

Bio-inspired Algorithms: Reinforce your Learnings

AI exploration phase

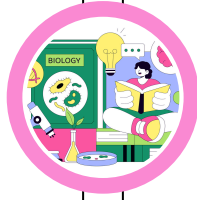
P2 - Building Hypothesis on AI

AI and Exploration Topics.

Reinforcement learning: how AI learns through trial and error

Bio-inspired learning: how machines imitate living organisms

Mental models: how humans and machines build internal representations



Materials Needed and to Create.

6x6 grid (floor version with tape)
 Memorisation sheets (1 per participant)
 Rewards for reinforcement (candies, tokens, pompoms)
 Cubetto, Sphero Indi and micro:bit-based robots, mission cards and computers

Exploration Steps and Description.

This activity reveals how both humans and machines learn through trial and error. By playing the role of a learning algorithm, participants discover reinforcement learning — rewards for success, penalties for failure — a universal principle shared by biological and artificial intelligence.

Activity 1 - Be the Robot (Reinforcement Learning - Unplugged): Participants explore a 6x6 grid to find a hidden goal. They do not know where obstacles are or where the goal is located. Moving one square at a time, the group decides each move collectively. After each move, the facilitator answers only RIGHT (reward: +1 token) or WRONG (penalty: lose ALL tokens, restart from beginning). Each participant fills their own memorisation sheet to record discoveries. After several attempts, they find the path and keep their sheet for later.

Activity 2 - Talk to Robots (Programming Basics): Through progressive missions, participants discover how to program robots. Each robot has its own logic, in our example: Cubetto uses physical wooden blocks, Sphero Indi reads coloured tiles on the floor, micro:bit robots use block coding on screen. Missions go from simple (move forward) to complex (sequences, turns).

Activity 3 - Transfer Your Knowledge (Programming the Path): Using ONLY their memorisation sheet from Activity 1 and the knowledge acquired in activity 2, participants must program their robot to follow the path they discovered. They cannot look at the grid before programming. This reveals the quality of their mental model: clear notes make programming easy, unclear notes cause struggle. The robot must complete the path autonomously.

Expected Output.

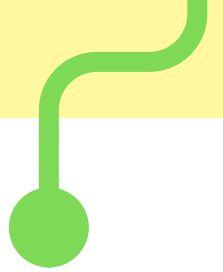
By the end of this activity, participants have experienced reinforcement learning from the inside — as the learning agent, as the programmer. They have created their own mental model, and discovered that the same logic can be expressed through programming. To conclude, make them observe how AI is doing the same work using: <https://steamcity.github.io/BioLearningGame/> to compare its learning path with biological strategies.

The Hook and the Playfulness.

Participants physically embody the algorithm — they ARE the robot exploring unknown territory. The reinforcement system creates excitement. Programming real robots that move brings abstract concepts to life.

Success indicators.

Participants can explain reinforcement learning in their own words. They understand the basic of a model. They program different robots using only what they learned to autonomously discover a given environment.




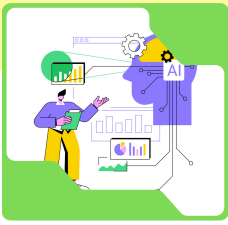
Appendix Example of material

Appendix 1

Example of Memorisation Sheet

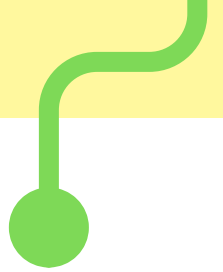
MEMORISATION SHEET



Appendix

Example of material



Appendix 2

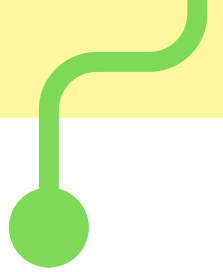
Example of Game Grid

	A	B	C	D	E	F
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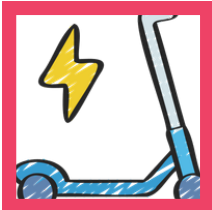



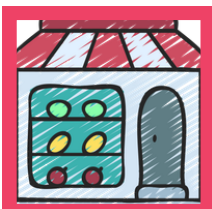


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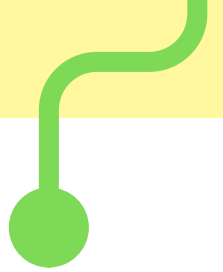
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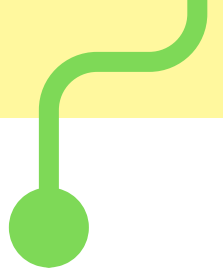
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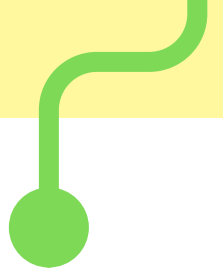
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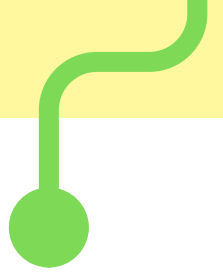
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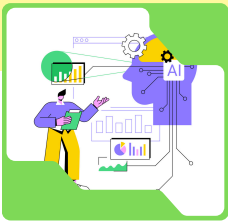
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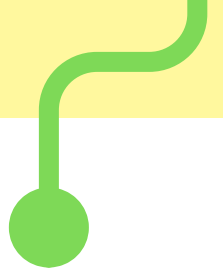
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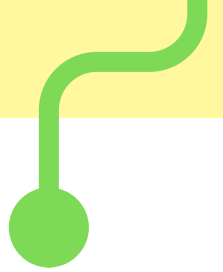
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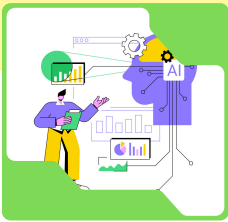
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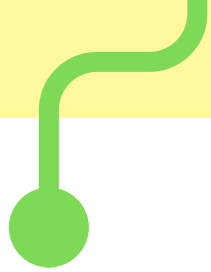
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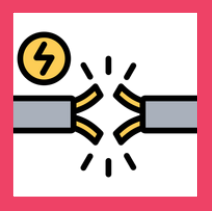




