



# Splinoids project outline

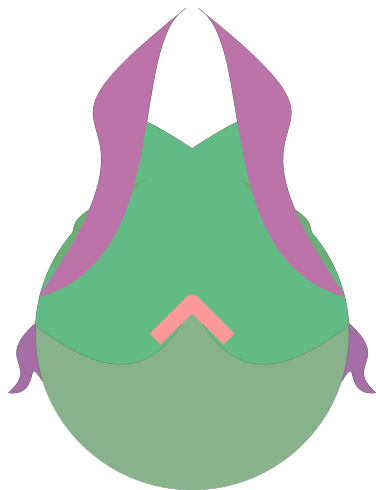
GODIN-DUBOIS Kevin

April 6, 2020

foo

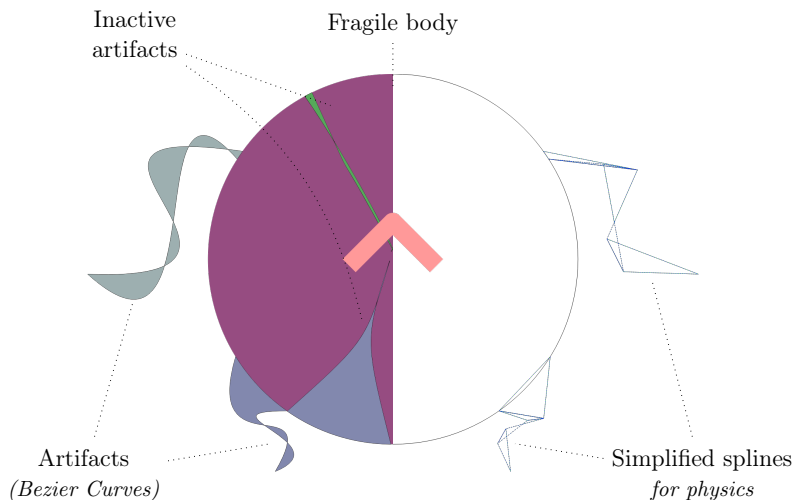
# Splinoi

# Spline + Boids



- 2D creatures
- Low-level combat
- Low-level vision
- Growth
- Autonomous reproduction
- Sexual dimorphism

# Anatomy



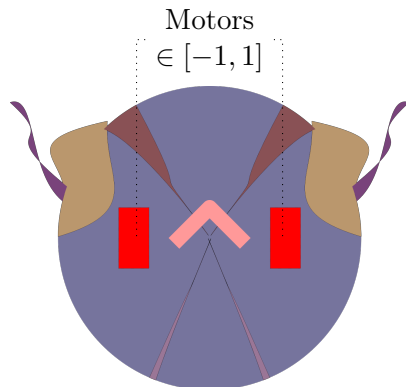
# Combat

- Based on physical collision of primitives
- Both creatures receive damage<sup>1</sup>
- Artifacts are denser and more resilient than the body
- Health regenerates but is costly

---

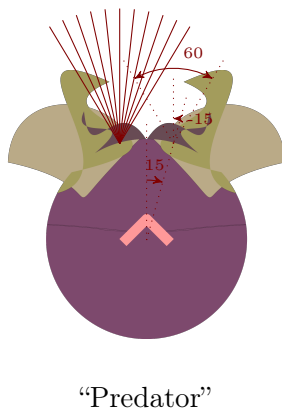
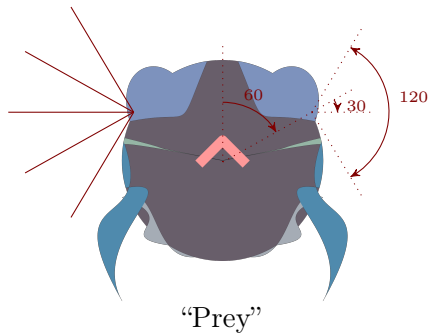
<sup>1</sup>Unlike [2]

# Motion



Tank-like behavior:  
 $\{ 1, 1 \} \rightarrow$  Forward  
 $\{ -1, -1 \} \rightarrow$  Backward  
 $\{ -1, 1 \} \rightarrow$  Rotation  
 $\{ 1, -1 \} \rightarrow$  Rotation

