Real-Time Interaction

Real-Time Interaction

Interaction

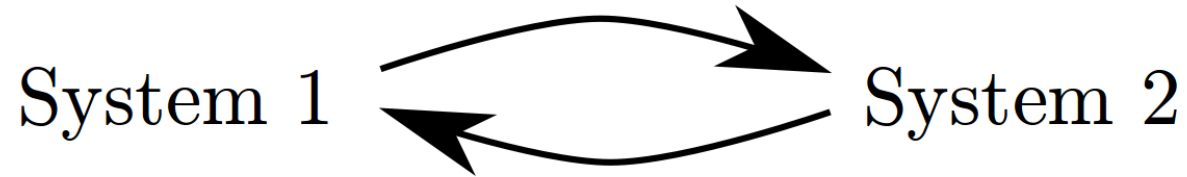# Interaction

From Oxford dictionary

Reciprocal action or influence

Interaction

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Reciprocal action or influence

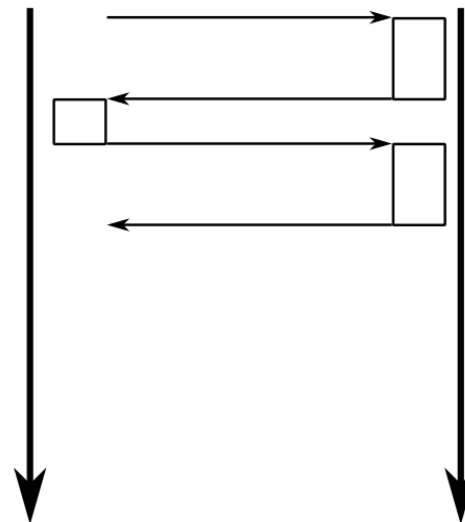System 1 ⇄ System 2

Interaction

From Oxford dictionary
Reciprocal action or influence

System 1   System 2

Time

Sequence diagram
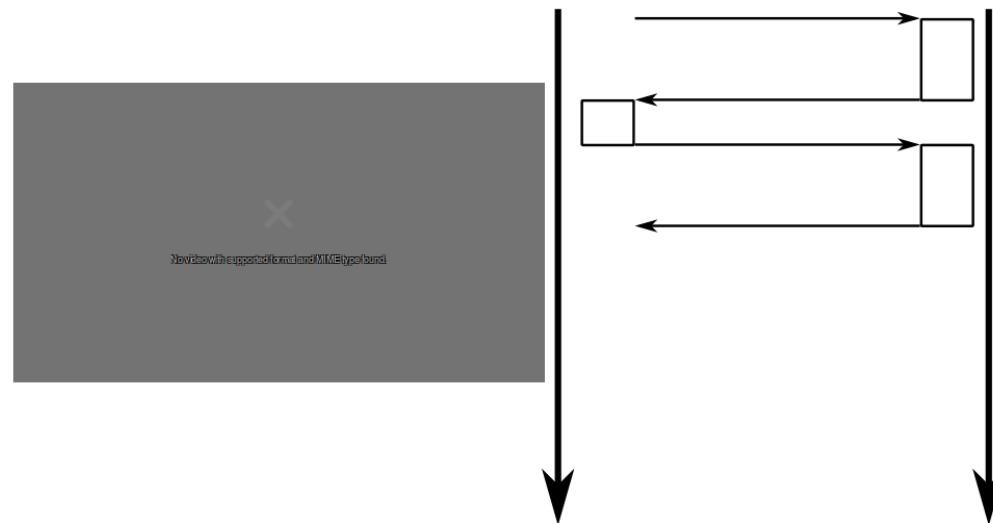
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Reciprocal action or influence

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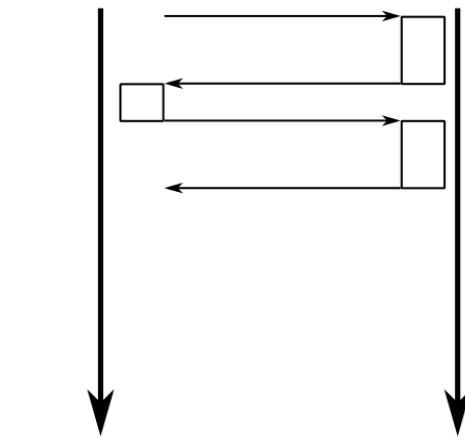# Real-Time Interaction

From Oxford dictionary

Reciprocal action or influence

System 1   System 2

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Sequence diagram

Real-Time

Real-Time

Definitions

From Cambridge dictionary

Communicated, shown, presented, etc. at the same time as events actually happen

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From Wikipedia

A real-time system has been described as one which "controls an environment by receiving data, processing them, and returning the results sufficiently quickly to affect the environment at that time"

Real-Time

is relative to the considered events

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Real-Time

is relative to the considered events

Real-time systems have to meet deadlines!

