

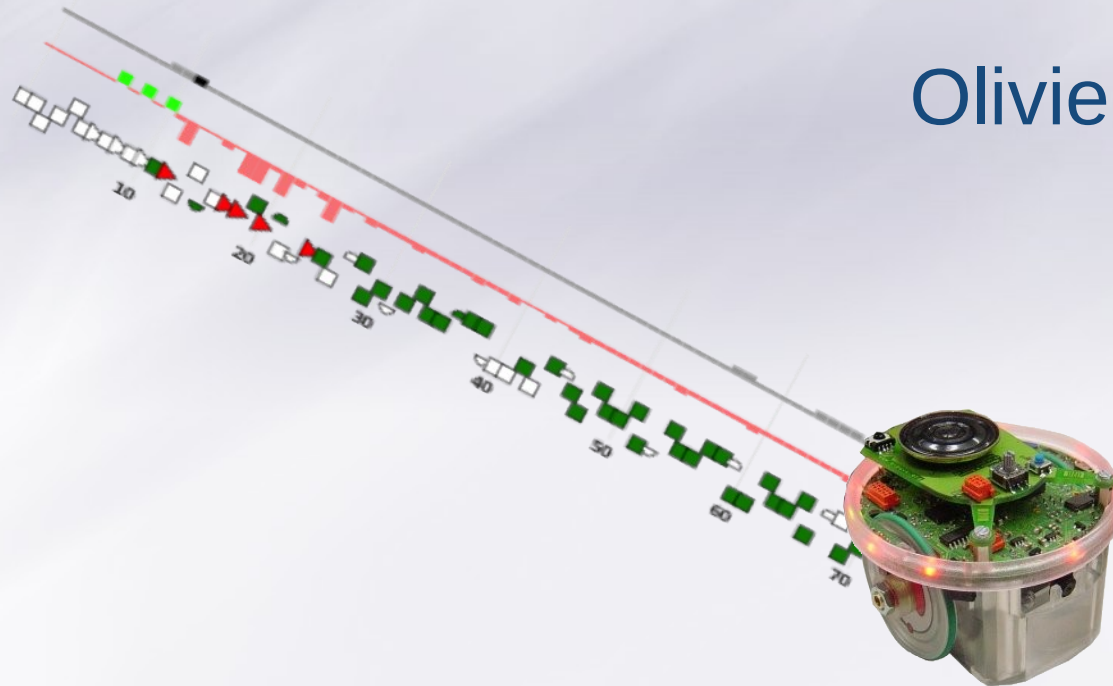
Une approche interactionniste pour des robots adaptatifs auto-motivés

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Alain Mille

Christian Wolf

LIRIS



Outline

 Challenge

 Theoretical approach

 Demonstrations

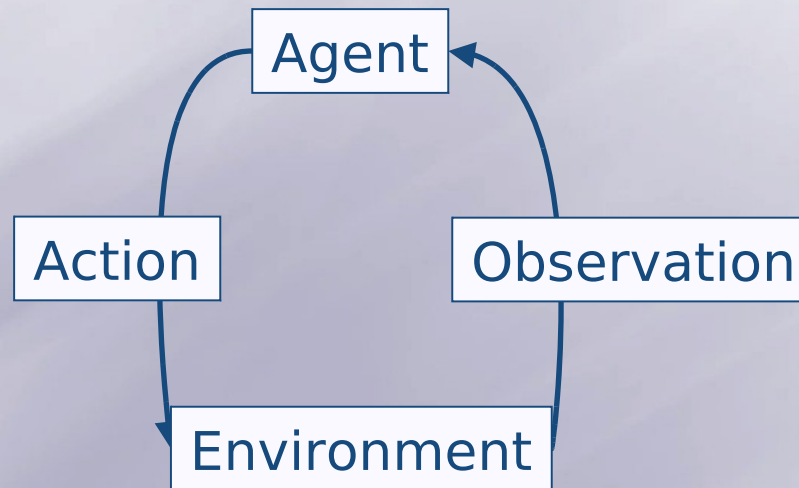
Challenge



- Generate "smart " behavior.
 - Unsolved challenge.
 - ill-defined challenge.
-
- It is not about problem-solving !

Issues with the “cognitive-loop” paradigm

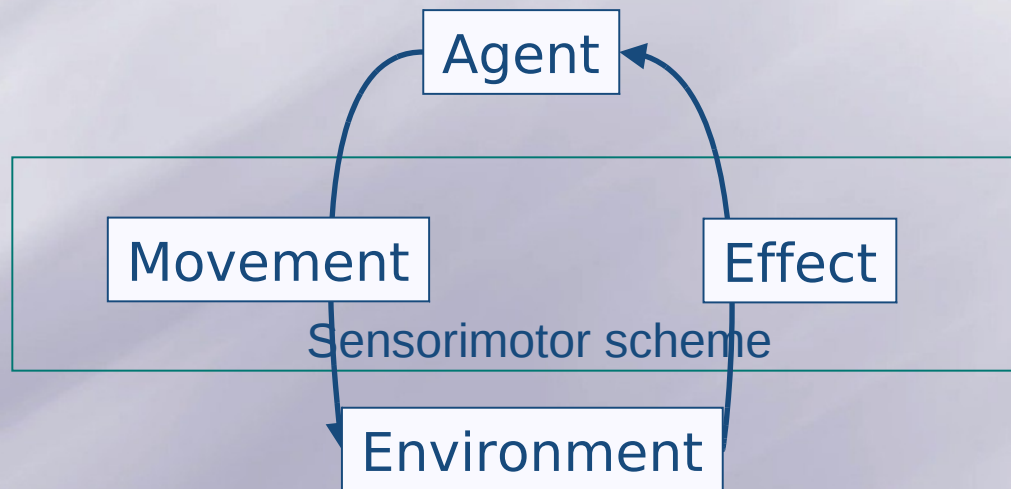
- ≡ Problem of using subjective concepts
- ≡ Problem of separating perception and action



The “cognitive sandwich” Hurley, S. (1998). Consciousness in action.