# Vision



Parameterized by number of rays and angles

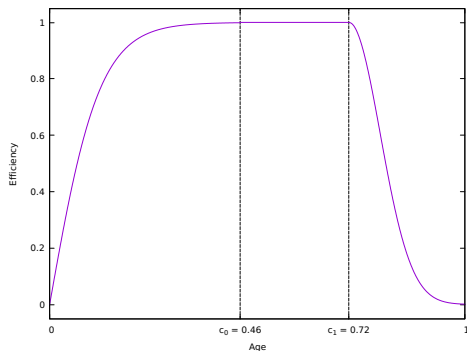


# Audition

Not implemented

- Similar approach to [1]
- Multiple emission channels (neural-controlled)
- As many reception
- Hearing range managed by physics engine
- Signal intensity = strength / distance<sup>2</sup>

# Life-Cycle



Age conditions life-step:

- $[0, c_0]$  youth
- $[c_0, c_1]$  maturity
- $[c_1, 1]$  old age

# Life-Cycle

## Youth



- Progressive growth of body size and artifacts
- Initial states are highly vulnerable

# Life-Cycle

## Maturity

- Reproductive behavior
- Based on energy accumulation<sup>2</sup>
- ANN-controlled decision
- Not yet implemented

---

<sup>2</sup>as in [3]

# Life-Cycle

## Senescence

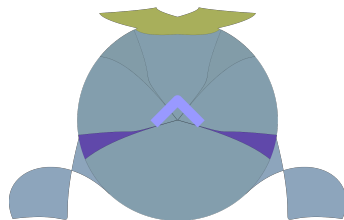
Reduction of maximal speed

> increased chance of starvation and being preyed upon

# Sexual dimorphism



Female



Male

Identical genotype (except gender)

→ different phenotypes (shapes and colors)

# Metabolism

- Energy extracted from plants or corpses
- Baseline life cost
- Consumed energy returned to the environment

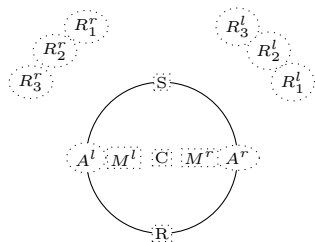
# Metabolism

Clock speed

- ANN-controlled value
- Genetically controlled bounds
- Impacts:
  - Motion speed
  - Resource absorption
  - Resource consumption
  - Regeneration



# Neural controller

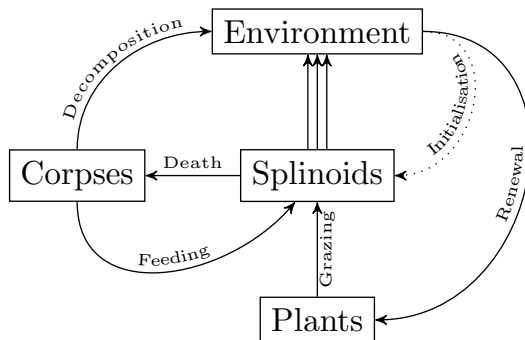


Inputs
$R_i^s$ : retina cell triplet (r,g,b) $i$ on side $s$
$A^s$ : auditive cells (equal to number of channels)
—: proprioceptors (health, energy, efficiency)
Outputs
$M^s$ : motor
$C$ : Clock speed
$R$ : Reproduction
$S$ : Multi-channel signal

Most nodes are geometrical  $\rightarrow$  HyperNeat?

# Environment

# Environment



Closed system with constant total energy level

# Environment

Potential genetic variables:

- Size
- Taurus (bool)
- Obstacles (distribution)
- Plants (distribution)

# Extensions

# Extensions

- Asymmetrical offspring investment  
→ Emergence of sexual specialisation?
- Day/night cycle  
→ Darkening of colors  
→ Emergence of night-vision?

- References



David Kadish, Sebastian Risi, and Laura Beloff. “An artificial life approach to studying niche differentiation in soundscape ecology”. In: *The 2019 Conference on Artificial Life*. Cambridge, MA: MIT Press, 2019, pp. 52–59.



Thomas Miconi. “Evosphere: Evolutionary dynamics in a population of fighting virtual creatures”. In: *2008 IEEE Congress on Evolutionary Computation (IEEE World Congress on Computational Intelligence)*. IEEE, June 2008, pp. 3066–3073.



Peter Paul Pichler and Lola Cañamero. “Evolving morphological and behavioral diversity without predefined behavior primitives”. In: *Artificial Life XI: Proceedings of the 11th International Conference on the Simulation and Synthesis of Living Systems, ALIFE 2008* (2008), pp. 474–481.