CE810 - Game Design 2

Lab - Searchable Design Spaces

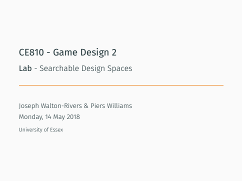
Joseph Walton-Rivers & Piers Williams

Monday, 14 May 2018

University of Essex

2018-05-25

CE810 GD2



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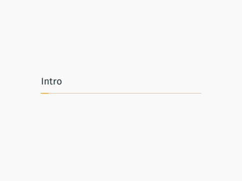
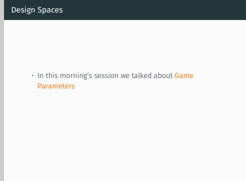
[2]

Intro


Intro

Design Spaces

- In this morning's session we talked about **Game Parameters**



Design Spaces

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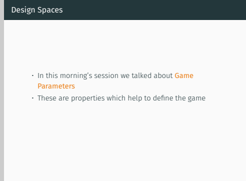
- Why is this dependance possibly an issue?

Design Spaces

- In this morning’s session we talked about Game Parameters
- These are properties which help to define the game



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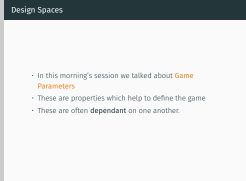
- These are often **dependant** on one another.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Flappy Bird

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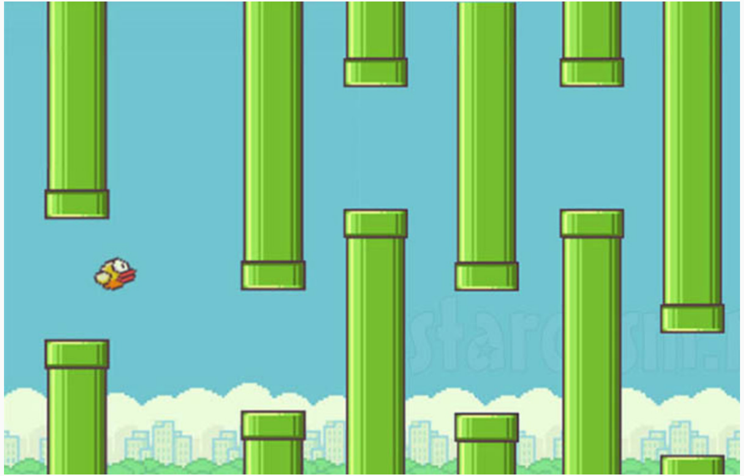
└─Flappy Bird

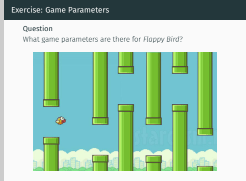
Flappy Bird

Exercise: Game Parameters

Question

What game parameters are there for *Flappy Bird*?





Exercise: Game Parameters

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What game parameters are there for *Flappy Bird*?

Answer: Game Parameters

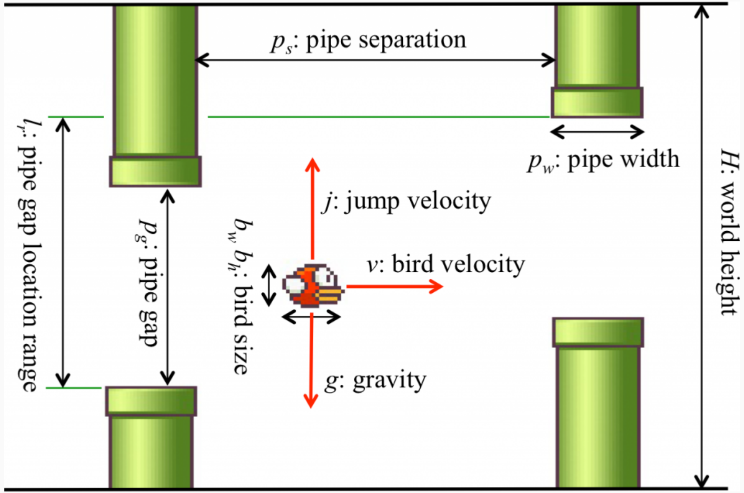

Figure 1: paramters by Isaksen et al @ NYU

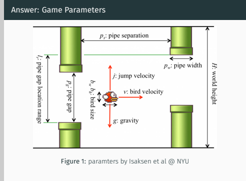
Answer: Game Parameters

Figure 1: paramters by Isaksen et al @ NYU

Flappy Birds

Activity

Go to the *Flappy Bird* demo and change the sliders.
How does changing the parameters affect the gameplay?

http://game.engineering.nyu.edu/projects/exploring-game-space/ [1]

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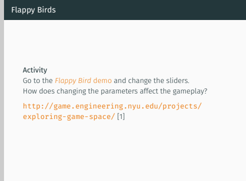
└Flappy Bird
└Flappy Birds



Flappy Birds

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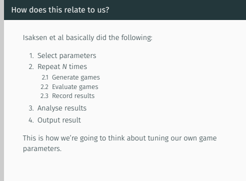
How does this relate to us?

