Evolutionary Robotics

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Keywords

Individuals: A specific instance of a training variable

Population: A group of individuals (mu)

Offspring: New individuals created from individuals in the population (lambda)

Fitness: How well an individual is doing

Hits: Negative feedback

Weight: Generally a number between 0 and 1 used to find a desired output strength

Binary Encoded: 01110010

Real Encoded: {-30,-30,-30,1}-{30,30,30,512}

A Design Perspective
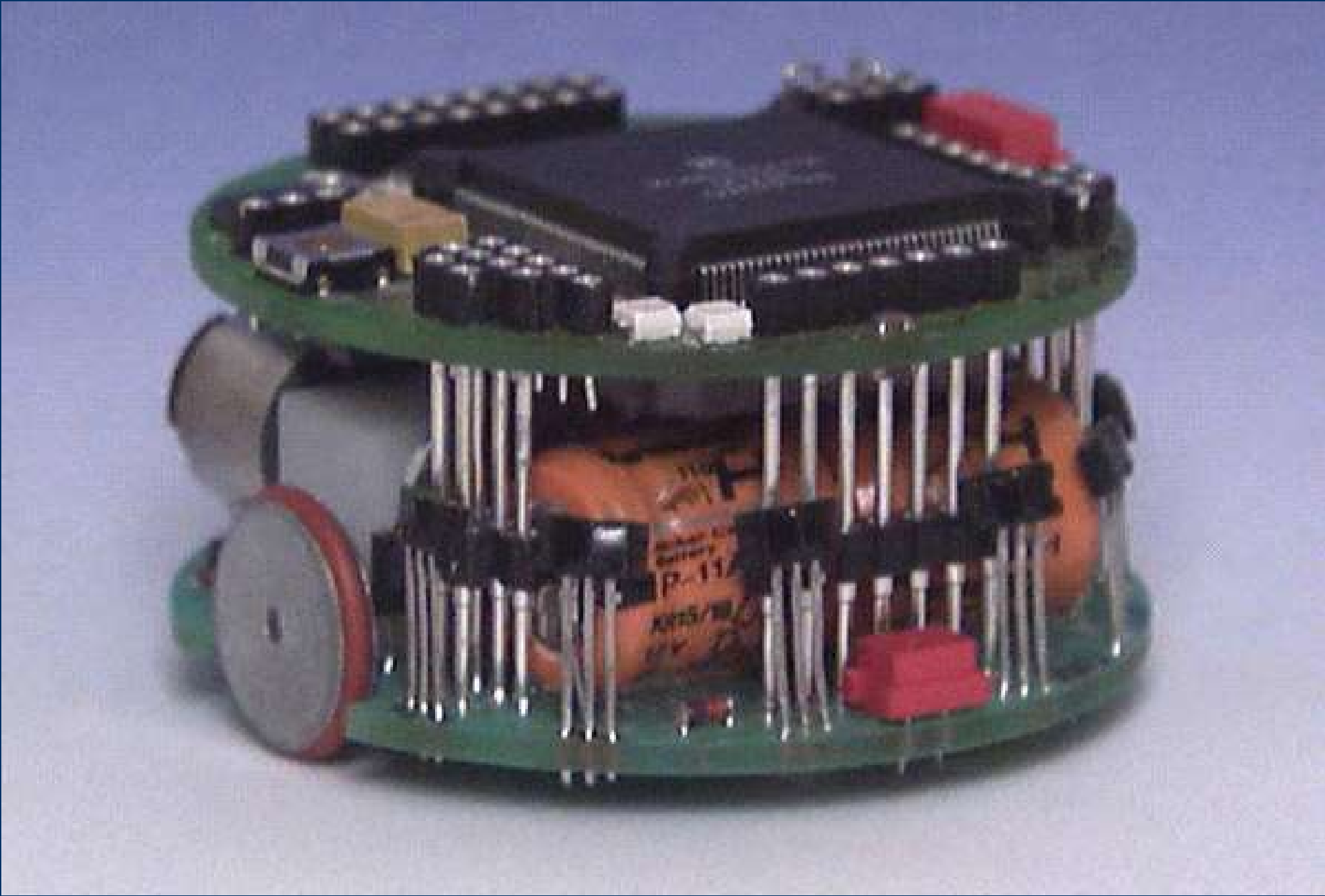
Divide and conquer - Perception, planning, action
Building blocks - build layers upon layers
Distal vs Proximal descriptions of behavior
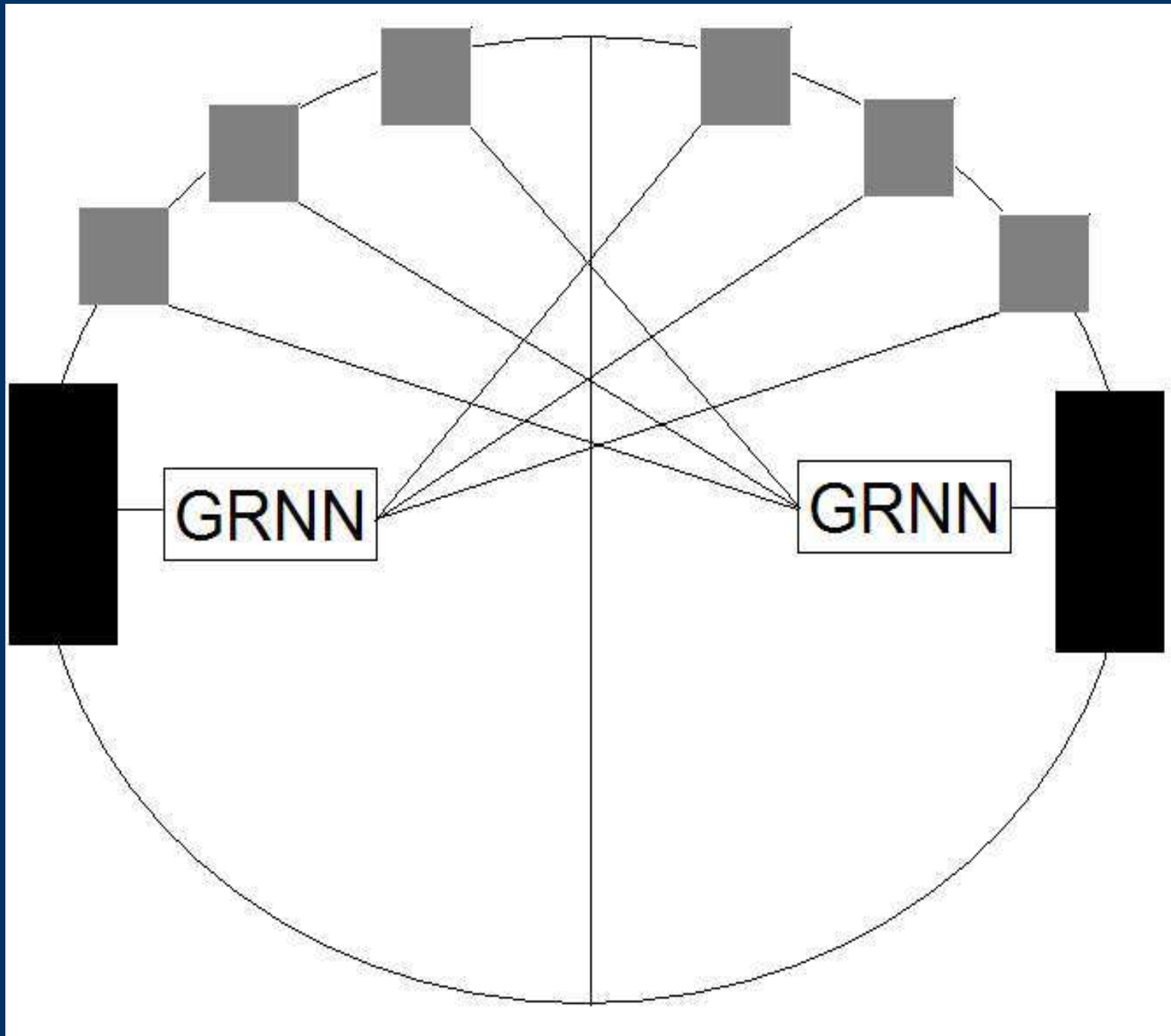Genotype vs Phenotype descriptions of response
Example Scenario: Explore, avoid walls, approach
target, discriminate target from wall

Khepera Design Aspects

- 55 mm in diameter
- 33 mm tall
- 68331 Motorola processor
- 8 infra-red sensors
- Max speed 127 mp (motor pulses)
- Roughly one meter per second

The Individuals

Four values

First three weights range from -30 to 30

- Effects wheel speed
- Each corresponds to a specific sensor

Final rate ranges from 0 to 512

- Effects overall motor speed
- "Sigma value"

Example individual: {-20,4,18,423}

The IEC

1) Random population is generated
2) Each individual controls the robot for 4 seconds*
3) User interfaces with robot
4) 2 individual tournament
5) Least hits wins
6) Construct difference rules
7) Evolve individuals
*unless aborted

The MEC

1) Khepera stops moving to "meditate"
2) Continues tournament, generates distance vector
3) Uses distance vectors generated during IEC for comparison
4) Evolution continues as previously mentioned

Biased Mutation Operator

Keeps track of user preference in distance vector
Uses preference to move mutation window

Example:
- Current mutation operator: -12...12
- P(High): 20 P(Low)8 for 30 vectors
- (20/30)-(8/30): .266...
- (-12...12)+(24*.266...) = -6...18

*Still in testing, minimal difference seen so far.

Questions? Comments?