How fast the system should respond depends on the considered situation

A real-time system maintains a continuous and timely interaction with its environment
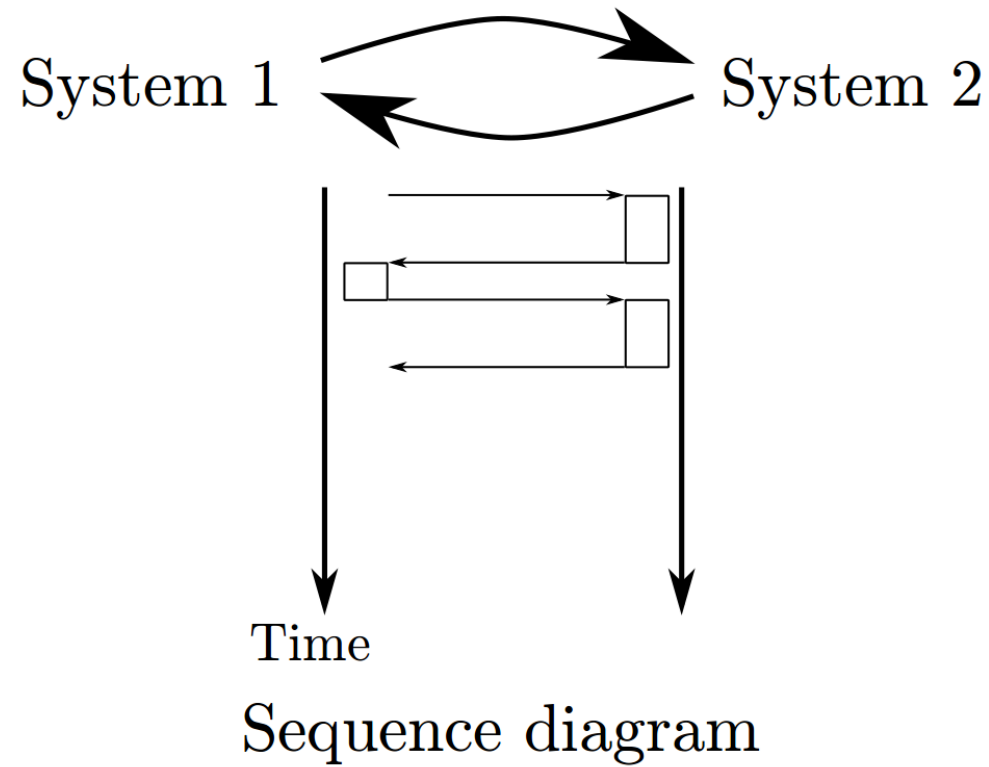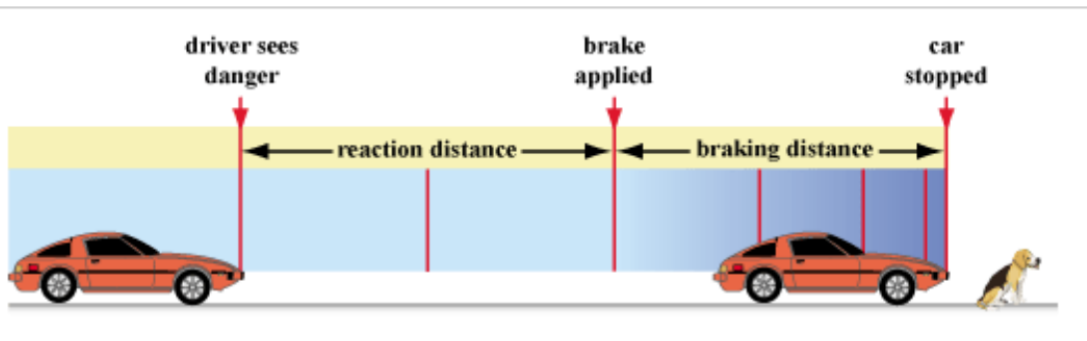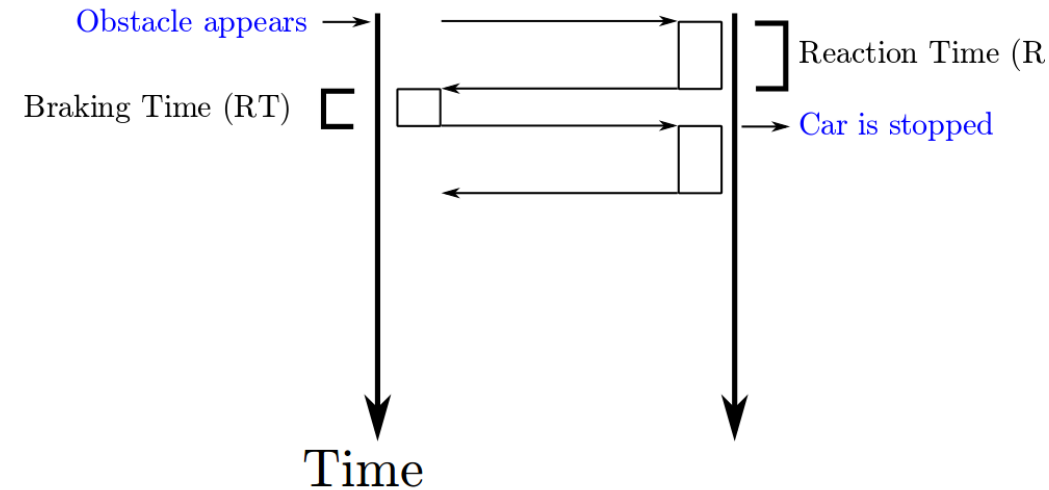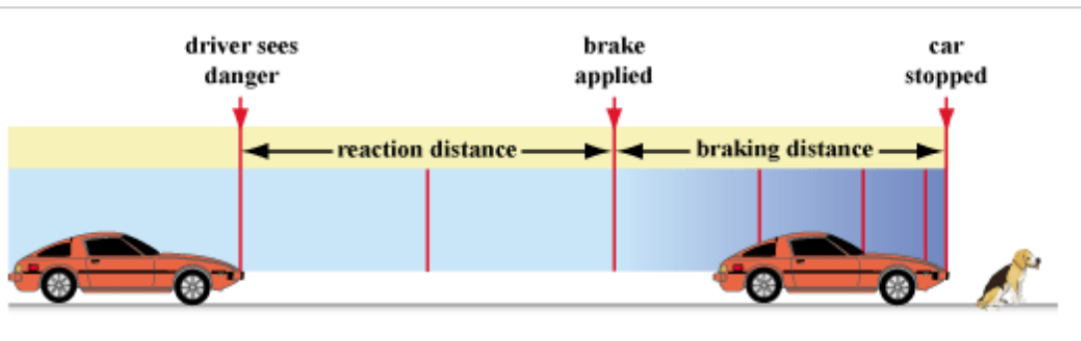
Real-Time Interaction