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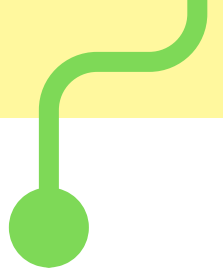
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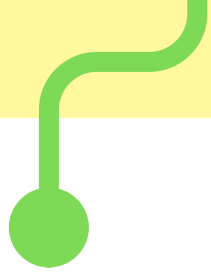
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Appendix 3


Example of Robot Missions

CUBETTO MISSIONS




**MISSION 1
FIRST CONTACT**

Move Cubetto forward 3 spaces in a straight line.




**MISSION 2
THE ROTATION**

Rotate Cubetto to the right, then move forward 2 spaces.




**MISSION 3
REVERSE GEAR**

Return Cubetto to its starting point.




**MISSION 4
L-SHAPED ROUTE**

Program a path from point A to point B that forms an L.




**MISSION 5
MYSTERY PATTERN**

Repeat the "forward-turn right" movement twice.




**MISSION 6
THE PERFECT SQUARE**

Program Cubetto to draw a 3x3 square.




**MISSION 7
THE STAIRCASE**

Program Cubetto to go down the stairs for as long as possible



**MISSION 8
SECRET CODE**

Program Cubetto to draw a T.



**MISSION 9
THE GRID**

Create a program that traverses as many squares of the grid as possible.



Appendix Example of material

Appendix 3

Example of Robot Missions



SPHERO INDI MISSIONS

MISSION 1 STRAIGHT LINE



Move the robot forward in a straight line of at least 2 meters.

MISSION 2 ROUND TRIP



Move Indi forward and then make him return to his starting point.

MISSION 3 TURN RIGHT



Turn Indi 90° to the right and then move forward.

MISSION 4 STOP !



Move Indi forward and then stop him precisely.

MISSION 5 CHANGING SPEED



Create a course with changes in speed.

MISSION 6 FLUID SLALOM



Slalom through a course with 3 obstacles, the start and finish of which are located on the same road.

MISSION 7 THE S-SHAPED ROUTE



Create an S-shaped path in a minimum area of one square meter.

MISSION 8 THE STAR



On the grid: start from the center and visit the 4 edges of the grid.

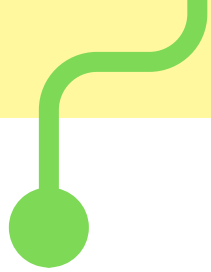
MISSION 9 THE DIAGONAL



On the grid: go from the bottom left corner to the top right corner.



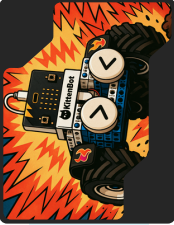
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Appendix 3

Example of Robot Missions

MiCRO:BiT MISSIONS



<div style="background-color: #FFD700; padding: 5px; font-weight: bold; font-size: 0.8em;">MISSION 1 HELLO ROBOT</div>	 Make the robot forward in a straight line of at least 2 meters.	<div style="background-color: #FFD700; padding: 5px; font-weight: bold; font-size: 0.8em;">MISSION 2 ROBOT BALLET</div>	 Make the robot dance in place (in a graceful way).
<div style="background-color: #FFD700; padding: 5px; font-weight: bold; font-size: 0.8em;">MISSION 3 CALIBRATION</div>	 Find out how to move your robot just one space forward on the grid.	<div style="background-color: #FFD700; padding: 5px; font-weight: bold; font-size: 0.8em;">MISSION 4 THE TURNS</div>	 Go through the grid: move forward, turn right, move forward, turn left.
<div style="background-color: #FFD700; padding: 5px; font-weight: bold; font-size: 0.8em;">MISSION 5 THE L ON THE GRID</div>	 On the grid: 3 squares forward, right, 2 squares forward.	<div style="background-color: #FFD700; padding: 5px; font-weight: bold; font-size: 0.8em;">MISSION 6 THE SQUARE</div>	 On a grid: create a 3x3 square using a loop.
<div style="background-color: #FFD700; padding: 5px; font-weight: bold; font-size: 0.8em;">MISSION 7 THE LOOPS</div>	 Move the robot forward 6 times with only 2 lines of code.	<div style="background-color: #FFD700; padding: 5px; font-weight: bold; font-size: 0.8em;">MISSION 8 THE FUNCTIONS</div>	 Complete the previous mission using the functions.
<div style="background-color: #FFD700; padding: 5px; font-weight: bold; font-size: 0.8em;">MISSION 9 DISPLAYING</div>	 Add messages using LEDs and sounds while on the go.		