Issues with the “cognitive-loop” paradigm

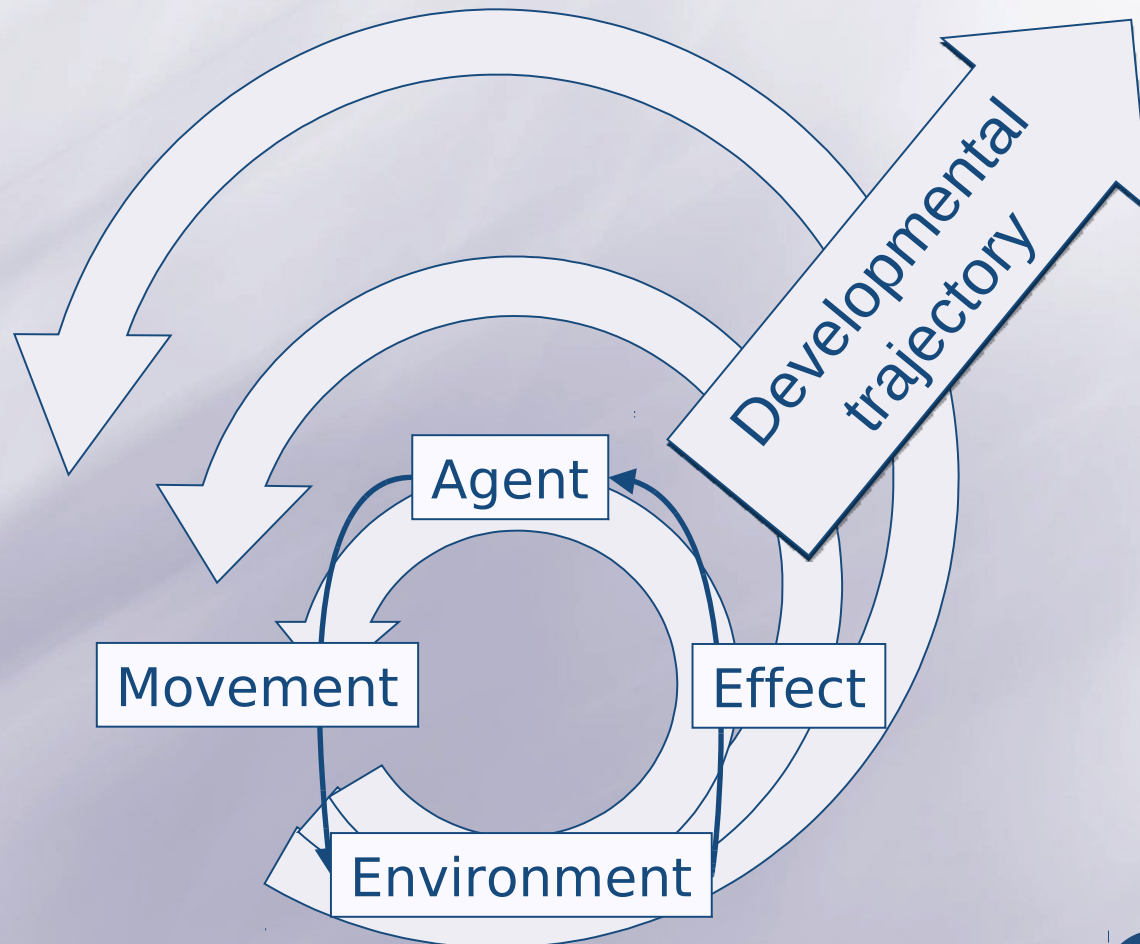
- Consider “perception” as a cognitive construct rather than an input.



Piaget (1937) La construction du réel chez l'enfant.

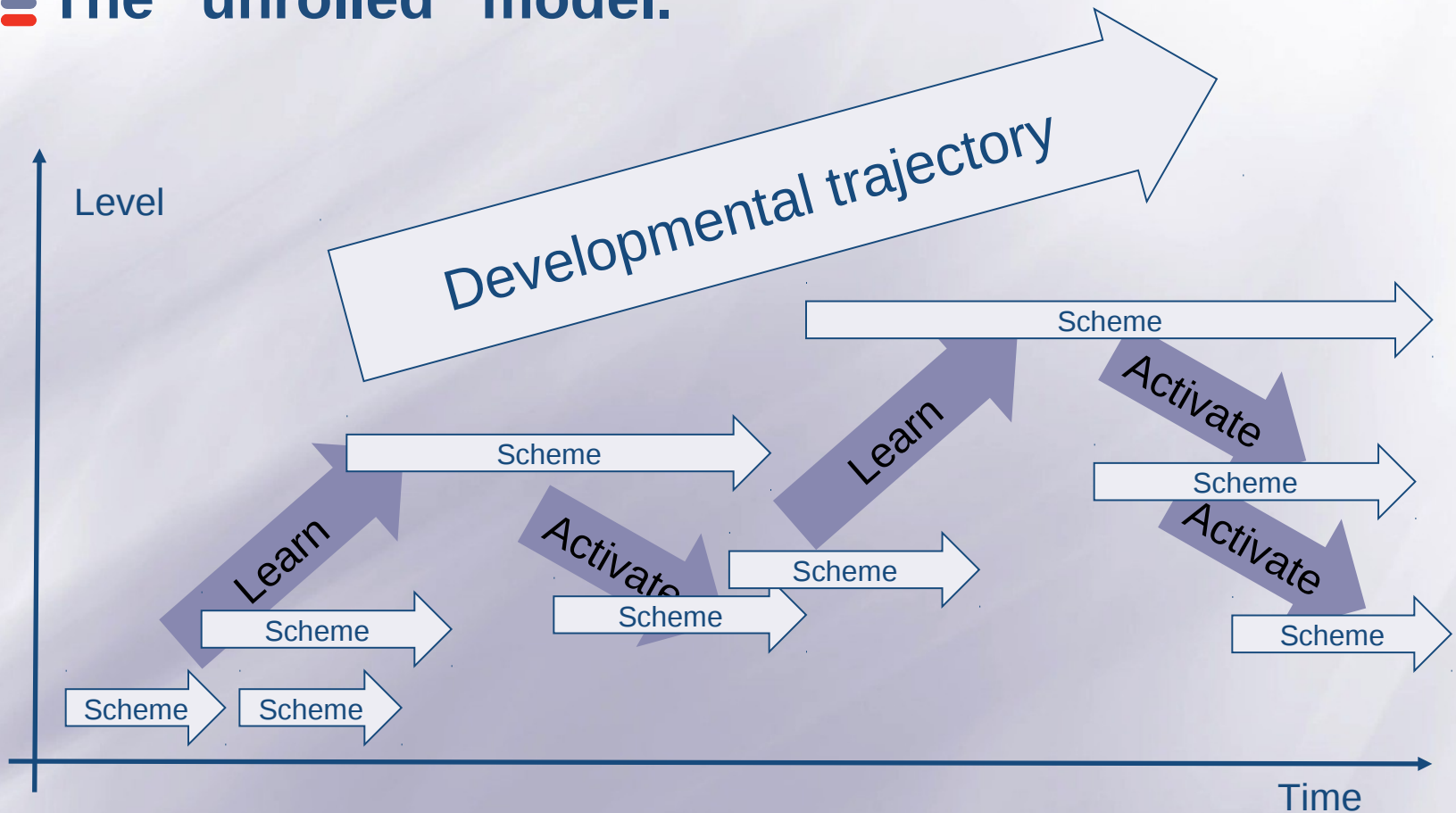
Issues with the “cognitive-loop” paradigm

☰ Problem of levels of time scales.



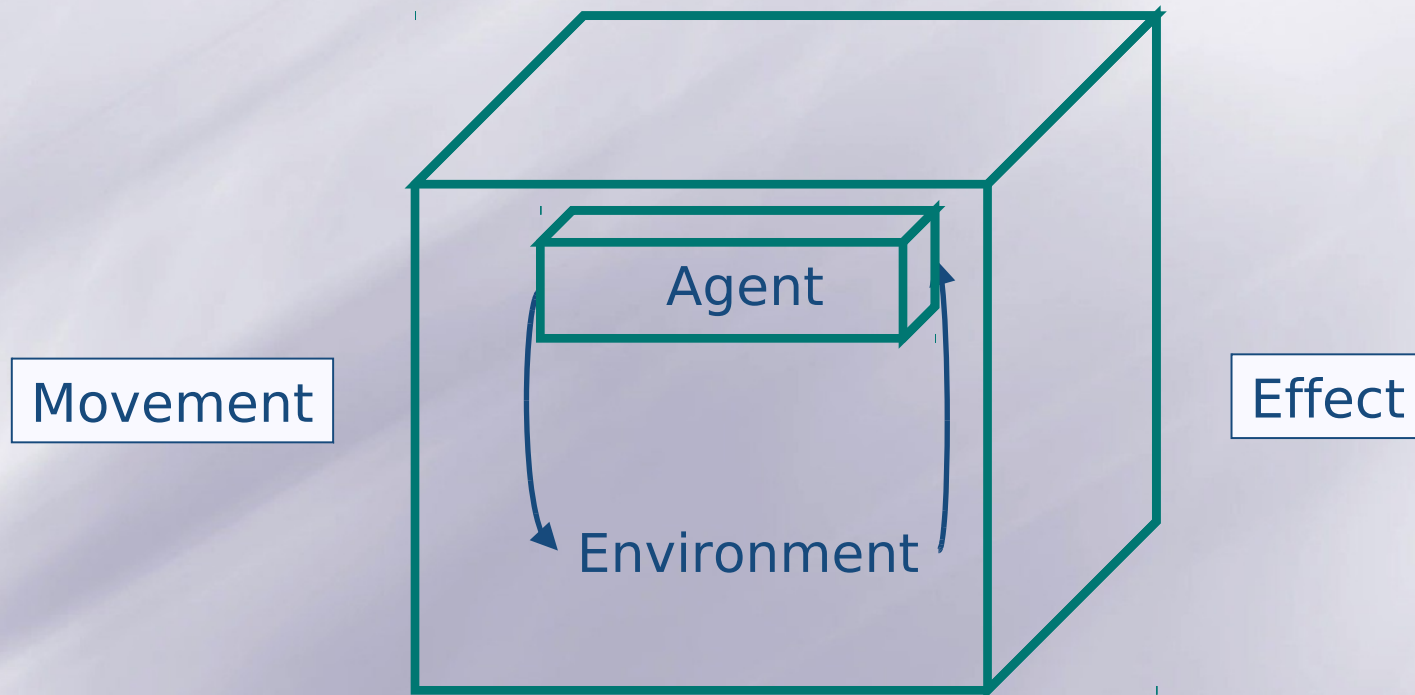
Issues with the “cognitive-loop” paradigm

