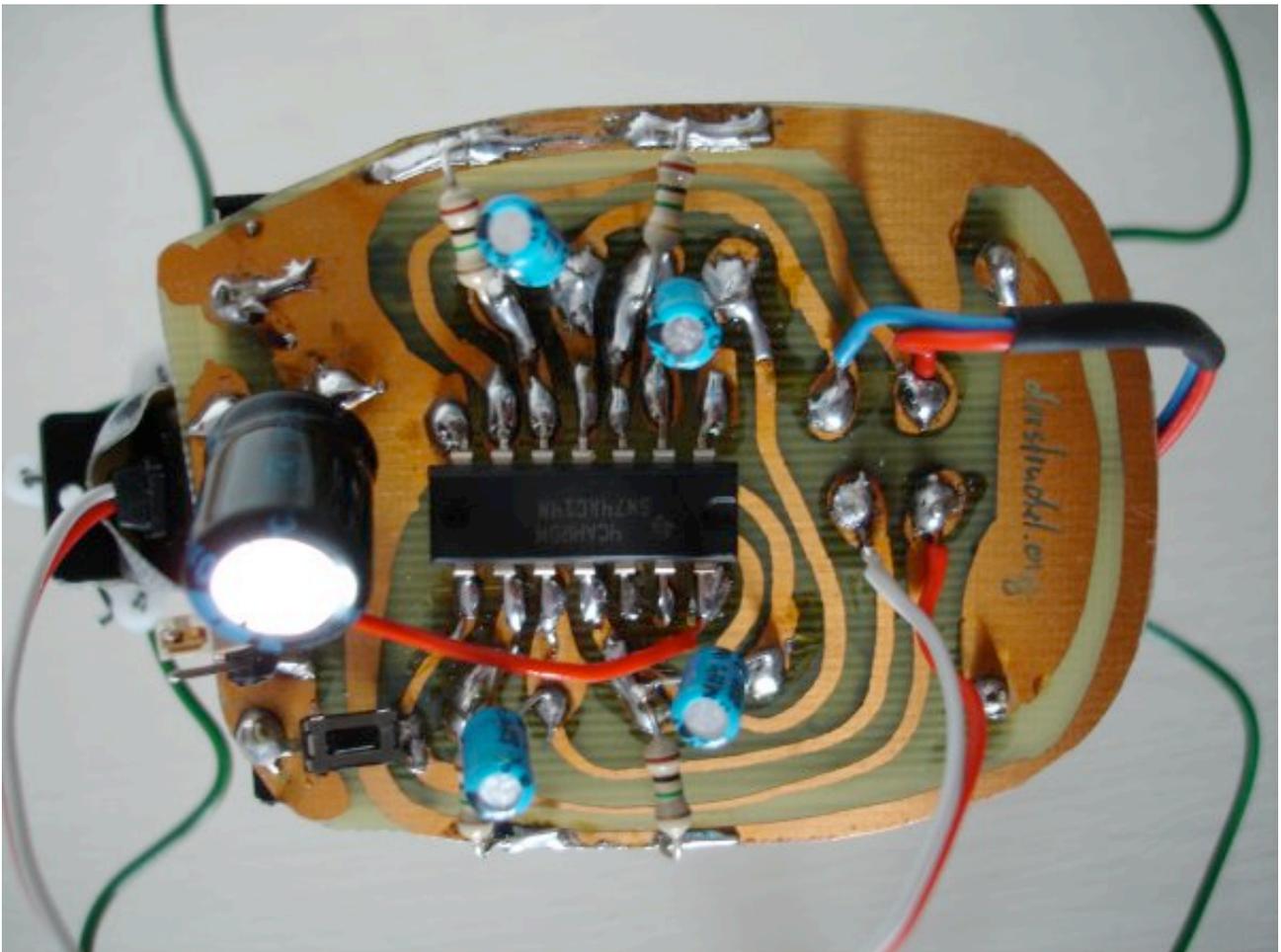
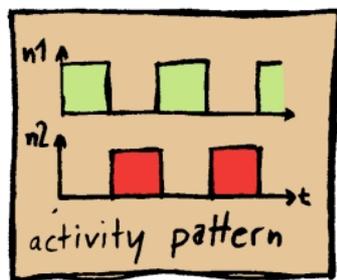
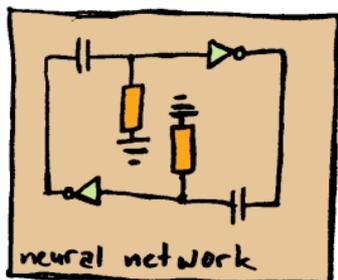
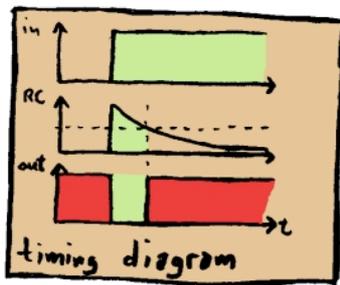
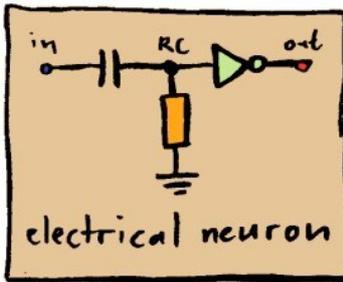