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System 1   System 2

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Sequence diagram

Real-Time Interaction

Example: Stopping a car

Environment   **Driver**

Obstacle appears →

Reaction Time (R

Braking Time (RT)

Car is stopped

Time

Sequence diagram

Real-Time Interaction

Example: Stopping a car

driver sees danger   brake applied   car stopped

← reaction distance → ← braking distance →

$SD = RD + BD$

$SD < OD$

$RD = v * RT$

$BD = v_2 / a$

What is the minimum RT in town?

(v < 50km/h; OD > 10m, a=14)

Environment   **Driver**

Obstacle appears →

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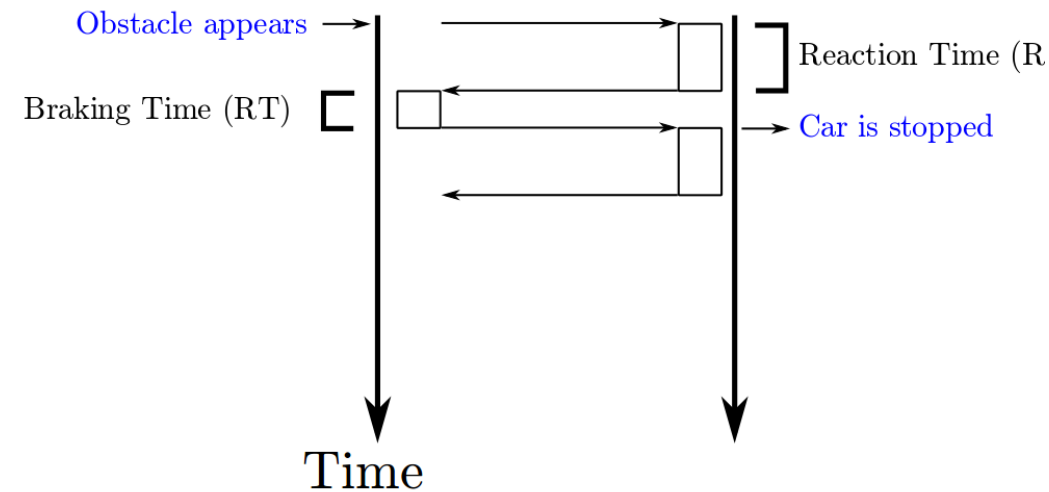
Time

Sequence diagram

Real-Time Interaction

In cognitive systems

Real-Time Interaction

In cognitive systems

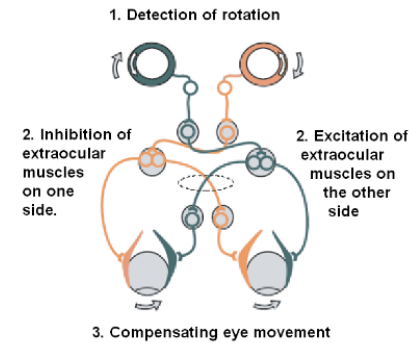In vivo   In silico

In vivo

Individual behavior
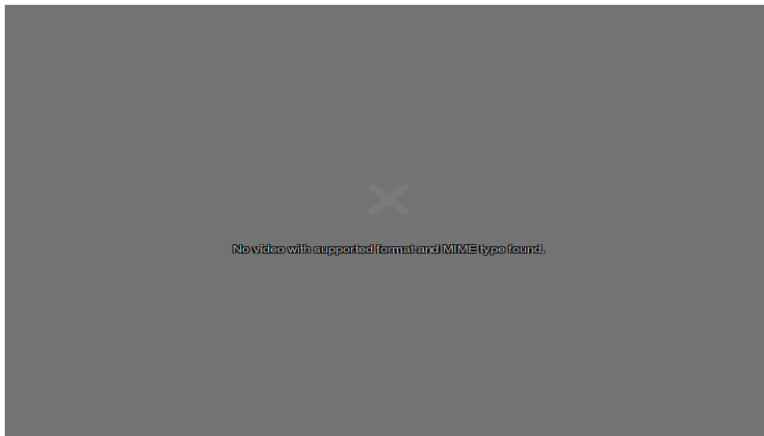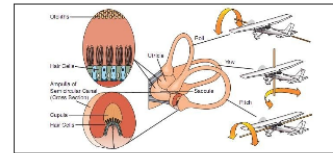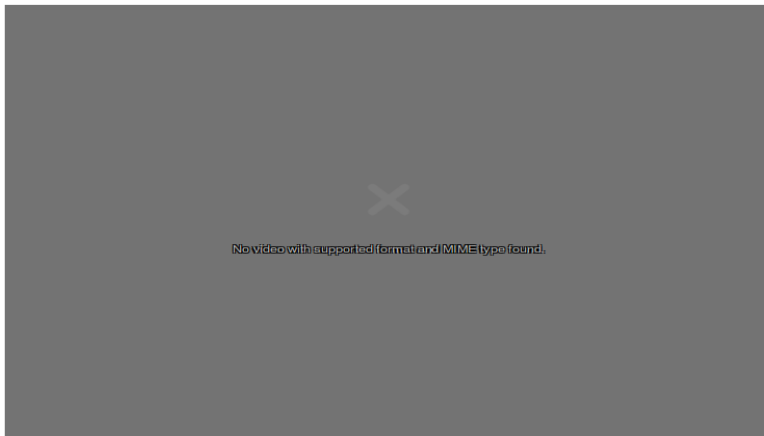
Group coordination