☰ The “unrolled” model.



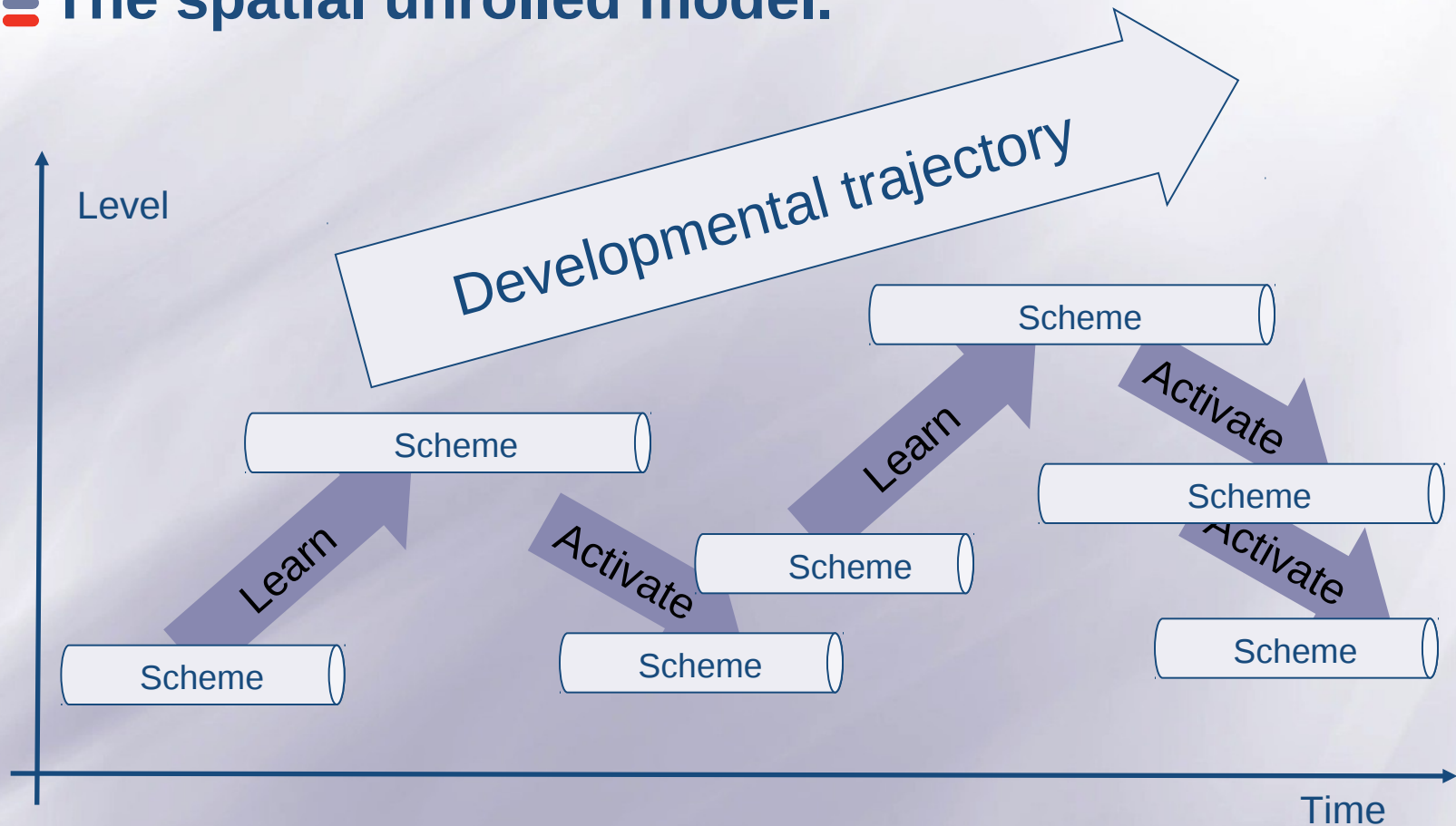
Issues with the “cognitive-loop” paradigm

- ☰ The problem of “space”.
It is not only about time and sequences!

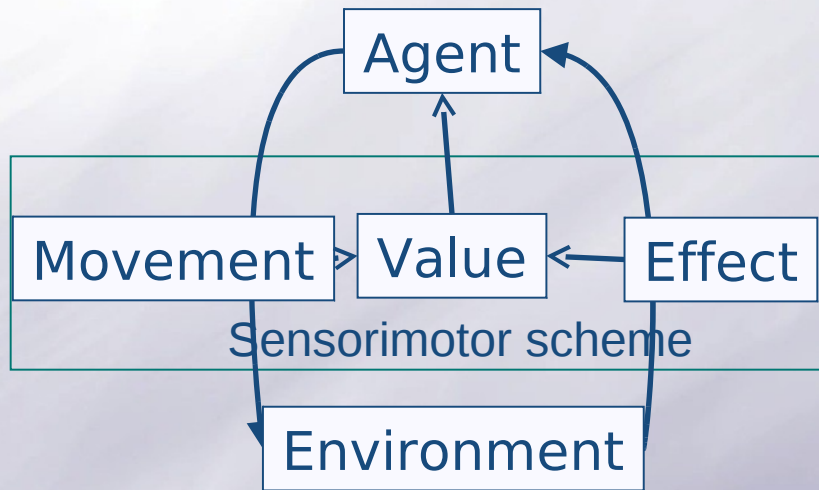


Issues with the “cognitive-loop” paradigm

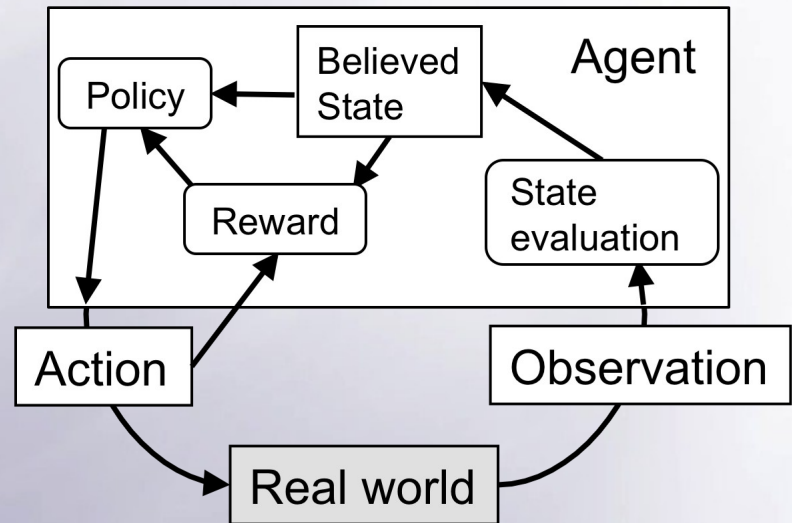
☰ The spatial unrolled model.



