

# How to learn from autonomisation and automation?

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# The concepts

(Lemétayer, Lanfranchi, 2006, Xiaobo, Ohno, 2000; Black, 2002)

Concept	Application	Definition	Principle	Supports
Autonomisation	Social system	“to autonomize”: To become autonomous	To transform dependent systems into independent ones	Learning process Human-machine co-agency Human automation
Autonomation (“Jidoka”)	Production system	“to autonomate”: To increase autonomy	To take advantages of human and technological knowledge to increase system autonomy	Cooperation Training program

## Characteristics for autonomy

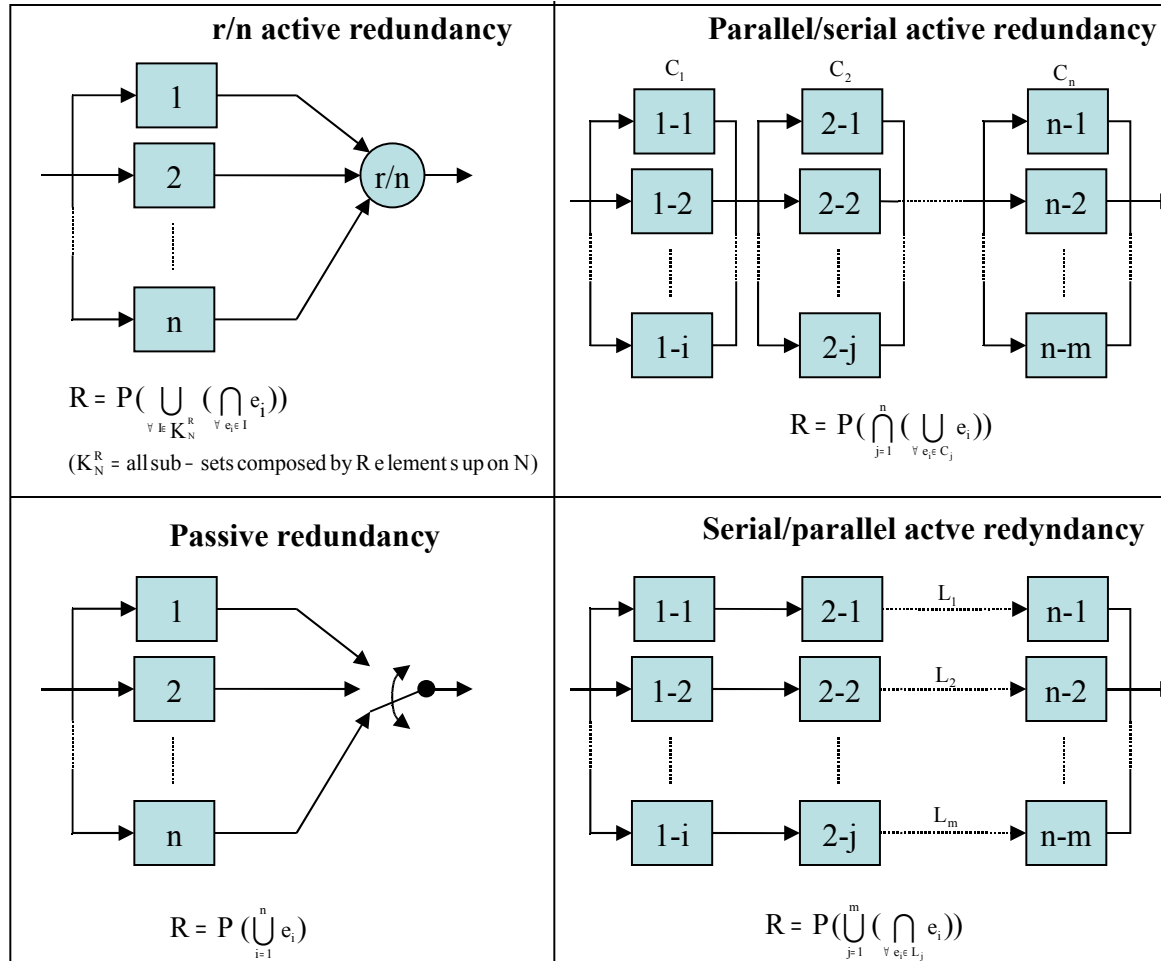
(Demazeau, 1995; Carabelea and Boissier, 2006; Zieba et al., 2009):