Isaksen et al basically did the following:

1. Select parameters
2. Repeat *N* times
   - 2.1 Generate games
   - 2.2 Evaluate games
   - 2.3 Record results
3. Analyse results
4. Output result

This is how we’re going to think about tuning our own game parameters.



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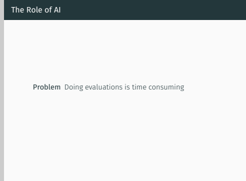
The Role of AI

Problem Doing evaluations is time consuming



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Solution Make AIs that play them

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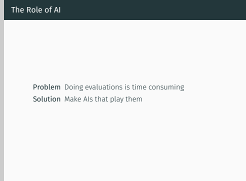
└─Flappy Bird
└─The Role of AI


The Role of AI

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Asteroids

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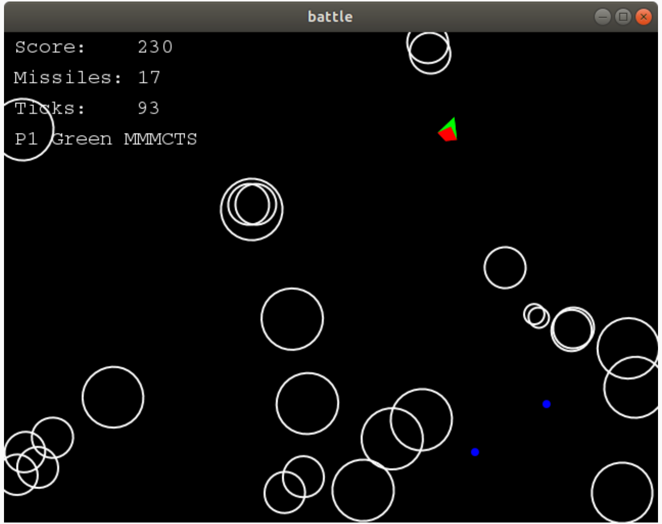
└─Asteroids

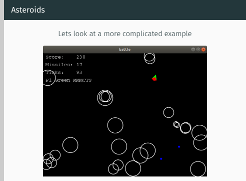
Asteroids

Asteroids

Lets look at a more complicated example



```
Score:     230
Missiles:  17
Ticks:     93
P1 Green MMMCTS
```

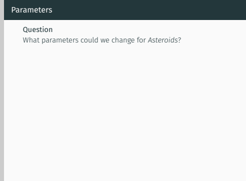

Asteroids

Lets look at a more complicated example

Parameters

Question

What parameters could we change for *Asteroids*?



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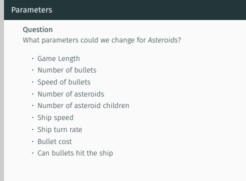
What parameters could we change for *Asteroids*?

- Game Length
- Number of bullets
- Speed of bullets
- Number of asteroids
- Number of asteroid children
- Ship speed
- Ship turn rate
- Bullet cost
- Can bullets hit the ship



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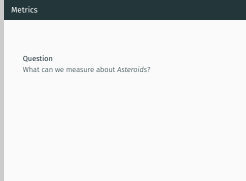
What can we measure about *Asteroids*?



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Only some examples

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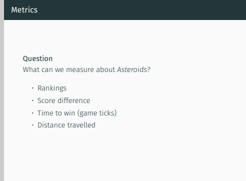
What can we measure about *Asteroids*?

- Rankings
- Score difference
- Time to win (game ticks)
- Distance travelled



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What can we measure about *Asteroids*?

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Only some examples

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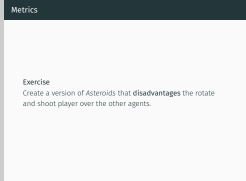
Exercise

Create a version of *Asteroids* that **disadvantages** the rotate and shoot player over the other agents.



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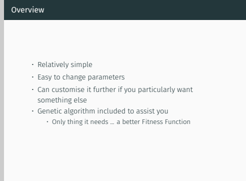
Asteroids Codebase

Asteroids Codebase

Overview

- Relatively simple
- Easy to change parameters
- Can customise it further if you particularly want something else
- Genetic algorithm included to assist you
    - Only thing it needs … a better Fitness Function



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Running a Game

```
SimpleBattle battle = new SimpleBattle(true, params);
BattleController p1 = new SingleMCTSPlayer(new Random());
battle.playGame(
  p1,
  new MultiRecorder(scoreRecorder, bulletRecorder)
);
```

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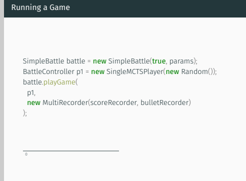

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Most examples shortened for fitting in the slides

Parameters?

```
int[] params = new int[N_PARAMS];
Arrays.fill(params, -1);
params[N_MISSILES] = 200;
```