Interactional motivation



Interactional Motivation



Partially Observable Markov Decision Process (POMDP)

Interactional Motivation in Artificial Systems: Between Extrinsic and Intrinsic Motivation.
Georgeon, Marshall, Gay. Submitted to EpiRob 2012.

Exemple

ticks: 0 3D

Run

step 5

bump -10

turn -3

touch-empty -1

touch-wall -2

time-interval 0.00

Interaction - Value:

Step

Re-initialise

Reset Values

Origin 1 1 Origin 1 2 Origin 1 3 Origin 1 4 Origin 2 4 Origin 3 4 Origin 3 3 Rotate

Set of schemes:

-Step or bump 5 / -10

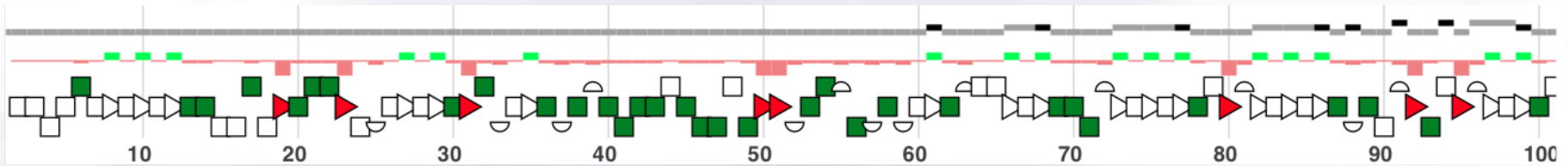
-Turn left / turn right -3

-Touch front / left / right -1

Bump: 

Touch: 