analog robots

a hands-on, playful workshop in building 'life-like' electromechanical artifacts that walk.



about



in this workshop we show how to build analog robots, that crawl and react to obstacles.

every such robot consists of a body, a circuit board, 2 motors, and batteries, the whole is connected by some wires.

the robot's motion results from alternating rotation directions of the 2 motors, arranged in perpendicular planes

the controller, that generates the signals to drive the motors, is the simplest realization of a neural network: 2 neurons that mutually activate each other.

the 2 robots we will build in the workshop use a slightly more complex network of 4 neurons connected in a ring.

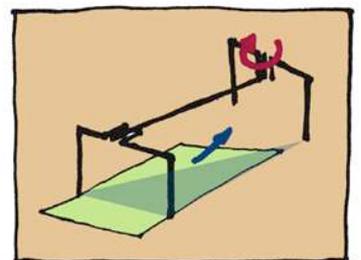
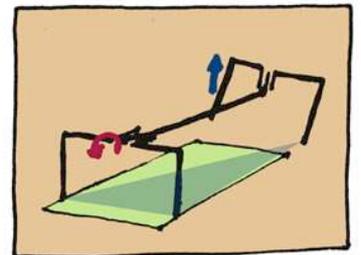
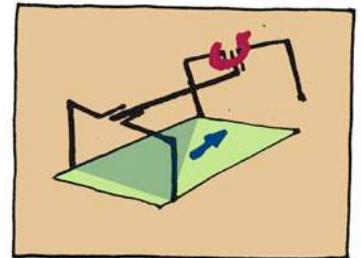
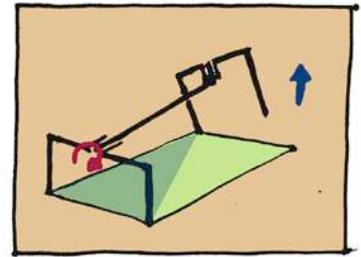
a neural loop is part of central pattern generators, which are the foundation of rhythmic movement in animals.

we use a timed thresholding unit as technical approximation of neural processing.

it is realized by an resistor-capacitor element, and an inverter. the rc-element determines the neurons timing behavior.

as the motors are part of the whole loop their feedback influences the timing of the neurons, giving the robot adaptivity without any sensors.

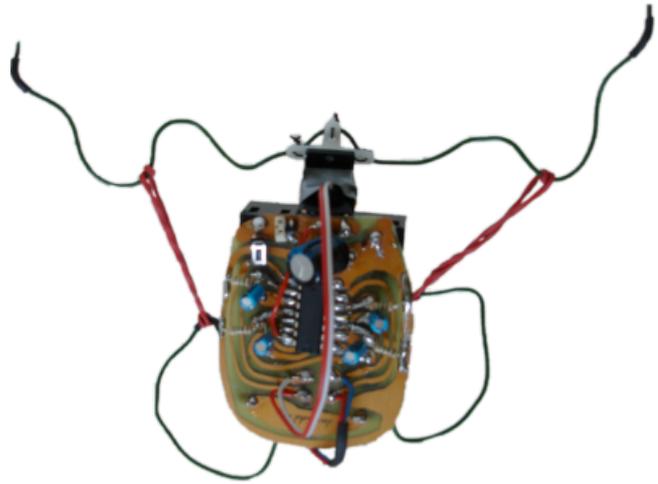
this circuit is also referred to as the microcore¹.