In vivo

Individual behavior

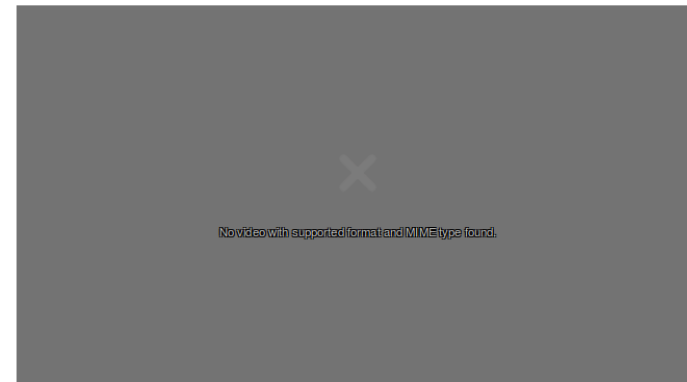### Head stabilization

Group coordination

In vivo

Individual behavior

Head stabilization

1. Detection of rotation

2. Inhibition of extraocular muscles on one side.

2. Excitation of extraocular muscles on the other side

3. Compensating eye movement

Group coordination

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Group coordination

V-formation in bird groups

In silico

Individual behavior

Group coordination

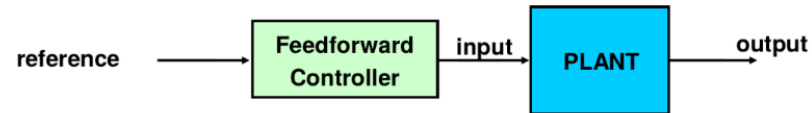# In silico

Individual behavior

Not real-time

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Real-time

No video with supported format and MIME type found.
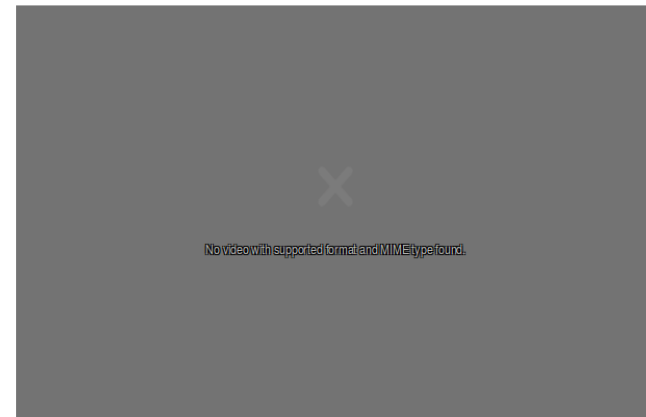
Group coordination

In silico

Individual behavior

- Feedforward control

- Feedback control
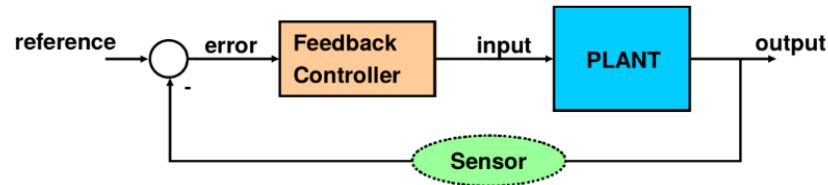
Group coordination

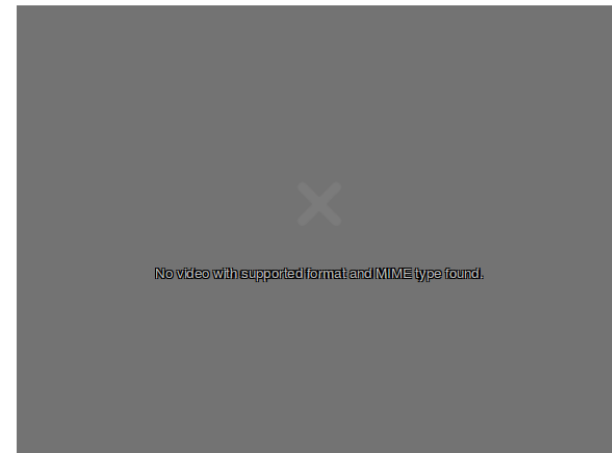# In silico

Individual behavior

- Feedforward control

reference → **Feedforward Controller** → input → **PLANT** → output

- Feedback control

reference → error → **Feedback Controller** → input → **PLANT** → output
Sensor

Group coordination

No video with supported format and MIME type found.