Trace



Touch

Touch wall

Left

Touch empty

Front

Right

Try move forward

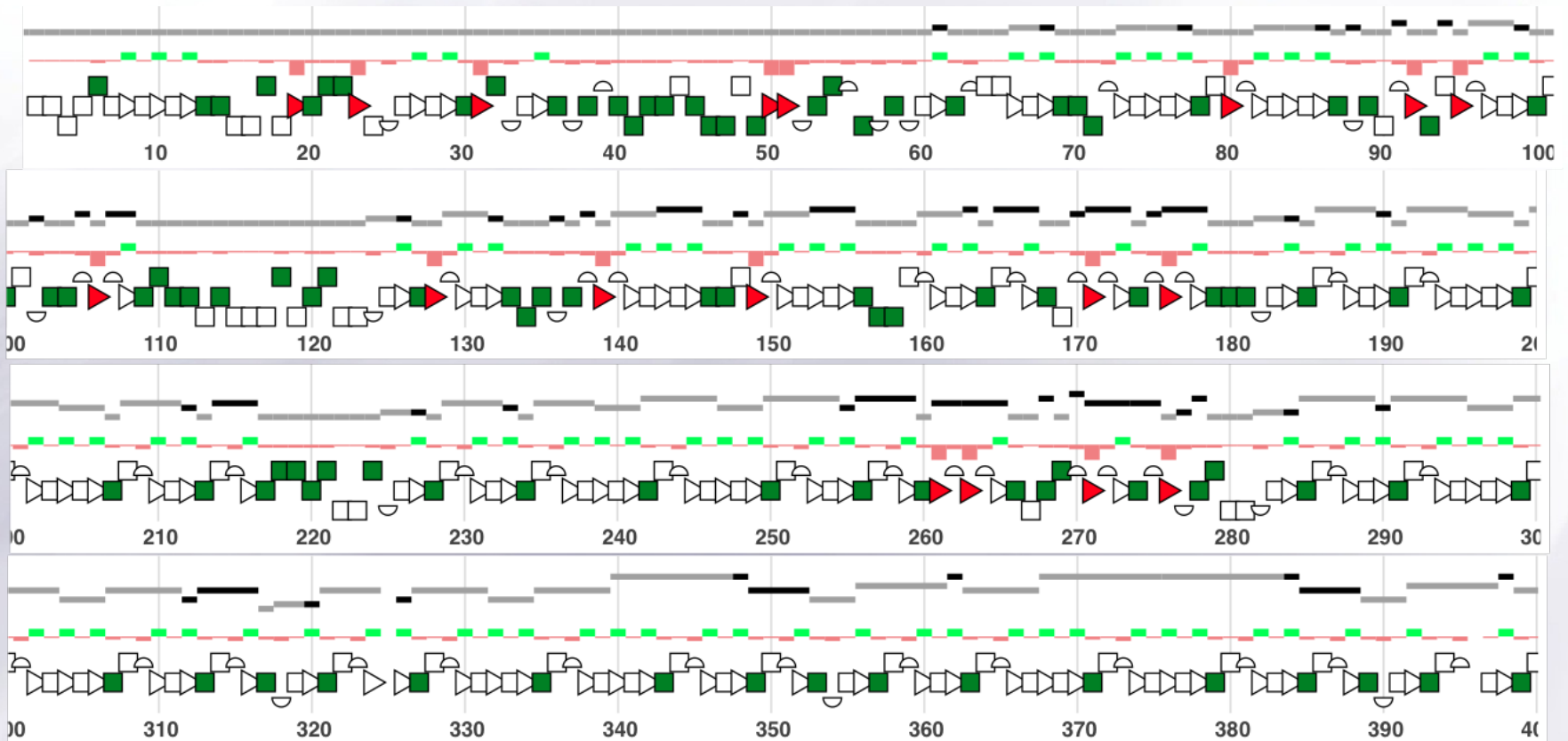
Move forward

Bump

Turn left

Turn right

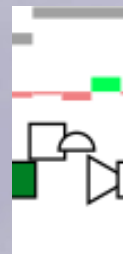
Trace



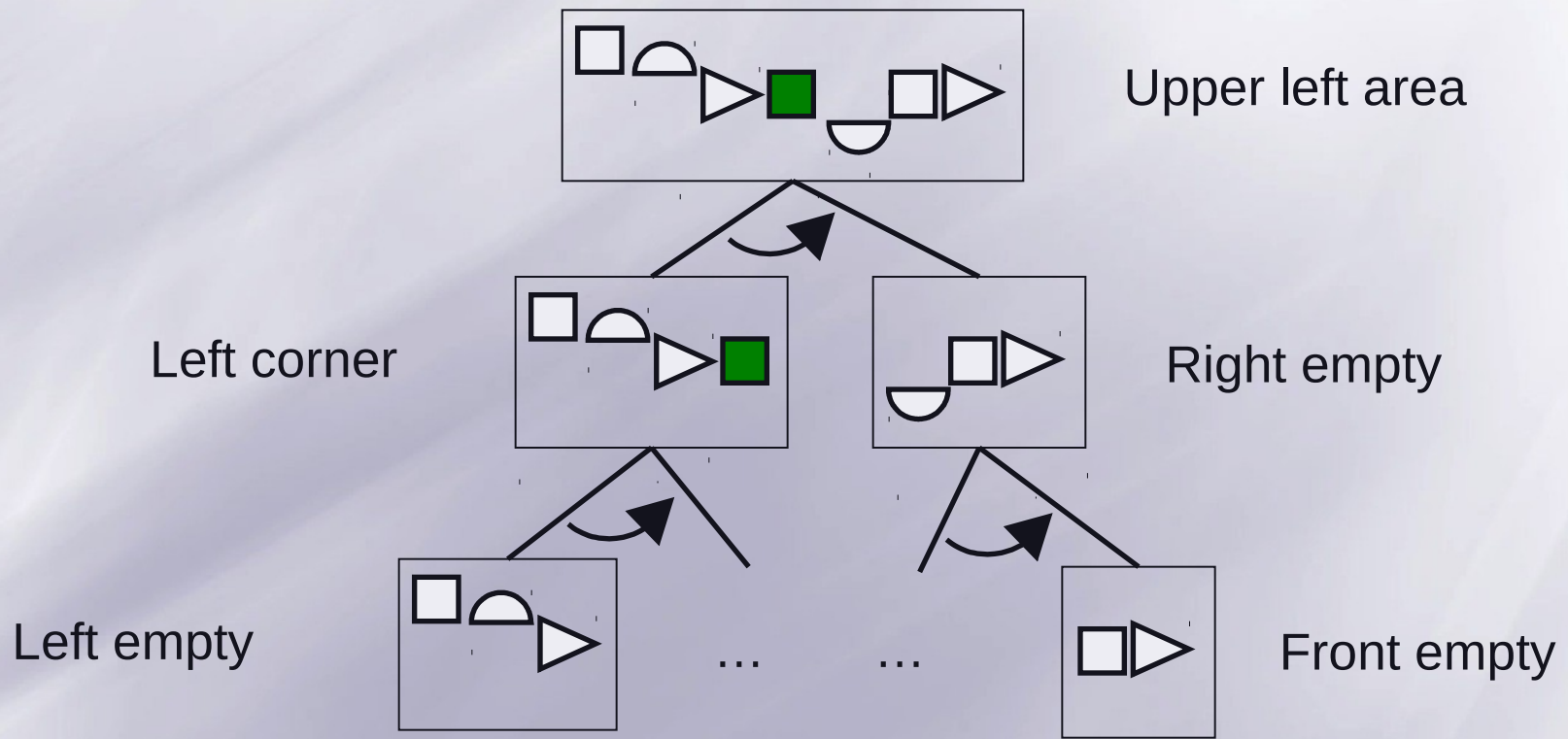
touch front –
move forward
(step 67)



touch left –
turn left –
move forward
(Step 99)



☰ “touch left empty, turn left, move forward, touch front wall”.