¹ microcore by mark w. tilden

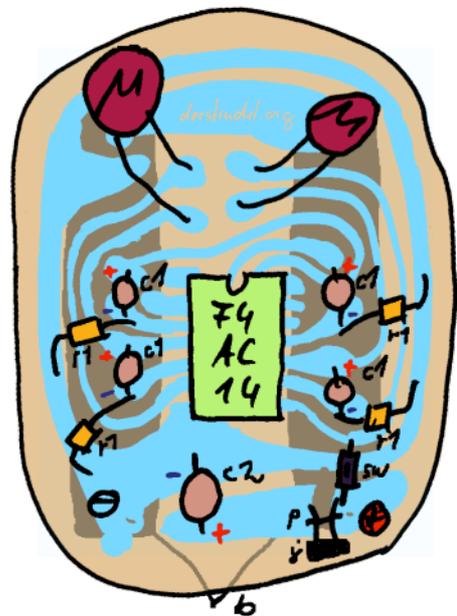
bot nr.1

a simple microcore based robot that walks.
takes approximately 2 hours to build.

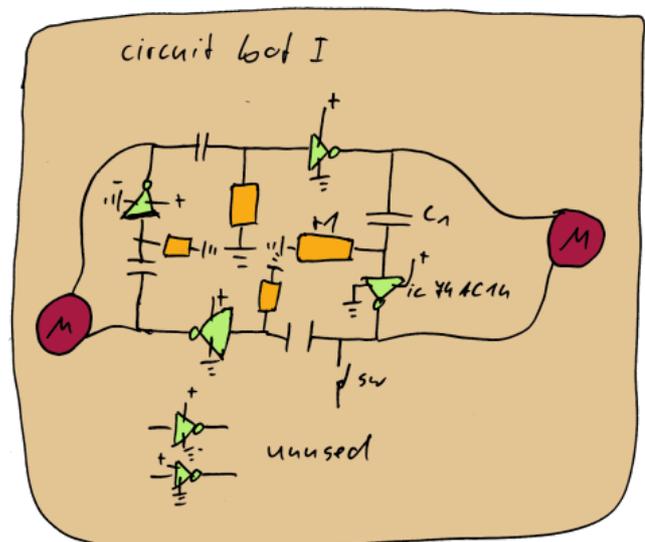


building instructions

- start with the servo hack on page 6
- glue the 2 battery-packs (b) and then solder the pins.
- prepare the inverter (74AC14) by bending its legs. then solder it.
- bend and solder the 4 capacitors (c1), **attention** take care of the polarities.
- bend and solder the 4 resistors (r1)
- bend and solder the big capacitor (c2)
- solder the 2 pins (p)
- solder the switch (sw)
- solder the 4 motor cables
- put batteries and the little jumper and test.