Self-organization in robotic swarms

Real-Time Interaction

In cognitive systems

In vivo

In silico

Individual behavior
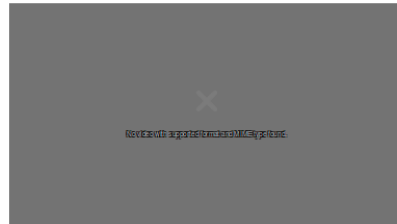
Head stabilization
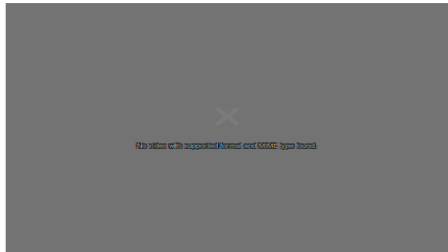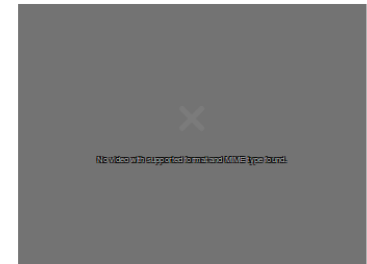
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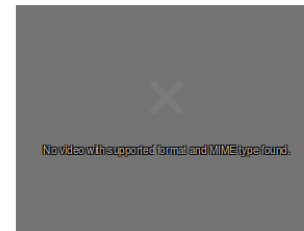
Real-time
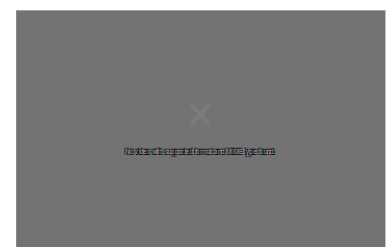
Group coordination

V-formation in bird groups

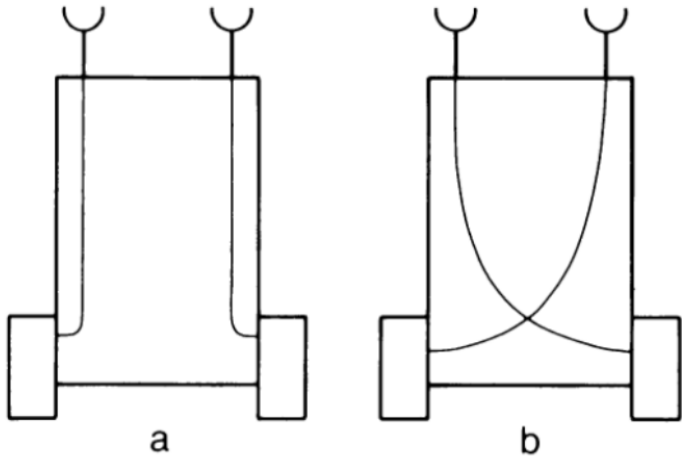Self-organization in robotic swarms

Real-Time Interaction

Minimal examples

Real-Time Interaction
Minimal examples

Braitenberg, V. (1986). Vehicles: Experiments in synthetic psychology. MIT press.
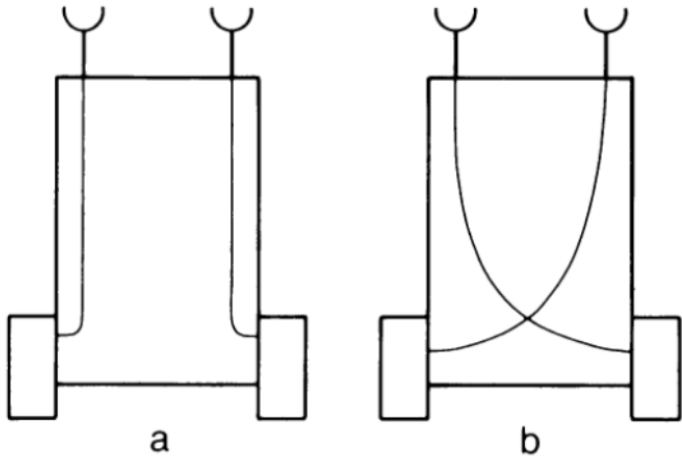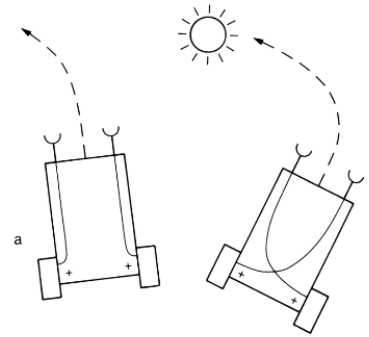
"Vehicles" are quite simple cognitive systems