Assessment criteria

Measurable criteria

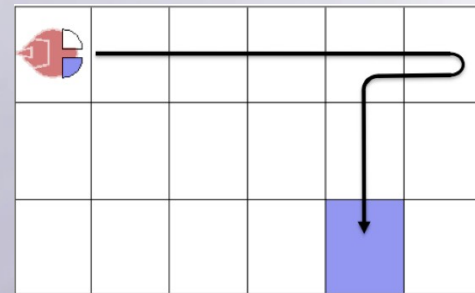
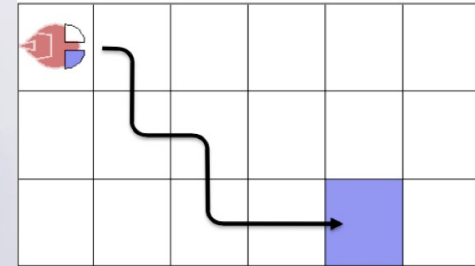
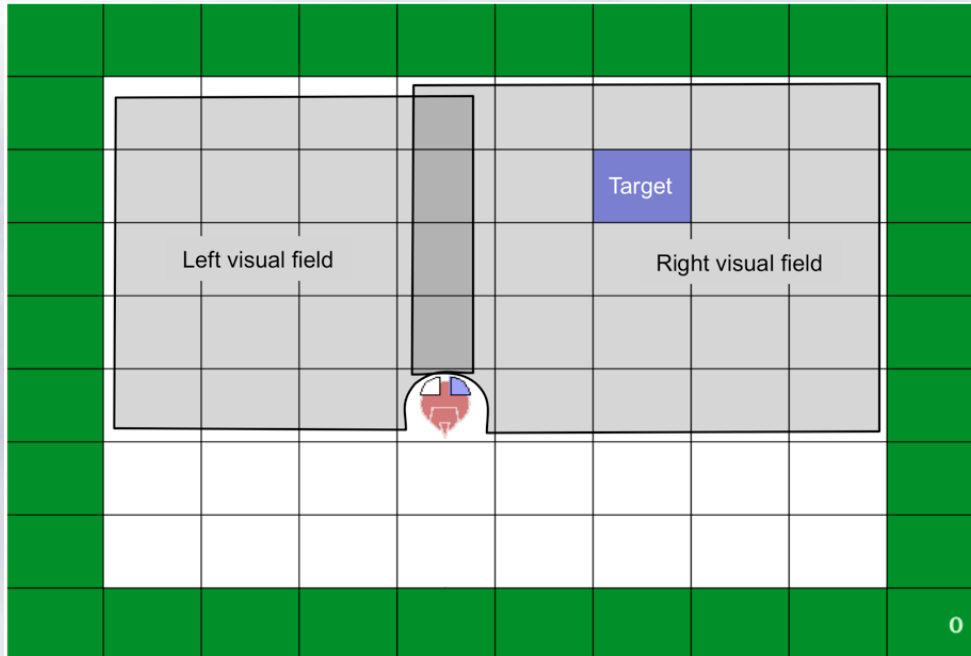
- *Objective hedonism*
- *Situational categorization*
- *Situational disambiguation*

Behavioral criteria

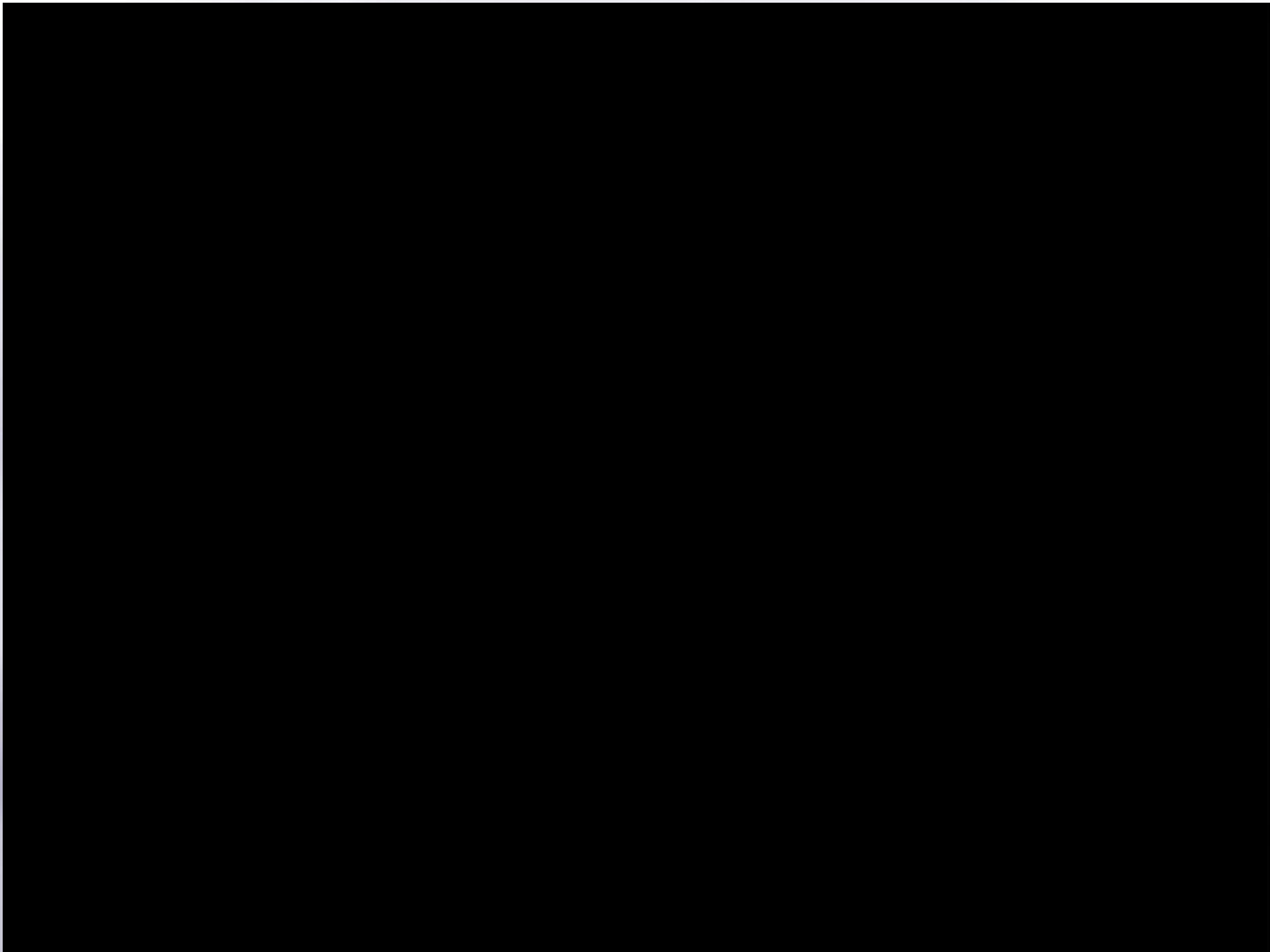
- *Hedonistic temperance*
- *Graceful readaptation*
- *Active perception*
- *Individuation*