- Several available behaviours and capacity to choose one of them.
- Dynamic evolution in a given environment
- Not controlled by this environment
- Interaction management with other agents
- Capacity to accept or refuse a goal proposed by another agent.
- Capacity to select alternatives (e.g., violation of rules).
- Capacity to choose an action without interacting with other agents.
- Capacities to learn from known and unknown situations.
- ...

## Requirement:

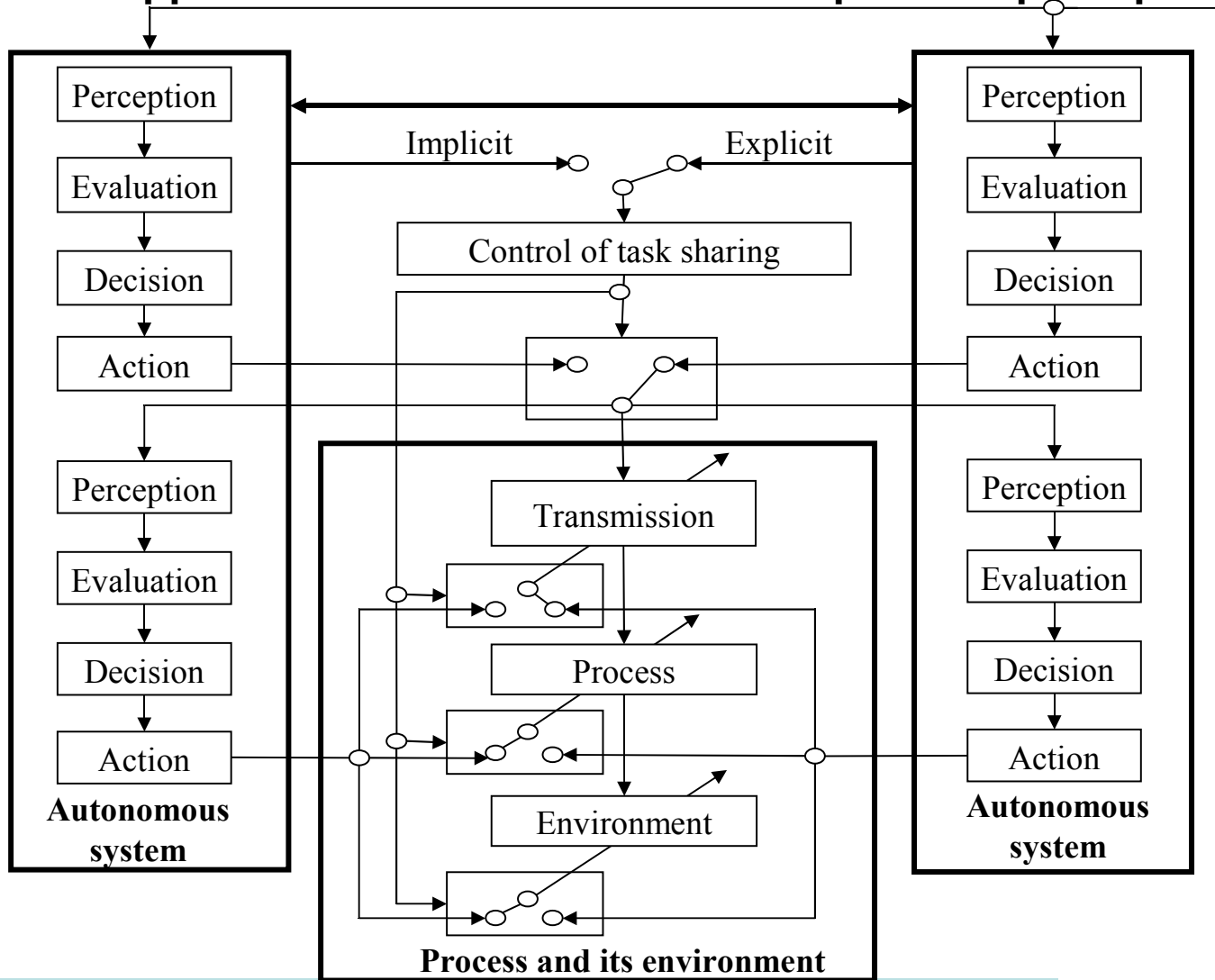
- Knowledge management and use
- Physical capacities
- Availability
- Authorization / Prohibition for the achievement of some actions

