Swarm Intelligence H-414

Swarm robotics

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Today

- Part 1
  - Introduction
    - Reminder on swarm robotics.
    - What is a swarm control software?
    - How to program a swarm control software?
    - How to use the ARGoS simulator?
- Part 2
  - Exercise: Obstacle avoidance

Reminder on swarm robotics

In swarm robotics, we want a large group of robots to accomplish a task/mission (eg. flocking, foraging, patrolling, search and rescue).

The robots

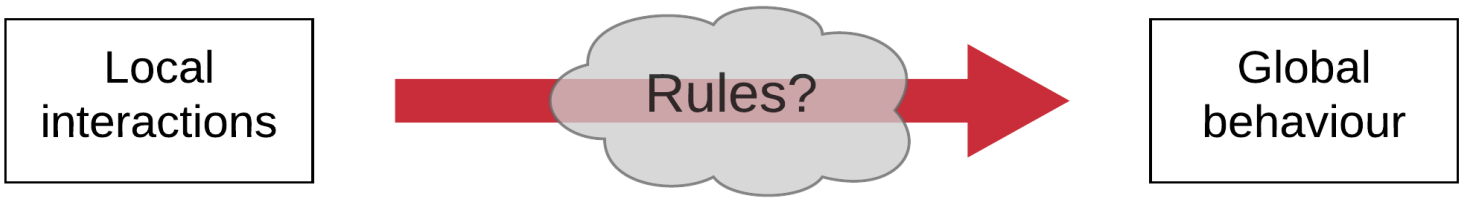
- are relatively simple $\rightarrow$ they must cooperate.
- are autonomous $\rightarrow$ there is no leader or orchestrator, no global information.
- have local sensing and communication capabilities.

Robot swarms are meant to be

- Robust (ability to cope with the loss of individual)
- Scalable (ability to perform well with different group sizes)
- Flexible (ability to cope with different environments)

What is a swarm control software?

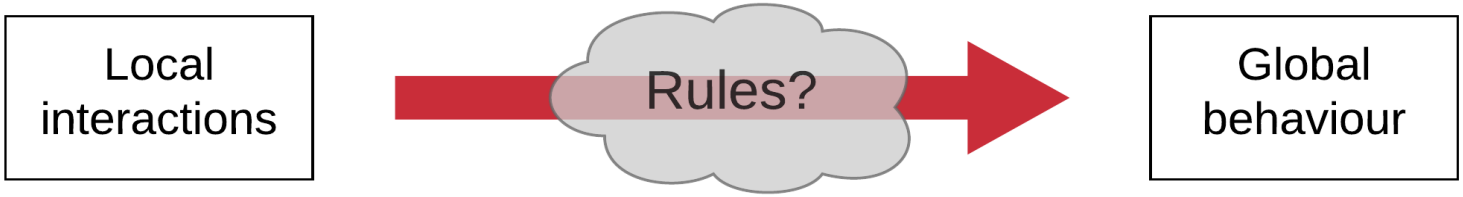
We don't program the swarm, but the individuals, based on the **local interactions**.

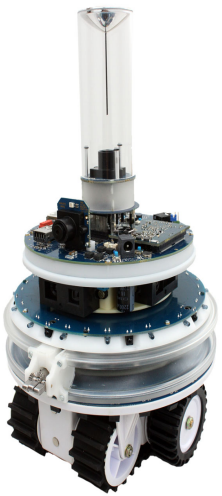


Swarm control software

- the code that controls a single robot.
- each robot in the swarm executes the same control software.

How to program a swarm control software?



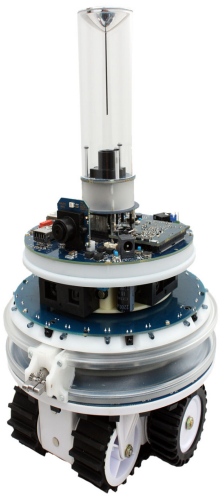


Footbot

- *Sensors* to gather information from the environment.
  - Proximity, ground, range-and-bearing, camera.
- *Actuators* to "act" on the environment
  - Wheels, LEDs, range-and-bearing.

How to program a swarm control software? (2)

Program in a sense-think-act loop.