 *Designing Environment-Agnostic Agents. Olivier L. Georgeon, Ilias Sakellariou. AAMAS (2012).*

Vision and space



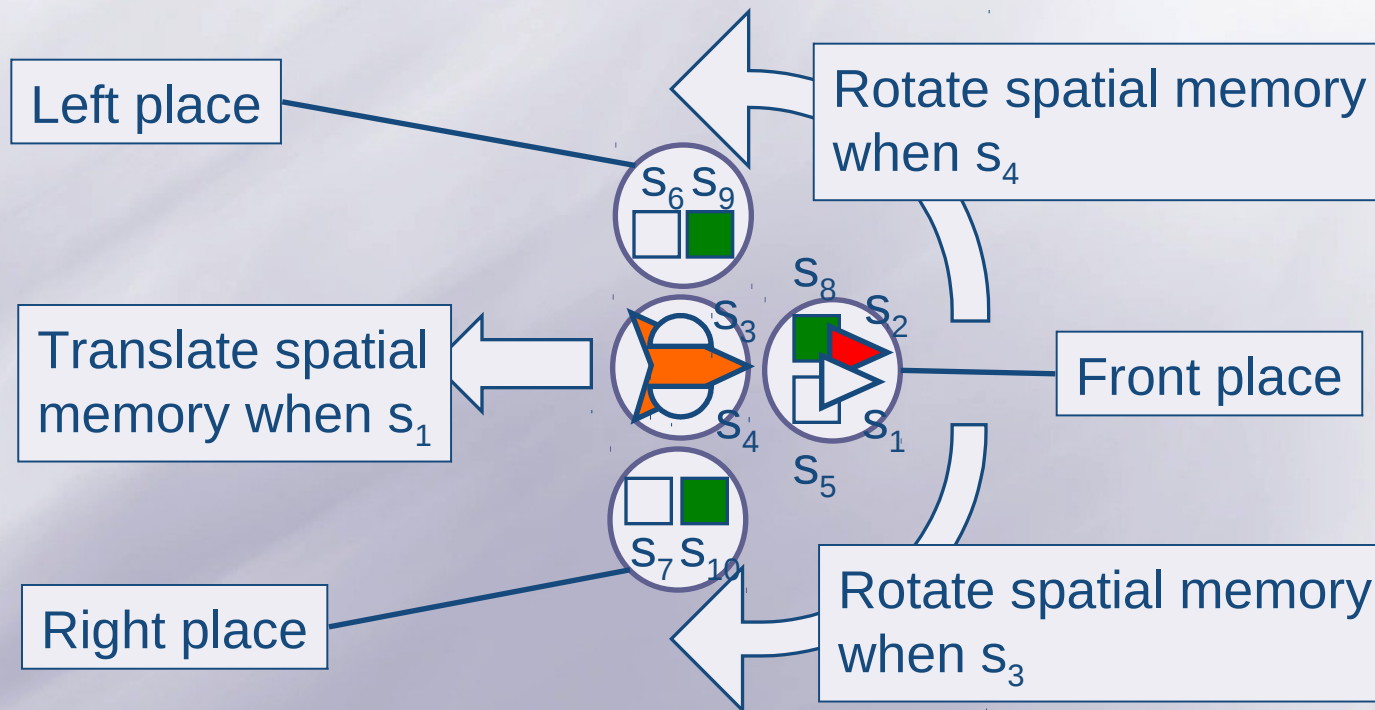
Stratégie diagonale



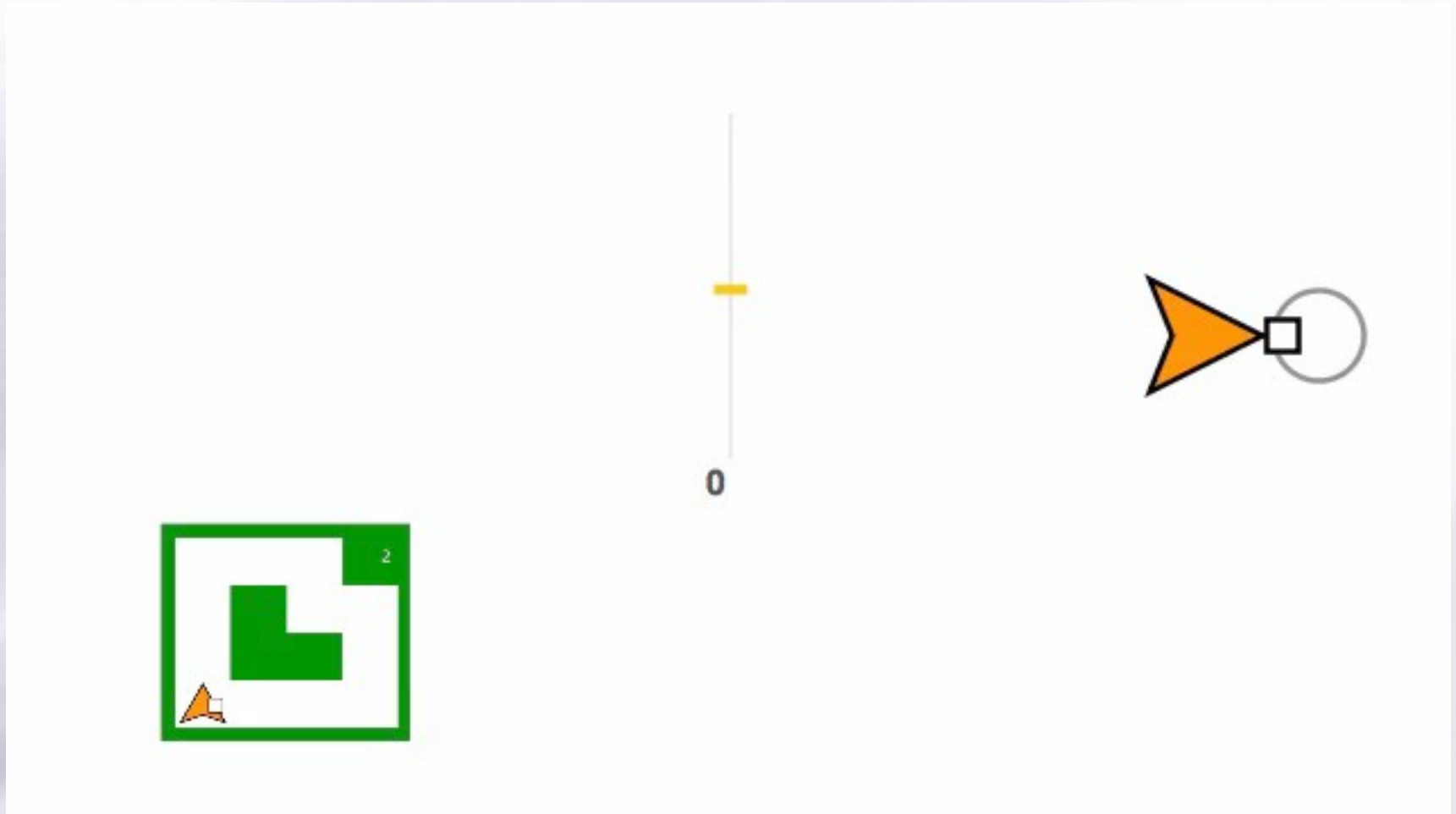
Stratégie tangentielle



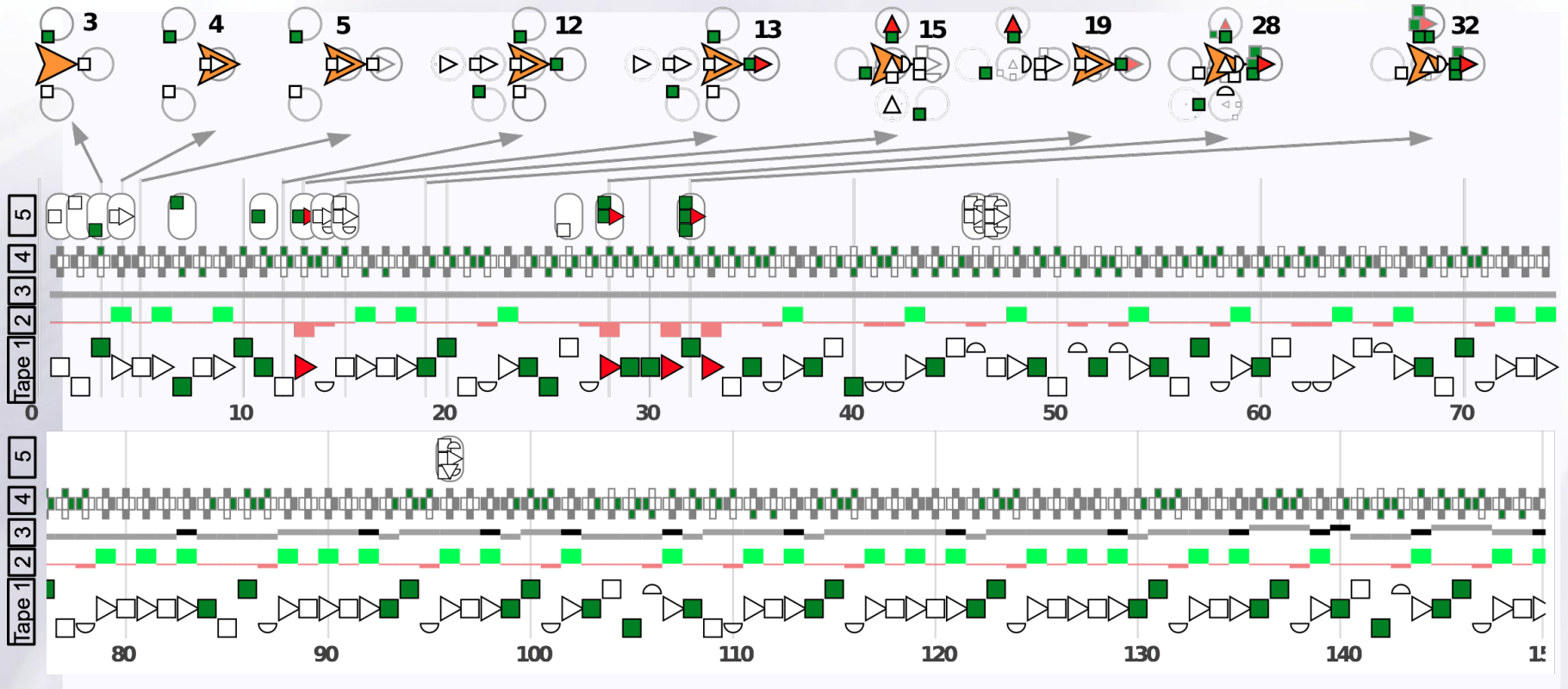
Self model and space



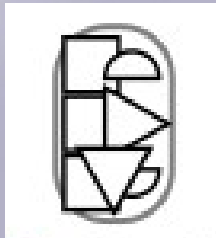
Exemple spatial



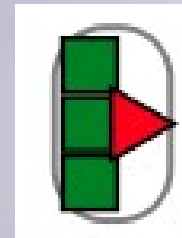
Trace



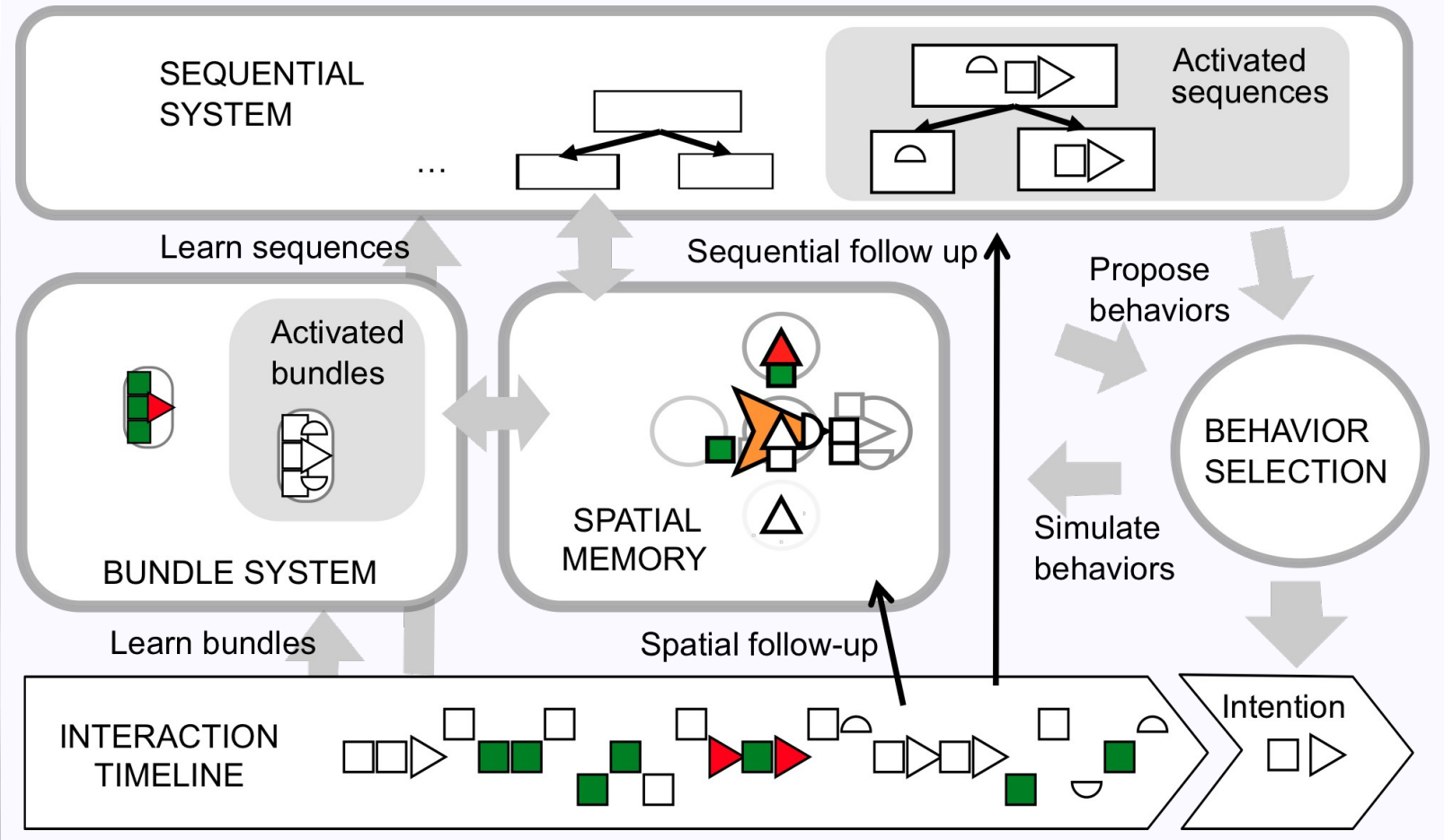
Empty phenomenon



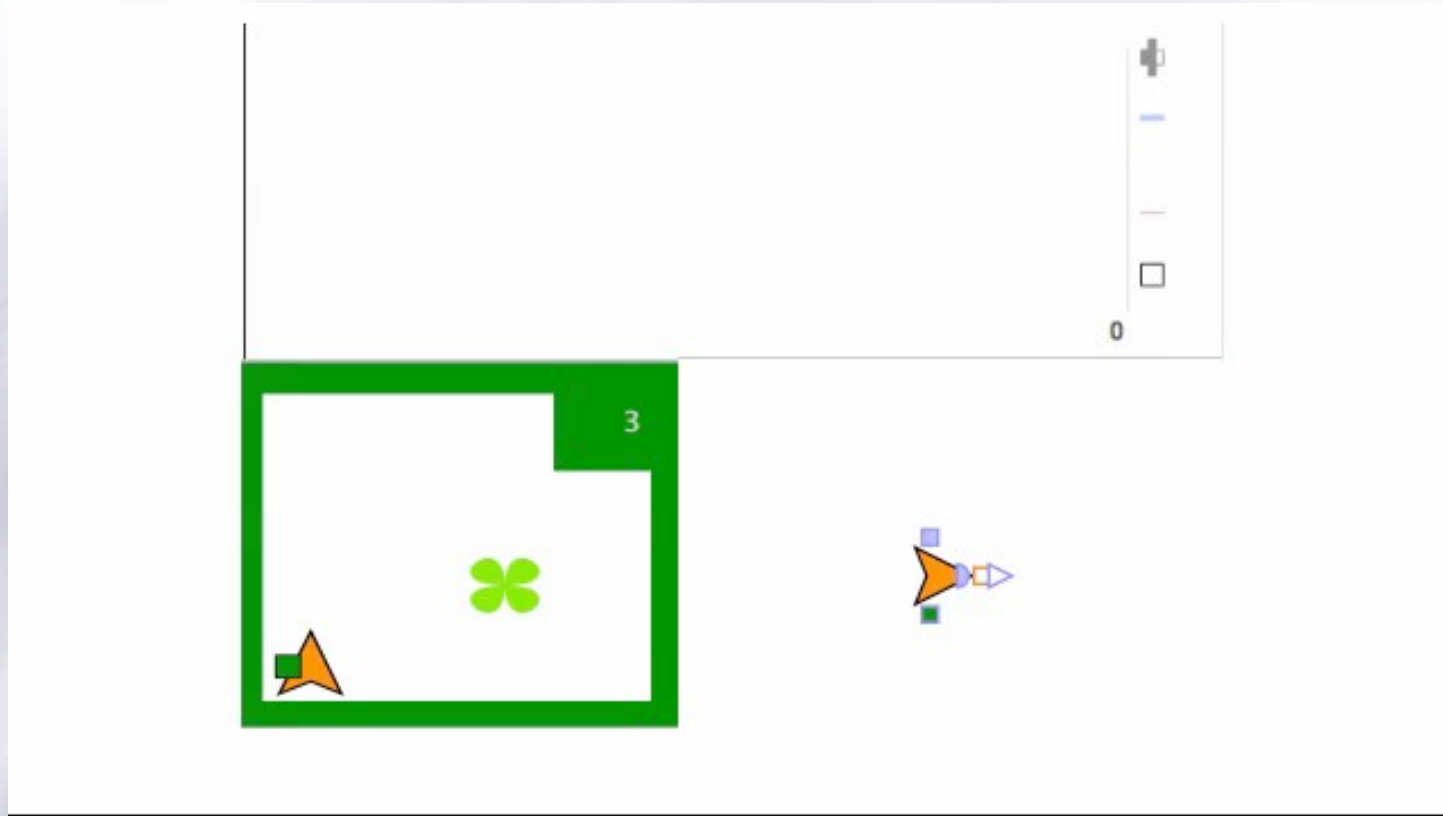
Wall phenomenon




Architecture



From “drives” to “goals”



Afforded 

Simulated 