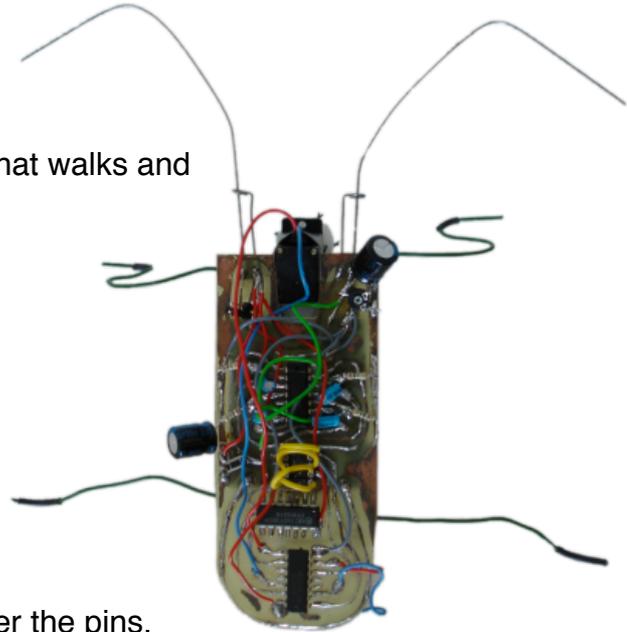


circuit schematic



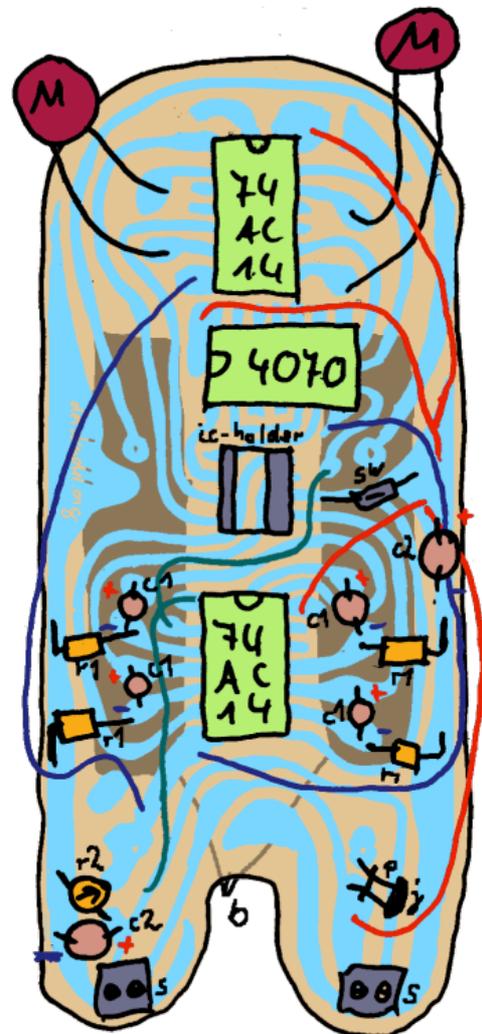
bot nr. 2

a bit more complex microcore based robot that walks and senses obstacles.
takes approximately 4 hours to build.

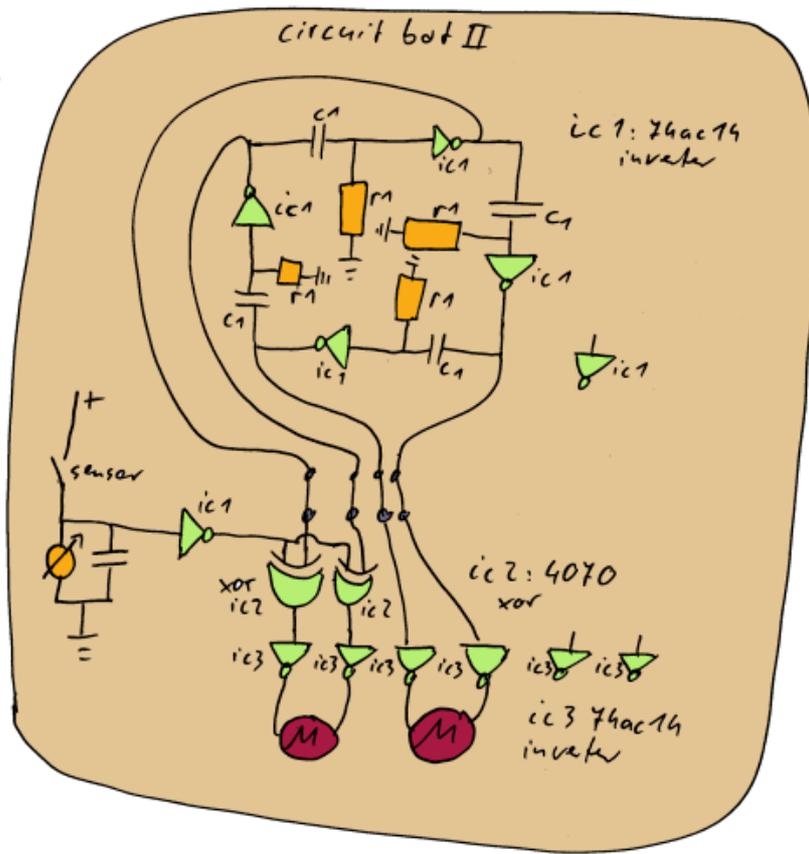


building instructions

- start with the servo hack on page 6
- glue the 2 battery-packs (b) and then solder the pins.
- prepare the inverter circuit (lower 74AC14) by bending its legs. then solder it.
- bend and solder the 4 capacitors (c1), **attention** take care of the polarities.
- bend and solder the 4 resistors (r1)
- bend and solder the 2 big capacitors (c2)
- solder the variable resistor r2
- solder the 2 pins (p)
- bend and solder the ic-holder
- solder the switch (sw)
- do a first test and plug the motor cables to the ic holder, the motors should turn, and simultaneously switch direction when forced to.
- bend and solder the xor (4070)
- bend and solder the second inverter (74AC14)
- solder the 2 motors
- solder the 2 sensor holders (s)
- put batteries and the jumper and test the connections on the ic-holder to get a working walking pattern.

