Braitenberg Vehicles: Robots That React to Light Stimuli

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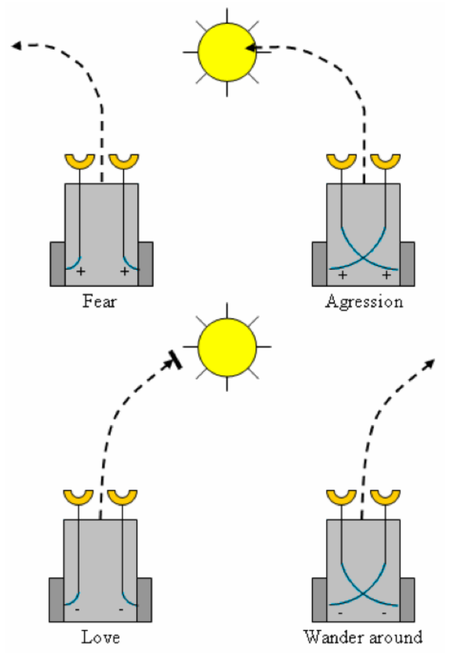
Introduction to Braitenberg Vehicles

Cyberneticist Valentino Braitenberg published the book *Vehicles: Experiments in Synthetic Psychology* in 1984. He describes the evolutive way that simple agents can exhibit complex behavior. Robots can demonstrate basic reactive behaviors just like animals with very little work on the roboticists part. Braitenberg vehicles are a series of robots that react to environmental stimuli in distinct ways. Specifically, the vehicles react to light stimuli. How the vehicles react depends on their current behavioral state as determined by their code, with each machine being able to mimic four “behaviors”. In animals, this behavioral reaction is called phototaxis.

Behavior Visual



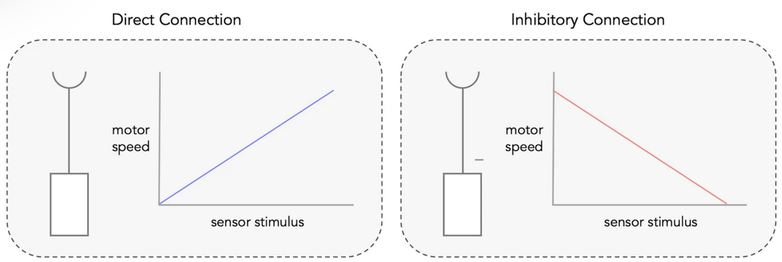
Four Behaviors of Agents

Fear

This vehicle cowardly runs away from light sources. The more intense the light, the faster it drives in the other direction. This is the result of a positive direct correlation between motor speed and light stimuli.

Aggression

This vehicle violently turns toward light and drives at it with high velocity, as if to destroy it. It is like Fear but with crossed sensor-motor connections. This is also the result of a positive correlation between motor speed and light stimuli.



Love

This vehicle amorously turns toward light and follows it. When farther away, it quickly runs up to it, and as it approaches, it slows down to a stop and admires it closely. This is the result of a negative correlation between motor speed and sensor stimulus.

Explorer

This vehicle adventurously goes up to light sources that are farther, but once near, it speeds off in search of other sources. The closer it gets, the more quicker it drives to new places. This is also the result of a negative correlation between motor speed and sensor stimulus.

Robot Setup

Photocell Sensors

To react to light stimuli in the environment in interesting ways, each Braitenberg vehicle has two primitive light sensors. Each sensor is attached to the front of the vehicle, one on the left in front of the left wheel, and one on the right. This way, light that is not head on in front of the vehicle will hit each sensor at different intensities, causing the vehicle to react accordingly.

Motors & Wheels

Corresponding to the two light sensors, there are two wheels and two motors on the vehicle. One side’s wheel and motor reacts to one of the sensor’s input, and the other side’s wheel and motor reacts to the other sensor, exclusively.

Wiring

For two of the vehicles, Fear and Love, the left sensor is wired to the left motor, and the right sensor is wired to the right motor. For Aggression and Explorer, the wires cross sides so that the right sensor is wired to the left motor and the left sensor is wired to the right motor.

State Design