## Application of redundancy principles



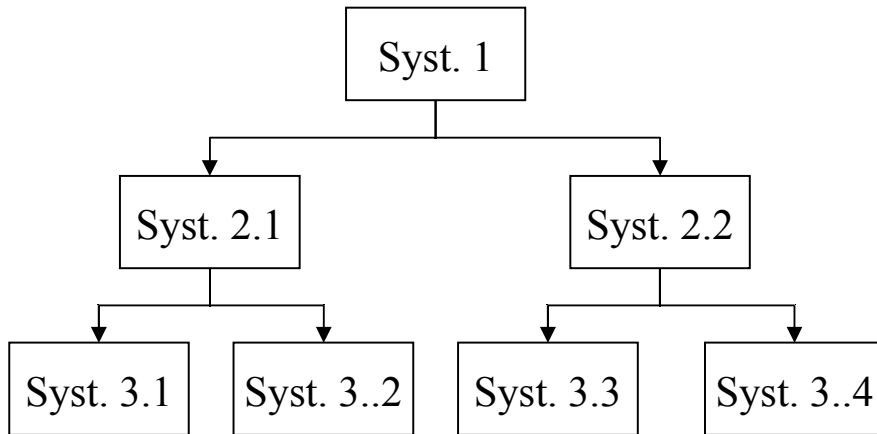
# Autonomisation

## Application of human-machine cooperation principles

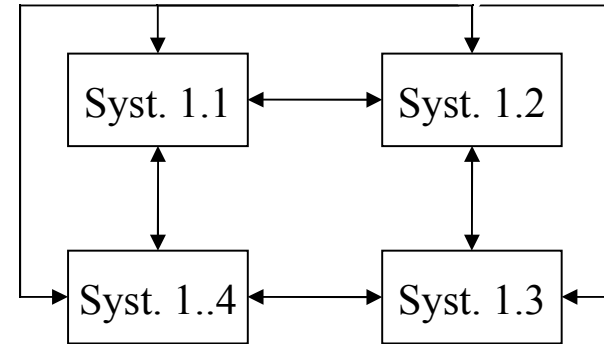


## Application of socio-technical organisation principles (concept of system of systems)

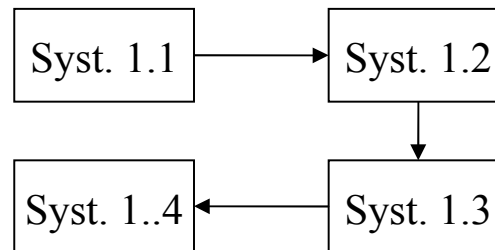
Hierarchical organisation



Interactive organisation



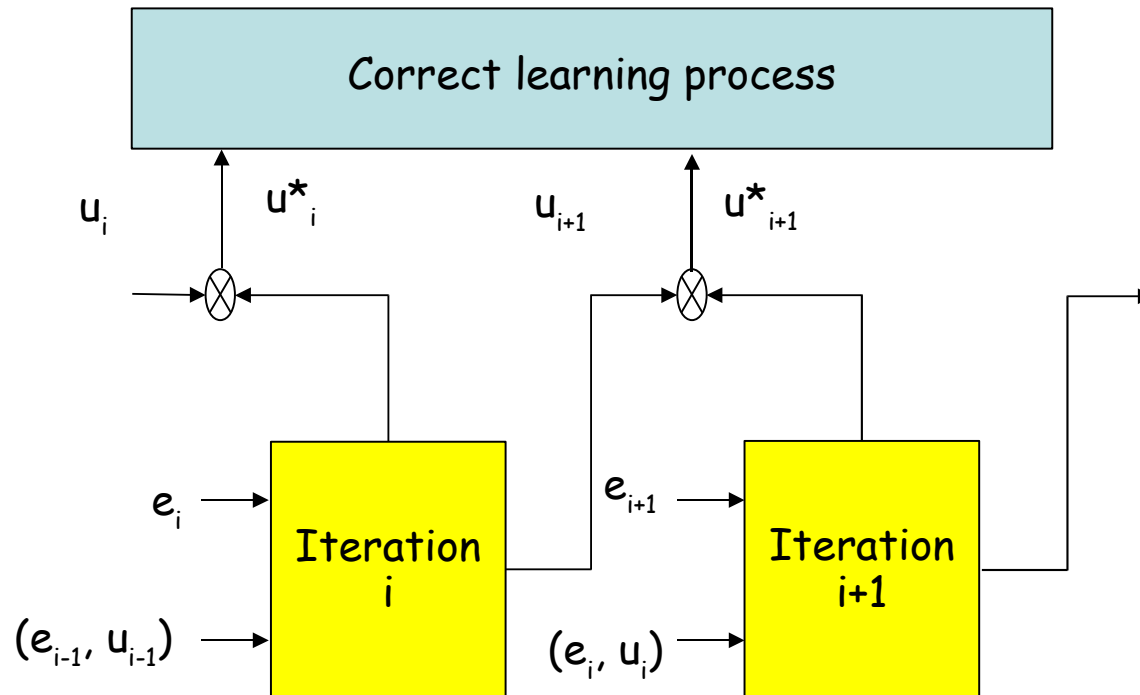
Serial organisation



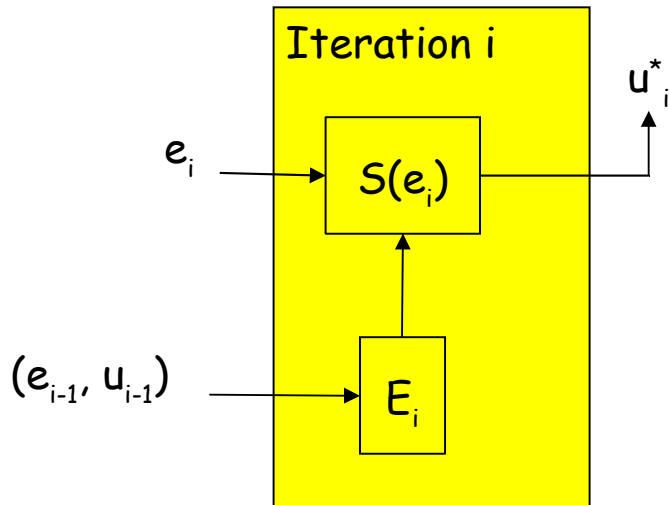
# Autonomisation

Objective of Autonomy Sharing (AS)	Prevention/Correction/Recovery
Object of AS	Function/Task/Action
Requirements of AS	Data/Resource/Knowledge/Goal
Transformation of AS	Interruptible/Uninterruptible - Recoverable/Unrecoverable Unique/Multiple - Local/Common Sequential/Simultaneous
Allocator control of AS	Passive/Active Urgent/Opportunist/Tactical/Strategic Manuel/Automated - Static/Dynamic
Dynamic control of AS	Explicit/Implicit Preemptive/Definitive
Integration of Communication System	Observable/Unobservable - Verbal/Non verbal Unmediated/Mediated - Inferred/Non inferred Formal/Informal - Acknowledged/Unacknowledged
Organisation of CS	Sequential/Simultaneous/Delayed/Requested Distant/Proximate Augmentative/Integrative/Debatative - Total/Partial