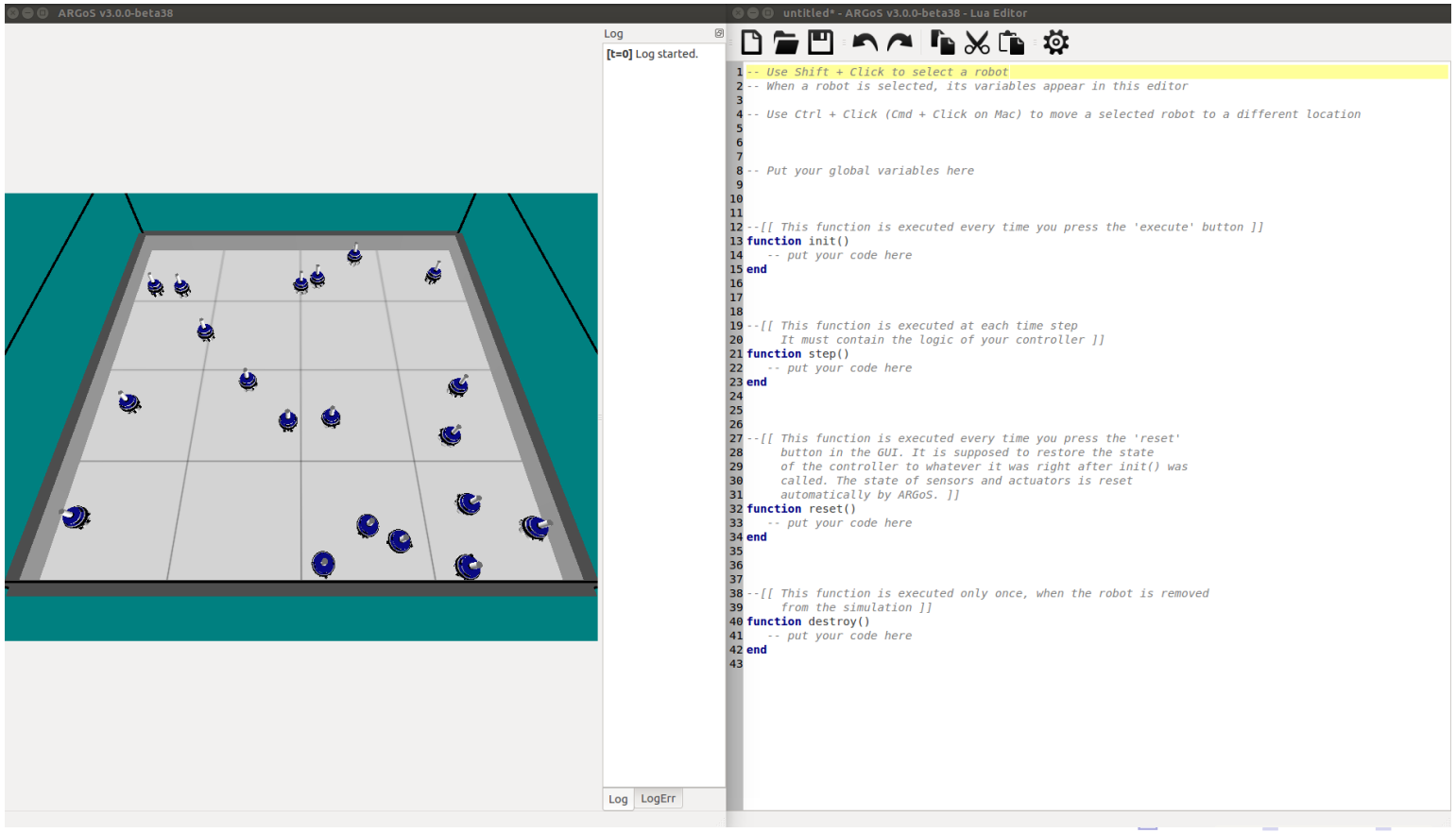
- **Sense** ... the environment, the other robots.
- **Think** ... process the information sensed.
- **Act** ... do something based on your thinking.
- **Repeat**

The less sensors/actuators you use, the better.

How to use the ARGoS simulator?

In a terminal:

```
argos3 -c experiment.argos
```



Exercise: Obstacle avoidance.

Goal:

The robots must explore the environment while avoiding collisions (with objects and other robots).

Material:

`https://iridia.ulb.ac.be/courses/2019/h-414/`

VUB students:

Login with username/password: *fsa-vub-students*