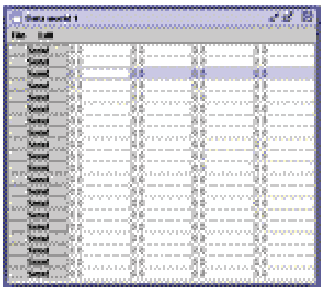
Dataworld - Collegamenti

- Dataworld è essenzialmente una tabella, in cui è possibile:
  - immettere valori
  - creare dati casuali (uniformemente fra una soglia minima ed un massima)
  - Importare ed esportare dati in formato csv

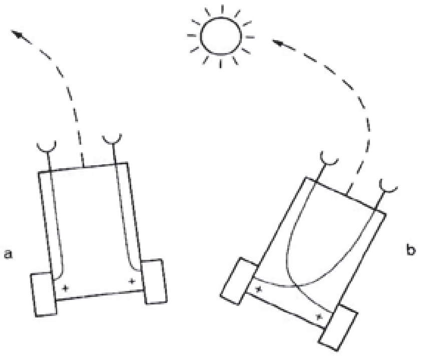


- Le colonne in dataworld possono essere consumatori oppure produttori di dati
  - Quando le colonne producono dati, durante ogni aggiornamento dello spazio di lavoro (workspace update) i valori delle colonne nella riga corrente sono spediti al consumatore (es. un neurone)
  - Quando le colonne consumano dati, durante ogni aggiornamento dello spazio di lavoro (workspace update) i valori provenienti da un produttore (es. un neurone) sono scritti nella riga corrente, in corrispondenza delle dette colonne

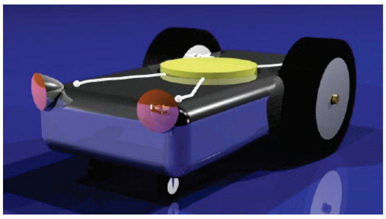
Braitenberg vehicle

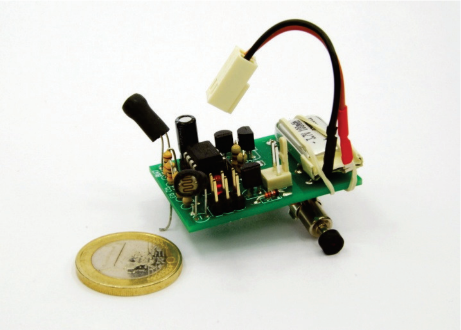
- A Braitenberg vehicle is an agent that can autonomously move around. It has
  - primitive sensors (measuring some stimulus at a point)
  - and wheels (each driven by its own motor) that function as actuators or effectors

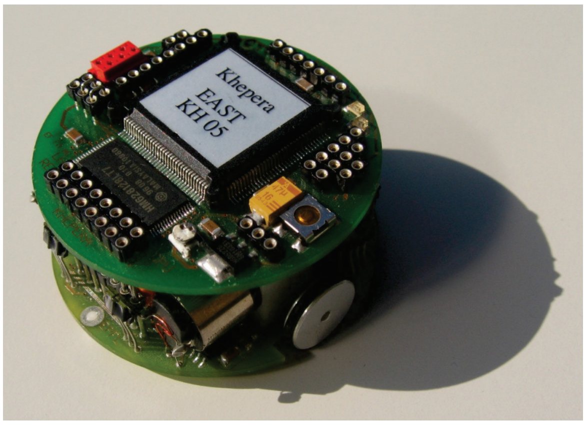
- A sensor, in the simplest configuration, is directly connected to an effector, so that a sensed signal immediately produces a movement of the wheel
  - depending on how sensors and wheels are connected, the vehicle exhibits different behaviors (which can be goal-oriented)
  - this means that it appears to strive to achieve certain situations and to avoid others, changing course when the situation changes



Braitenberg vehicle





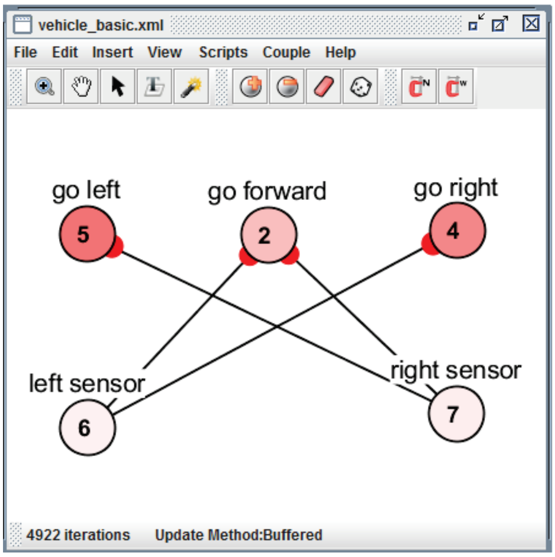


Braitenberg vehicle

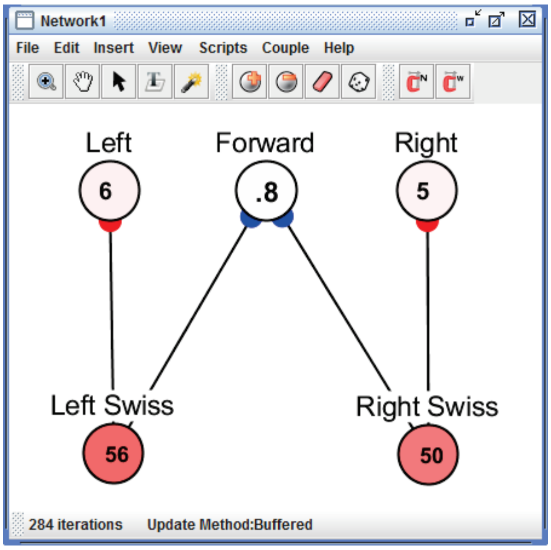
- The vehicle represents the simplest form of behavior based artificial intelligence and embodied cognition
  - intelligent behavior that emerges from sensorimotor interaction between the agent and its environment, without any need for an internal memory, representation of the environment, or inference
- A first example could be agent that has one light-detecting sensor that directly stimulates its single wheel, implementing the following rules:
  - More light produces faster movement
  - Less light produces slower movement
  - Darkness produces standstill
- This behavior can be interpreted as a creature that is afraid of the light and that moves fast to get away from it. Its goal is to find a dark spot to hide

Braitenberg vehicle

- Cosa potrebbero fare questi veicoli?



