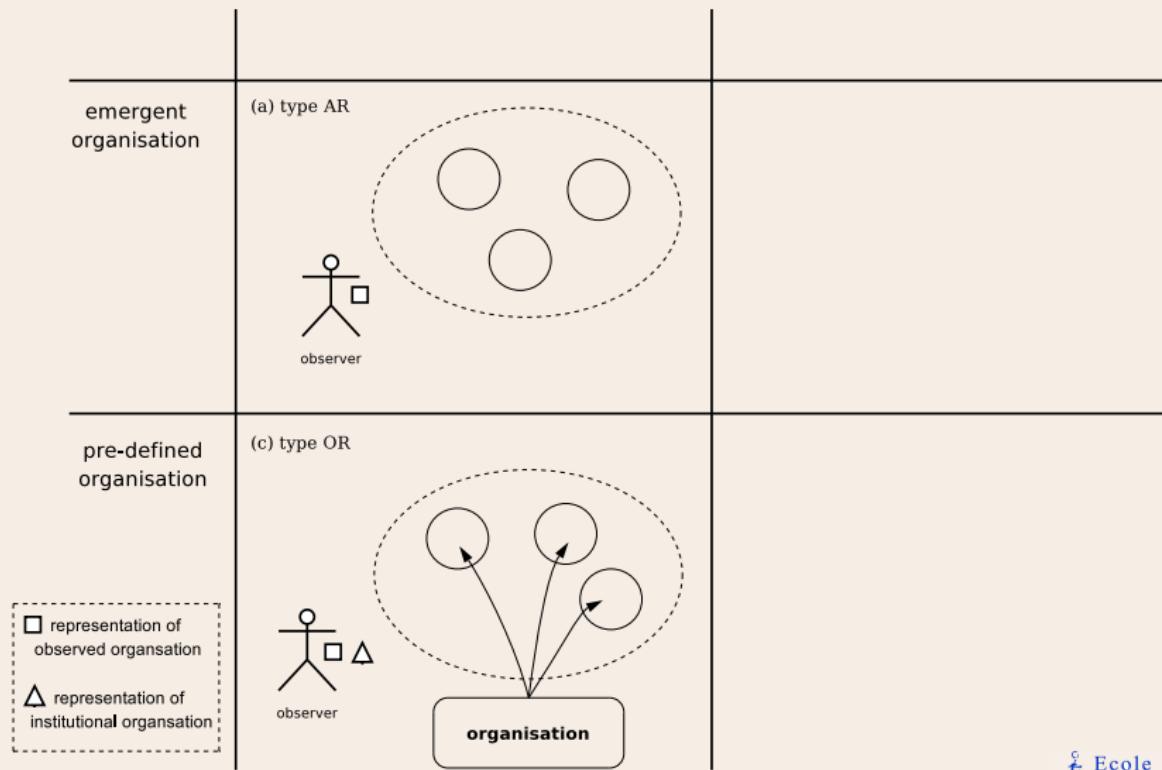
# More information

- <http://moise.sf.net>
- <http://jason.sf.net>
- J. F. Hübner, J. S. Sichman, and O. Boissier. Developing organised multi-agent systems using the MOISE<sup>+</sup> model: Programming issues at the system and agent levels. *Int. J.Agent-Oriented Software Engineering*, 1(3/4):370–395, 2007.

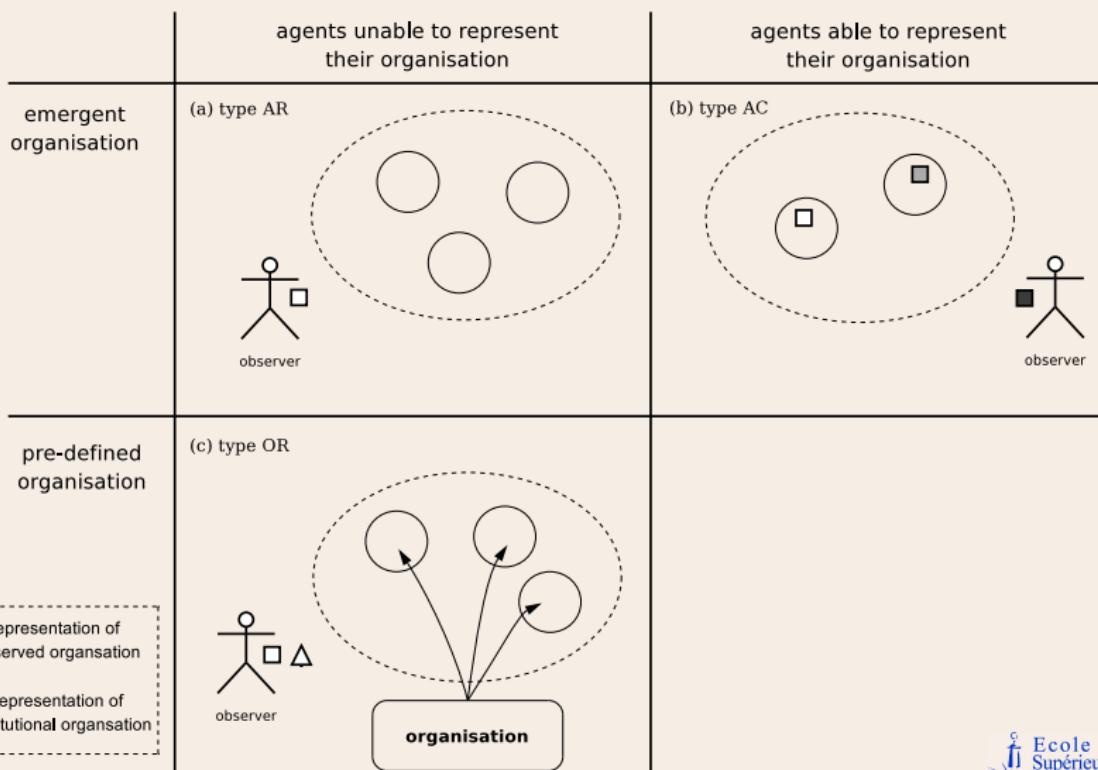
# Points of view on organisation



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