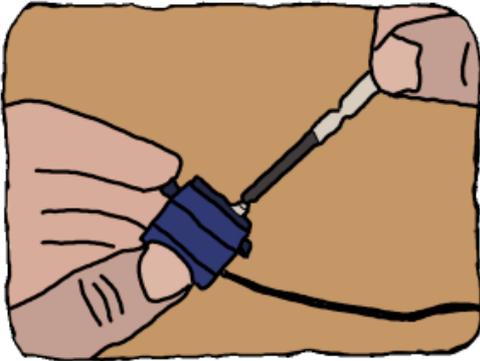


circuit schematic

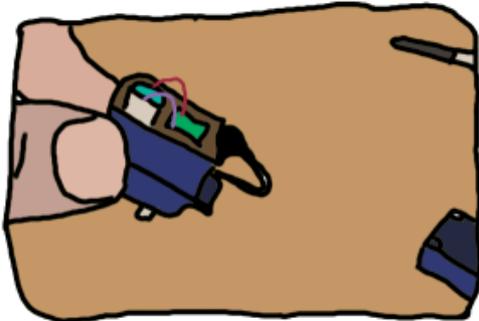


the servo hack

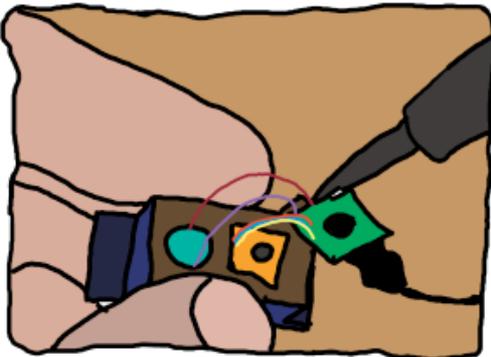
- secure the little screw.



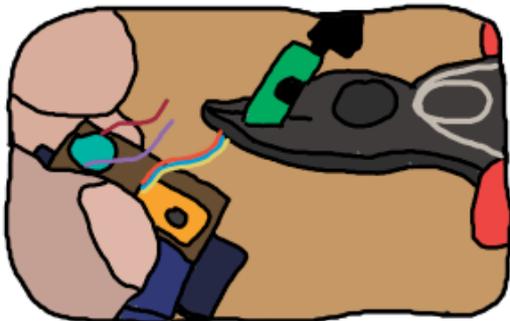
- open the bottom cap, keep the top cap closed.



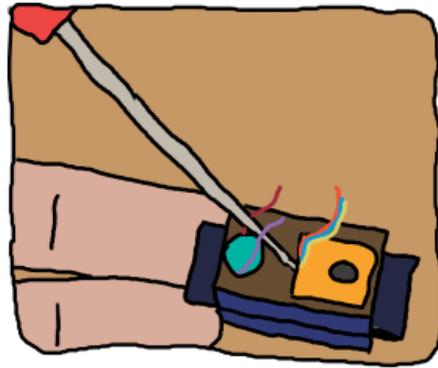
- unsolder the motor cables.



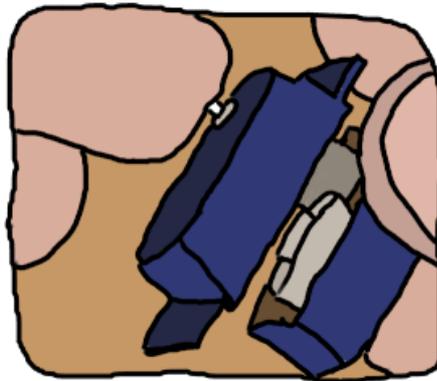
- cut the 3 cables from the poti.



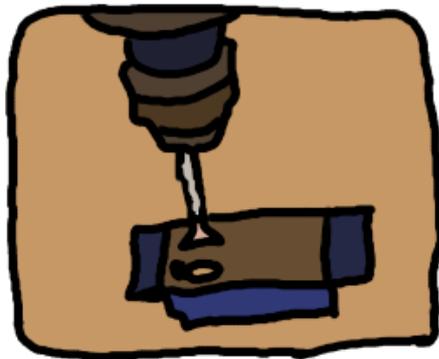
- pull out the potentiometer



- open the the top cap carefully while pressing on the output shaft.



- with the proxon remove the little part sticking out at inside of the top cap next to the hole of the output shaft.



- clean the top cap and put it back on top of the gears.

- solder 2 cables to the motor cables, use shrinking tubes to avoid short circuits and put the cord grip as it was before.

- close the motor put the screws back and test it with a battery