4922 iterations Update Method:Buffered



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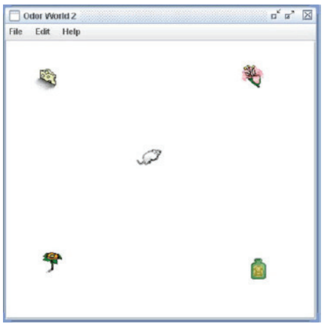
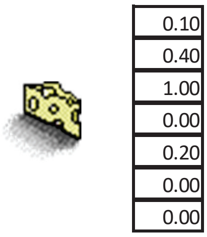
Odorworld

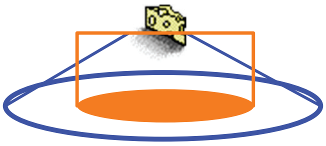
- In Odor World, sensory stimulation is modeled by simulating the impact an environment will have on a creature's sensory receptors



- Each object in the Odor World is associated with a "stimulus vector“
  - the way this vector will impact an agent is controlled by the entity and world dialog boxes



- In general, the further apart the creature and an object are from each other, the smaller the input generated by the world component is



Odorworld - agents

- An **agent** is a creature in Odor World that can be controlled by a neural network
  - the **neural network** can be thought of as the brain of the agent; without a network controlling the agent, it does nothing

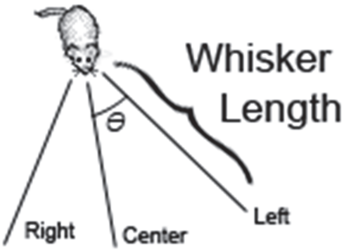
- For a network to control an agent, it must be **coupled** to an agent by Output Commands and Input Sensors
  - **output commands** are the motor controls of an agent, like moving forward or backward, and turning left or right
  - an agent's **input sensor** abstractly model reaction to stimuli, though they were created with olfaction in mind
- Sensors at three positions relative to the agent detect stimulus values associated with different objects and other agents
  - Agents can "smell" other agents, but not themselves

Odorworld - agents

- **Output Commands** are essentially the motor controls of the agent. When coupling a neuron to an agent, one can choose between two styles of movement
  - **relative** movements
    - e.g. move forward, move to the right, move to the left
  - **absolute** movements
    - movements in directions that are independent of its orientation,
      - e.g. move to the north, move to the south-west
- All **movements are scaled** based on the **activity of the coupled neuron** and a fixed movement factor set in the entity dialog.
  - the larger the activation, the faster the agent
  - if a neuron is coupled with an agent and its activation becomes negative, the neuron will command the agent to do the opposite of what it would normally do (turn right → turn left)

Odorworld - agents

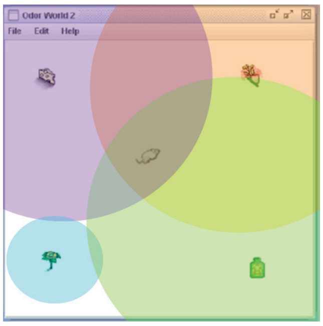
- **Input Commands** Each agent in an Odor World has a left whisker, a central nose, and a right whisker, each of which can sense independently
  - each of these sensors can detect parts of a broadcasted stimulus pattern, and depending on how well the signal is picked up, the neuron to which the neuron is coupled will be come active
  - although they are called whiskers, they are really just abstract sensors, which can respond to, e.g., olfactory stimuli
  - the location of the left and right whiskers can be set



- In the Odor World, there is a variable amount of stimulus Dimensions, set by default to be 8
  - all agents and objects broadcast customizable stimulus patterns during each iteration
  - an agent can pick up on these broadcasted signals, using its nose or whiskers, and send each to the coupled neuron
  - each sensor neuron can only receive one dimension of the stimulus pattern at a time from one input sensor

Odorworld - objects

- **Objects** in the Odor World are stationary entities. They act as olfactory stimuli
  - which emit chemicals which disperse from the center of the object and for the most part diminish with distance
  - objects act as a broadcasting center for a unique stimulus patterns, whose dimension is set by default to 8
  - how the signal disperses is based on a decay function associated with that particular object, and a vector of stimulus values



- Stimulus Dimensions
  - stimulus patterns are designed to be sensed by an agent when a neuron is coupled with it
  - a sensor can only receive one dimension of a stimulus pattern at a time, so, each stimulus value of an object is completely independent of other stimulus values
- In each position of the Odor World chemical patterns sum linearly

Scripting - Library

- Scripting
  - to produce custom simulations or behaviors not possible using the Simbrain GUI, you can either create scripts
  - all scripts are currently beanshell scripts (there is nothing to prevent other scripting languages, but none have been implemented yet)
  - All public objects in the Simbrain code can be accessed via these scripts. The scripts by default have access to two variables:
    - workspace: the underlying model of all components in Simbrain
    - desktop: the graphical object which displays a workspace

- Using Simbrain as a library (Beta)
  - Simbrain can be used as a library in a separate java program