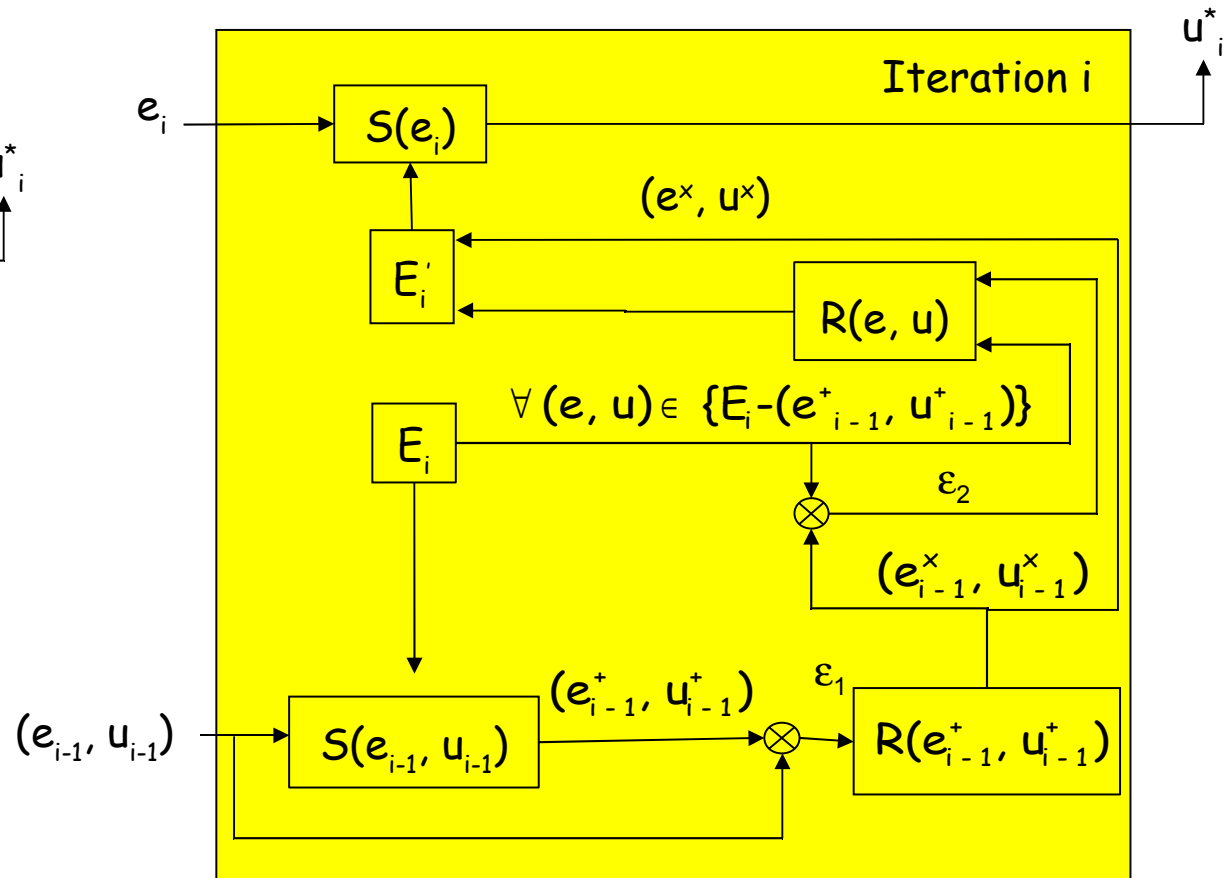
## Pedagogical learning for autonomy management:



## Autonomy management: Case based reasoning principle



## Autonomy management: Artificial neural network principle



# An example of automation

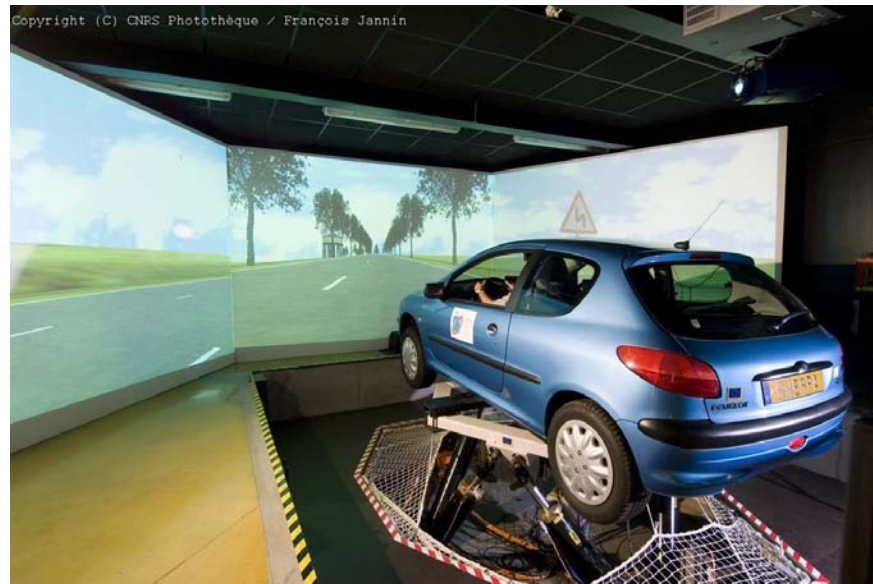
## Application to car driving

### Context

*40 subjects – 0,5 hour per each subject*

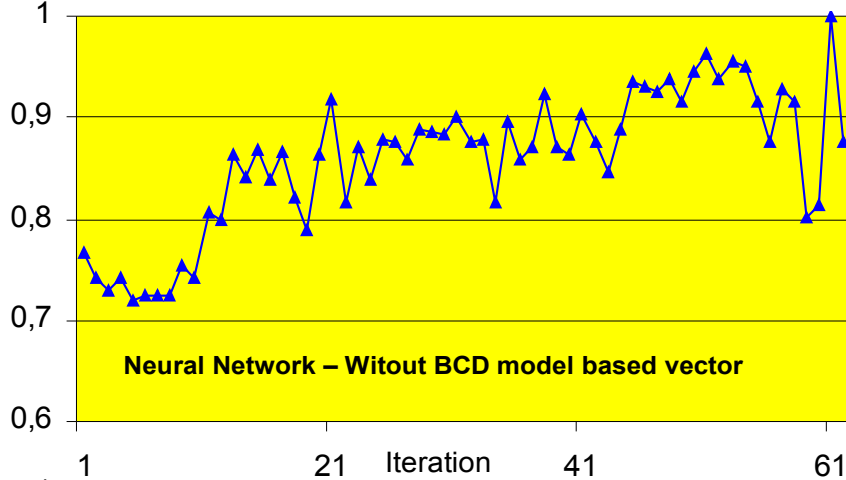
*Application for right priority violations (50 km/h – 90 km/h)*