a   b

Real-Time Interaction

Minimal examples

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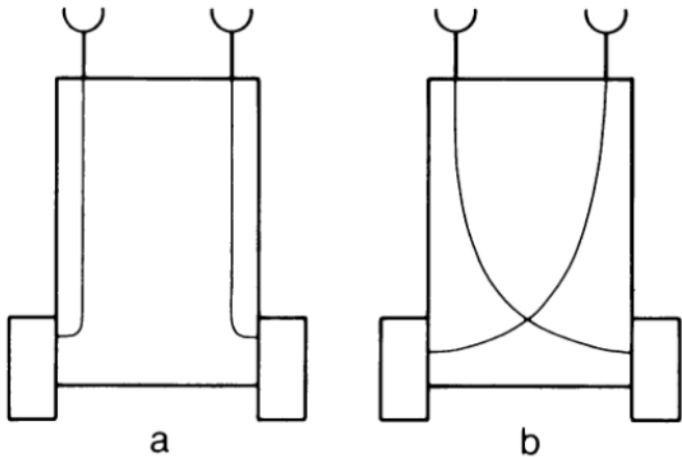"Vehicles" are quite simple cognitive systems
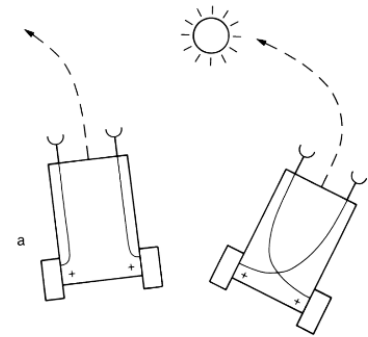
Fear and aggression

Real-Time Interaction

Minimal examples

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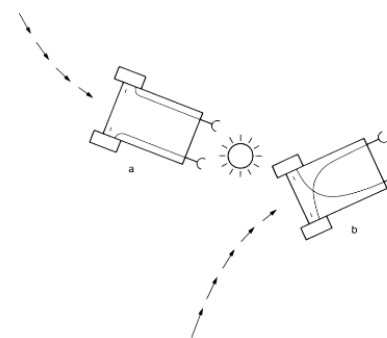
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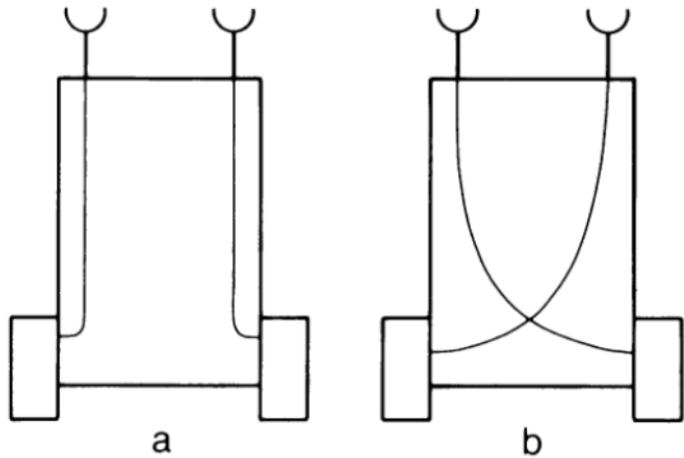Love

Real-Time Interaction
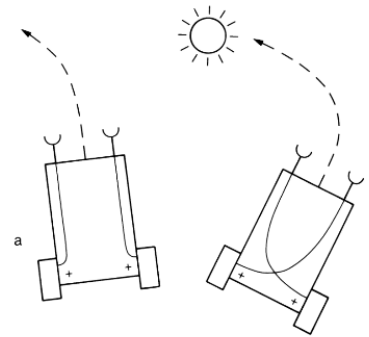## Minimal examples

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"Vehicles" are quite simple cognitive systems

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Love