The set of parameters currently supported is in that handy list from slide 9

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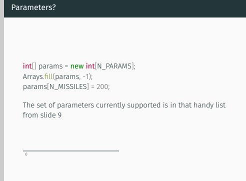

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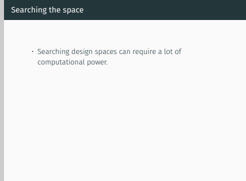

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We will cover how they work later

Searching the space

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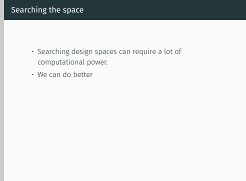

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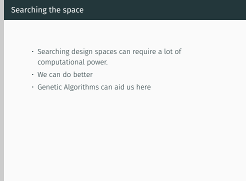
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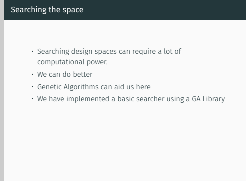
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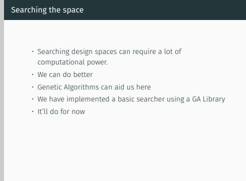

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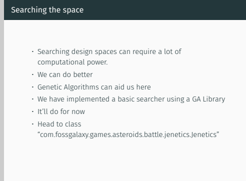

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Jenetics: Parameters

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Arrays.fill(USING, false);
USING[N_MISSILES] = true;
USING[BULLET_TIME_TO_LIVE] = true;
USING[SHIP_MAX_SPEED] = true;
USING[SHIP_STEER_RATE] = true;
USING[BULLET_KILL_SHIP] = true;
```

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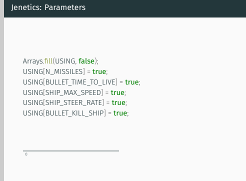

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0

Jenetics: Limits

```
int[][] limits = {
  {10, 500}, // N_MISSILES
  {20, 100}, // BULLETT_TIME_TO_LIVE
  {1, 10},
  {5, 50},
  {0, 1}
};
```

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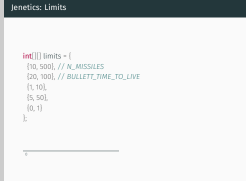

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Jenetics: Chromosomes

```
// Convert limits to the chromosomes
List<Chromosome<IntegerGene» genes = Arrays
  .stream(limits)
  .map(x -> IntegerChromosome.of(x[0], x[1], 1))
  .collect(Collectors.toList());

// Chromosomes to genotype
Factory<Genotype<IntegerGene» genotype =
 ↪    Genotype.of(genes);
```

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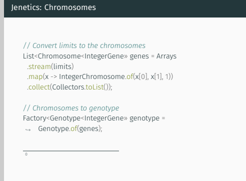
└Asteroids Codebase
└Jenetics: Chromosomes



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Jenetics: Fitness

```
int[] params = getParamsFromGenotype(genotype);
AIExperiment experiment = new AIExperiment(5,
 ↪   controllerFunctions, params);
Map<String, List<Integer» scores = experiment.run();
Map<String, Integer> avg = new HashMap<>();
for(Map.Entry<String, List<Integer» entry : scores.entrySet()){
avg.put(
entry.getKey(),
entry.getValue().stream().mapToInt(Integer::new).sum() / 5);
}
return avg.get(”PiersMCTS”) - avg.get(”RotateAndShoot”);
```

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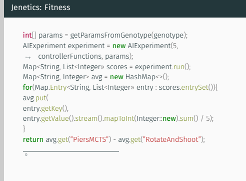
└Jenetics: Fitness



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Jenetics: Engine

```
ExecutorService exec = Executors.newFixedThreadPool(3);
final Engine<IntegerGene, Double> engine = Engine
  .builder(Jenetics::fitness, genotype)
  .populationSize(50)
  .executor(exec)
  .optimize(Optimize.MAXIMUM)
  .build();
```

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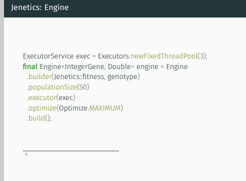
└Asteroids Codebase
└Jenetics: Engine



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Jenetics: Running it

```
final Genotype<IntegerGene> result = engine.stream()
  .limit(limit.byExecutionTime(Duration.ofMinutes(120)))
  .limit(300)
  .peek( x-> {
    System.out.println(”Generation: ” + x.getGeneration());
    System.out.println(”Best Fitness: ” + x.getBestFitness());
    }
  )
  .collect(EvolutionResult.toBestGenotype());

System.out.println(result);
```

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└Asteroids Codebase

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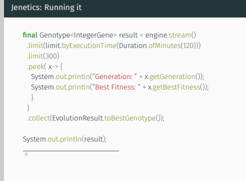

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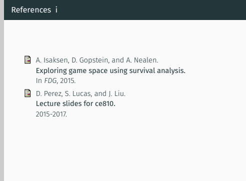
  Exploring game space using survival analysis.
  In *FDG*, 2015.
- D. Perez, S. Lucas, and J. Liu.
  Lecture slides for ce810.
  2015-2017.



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