*Application with / without the BCD model parameters*

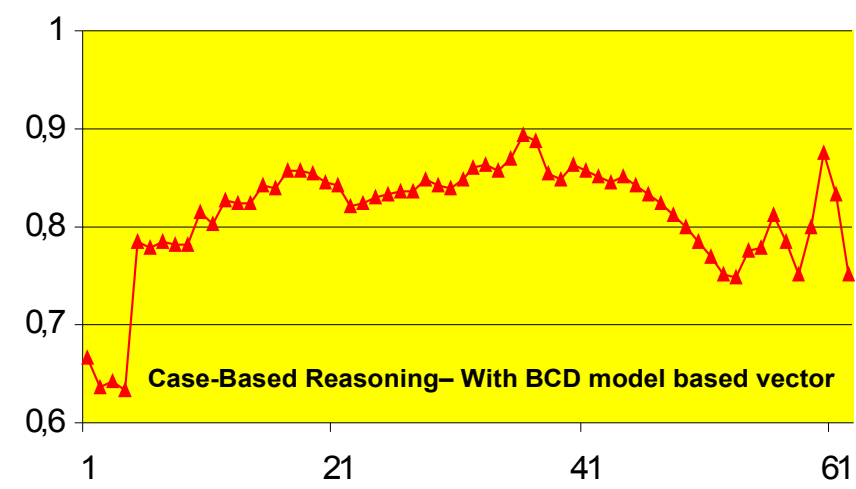
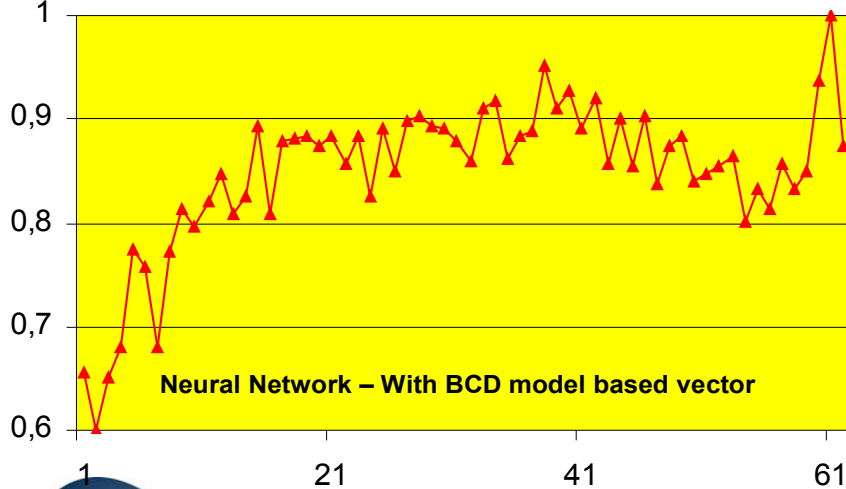
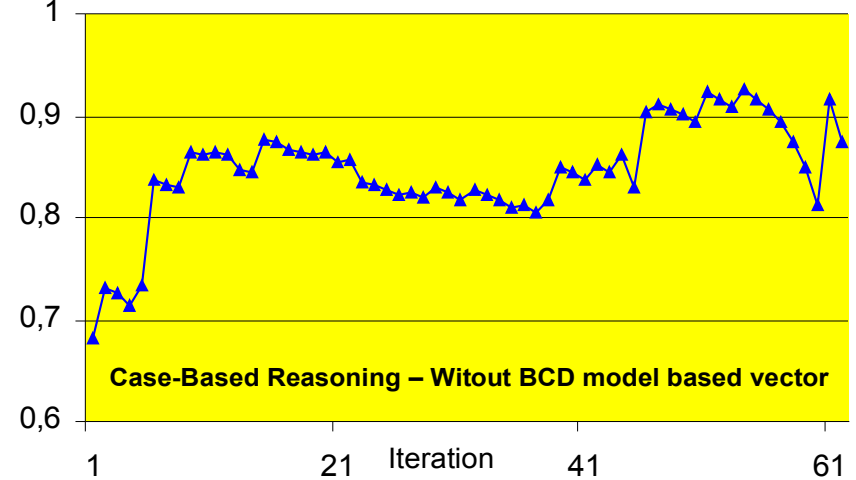