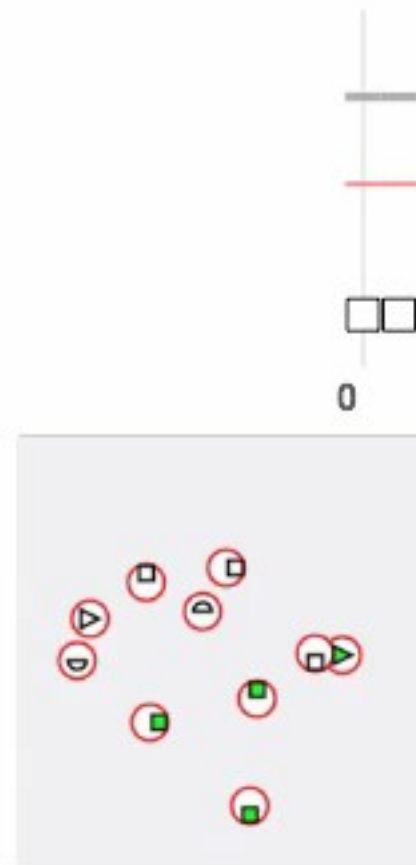
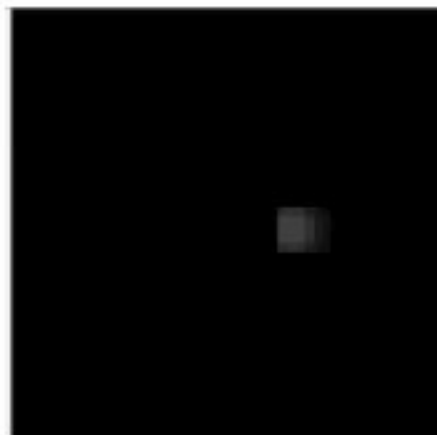
Dynamic and continuous environment

Implementing Self-Motivation in Artificial Agents

- Maintain a "Spatial Memory"
- Learn "affordances" of objects



Example in a robot



Robot with vision



Conclusion

- ≡ Novel learning algorithm
- ≡ Developmental approach to cognition
- ≡ Agnostic agents
 - No ontological presupposition on the environment
- ≡ Qualitative evaluation as opposed to performance measures
 - Activity traces
- ≡ Interactional Motivation
 - Between Extrinsic and Intrinsic motivation
- ≡ The Small Loop Problem
 - Still unsolved !