Framsticks experiment definitions

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What is an *experiment definition*?

- It is an important script that controls the behavior of the Framsticks system.
- Written in FramScript – a scripting language similar to JavaScript, Java, or C++.
- All scripts are `*.expdef` files and you can modify them – if you know what you are doing ⌣̈
- More details on scripts can be found in another presentation – `scripting.pdf`.
- A few examples of experiment definitions are mentioned on the following slides, along with their key parameters.

Evaluates all genotypes in the gene pool. During simulation, the output signal of each neuron is analyzed, and its average and standard deviation are computed. These data are then saved in the 'Info' field of the genotype.

Key parameters

- Evaluation time

generational.expdef

- a simple "evolutionary algorithm" experiment
- two gene pools (previous and current generation)
- one population for individuals
- generational replacement of genotypes
- fitness formula defined directly by users

Key parameters

- Initial genotype
- Gene pool size
- Mutation and crossover probabilities
- Evaluation time

standard.expdef

- complex experimental setup (many parameters)
- one gene pool
- one population for individuals
- one "population" for food
- steady-state evolutionary optimization
- fitness as a weighted sum of performance values or a custom formula
- selection: tournament or roulette (with fitness scaling)

Key parameters

- Initial genotype
- Gene pool size, World capacity
- Mutation and crossover probabilities
- Fitness criteria weights
- Selection method (positive and negative)
- Energy consumption/balance
- ...

reproduction.expdef

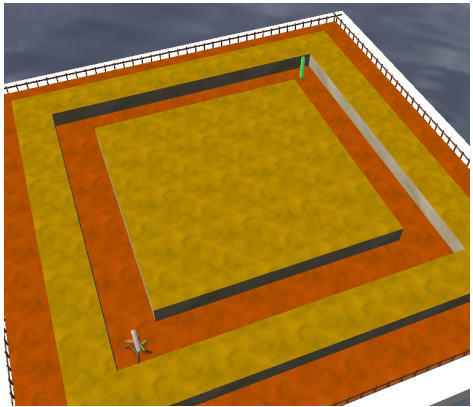
- endogenous fitness evolution
- asexual reproduction
- each creature with a sufficient energy level produces a mutant offspring, which is born near its parent
- food is created at a constant rate and placed randomly

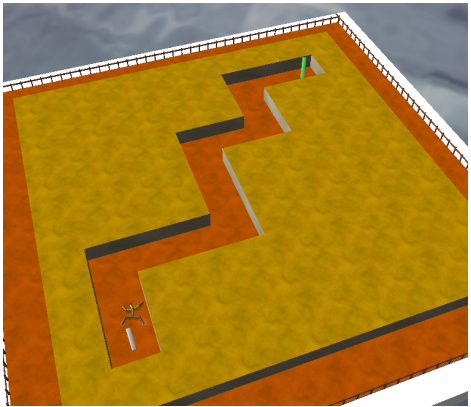
Key parameters

- Initial genotype
- Mutation probability
- Starting energy
- Reproduction energy
- Feeding rate

mazes.expdef

- `standard.expdef` modified to support simple mazes
- users can define a map with starting and target positions and headings
- maximized fitness is
  - energy left (when target found during lifespan), or
  - distance to the target (as a negative value)





Other experiment definitions

- `standard-eval.expdef` – evaluates loaded genotypes thoroughly one-by-one, and produces a report of performance averages, standard deviations, and average evaluation times. No evolution is performed.
- `standard-log.expdef` – logs all genetic and evaluation operations, producing a detailed history of evolutionary process. Useful for various analyses.
- `standard-tricks.expdef` – serves as an example of a few advanced techniques: random force can be applied to parts of a living creature during its life span, neuron property values can be used in the fitness function, and some statistical data can be acquired from coordinates of simulated creature parts.
- `deathmatch.expdef` – an educational tool intended for use in practical courses in evolutionary computing, evolutionary robotics, and artificial life. Using "education by competition", it implements a challenging tournament between teams of creatures, as well as between teams of students. To win, a team has to provide a creature which stays alive longer than creatures submitted by other teams. To stay alive, creatures need energy which can be collected by touching energy resources, winning fights, avoiding fights, cooperation, etc. More details here.