# An example of automation

Correct prediction rate



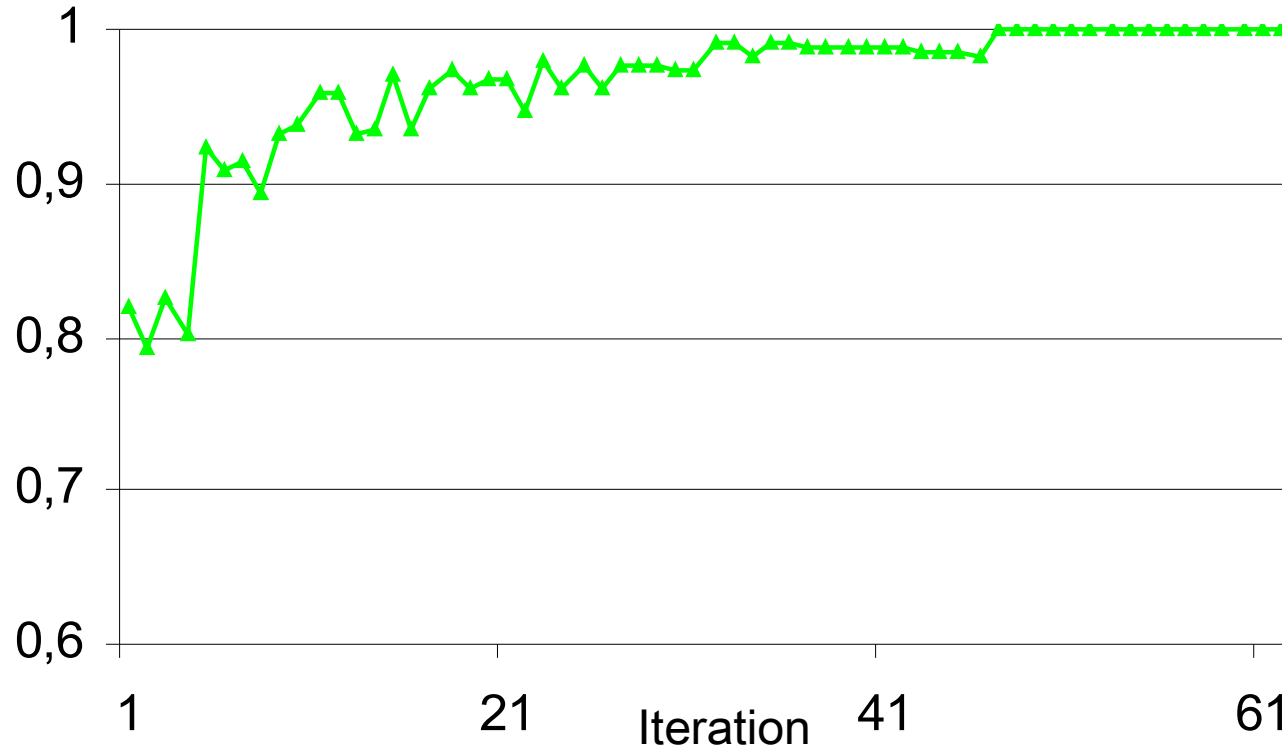
Correct prediction rate



# An example of autonomisation

**Autonomy of a system obtained by other autonomous systems?**

Correct rate prediction



Combining autonomy of systems: application of the 3 / 4 redundancy principle

## Conclusion / Perspectives

Autonomy management concepts: autonomisation & autonomation  
Autonomy management support: redundancy, cooperation  
Autonomy management system; case based reasoning, neural network

Development of learning for autonomy management:

- Trial and error
- Observation
- Imitation
- Reinforcement
- Iterative
- Cumulative
- Etc.

Autonomy management: knowledge, availability, authorisation

Manage and create knowledge for autonomy control