

CO345 Ludic Computing

Lecture I

Introduction to Ludic Computing

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<http://ccg.doc.ic.ac.uk/wiki/doku.php?id=ludic>

Ludic Computing

lu•dic |'loōdik|

adjective formal

showing spontaneous and undirected playfulness.

ORIGIN 1940s: from French *ludique*, from Latin *ludere* 'to play,'
from *ludus* 'sport.'

- The study of design, construction and evaluation of software for interactive play
- Entertains and enriches the user
- Cuts across many areas of computing

Ludic Computing

We focus on **digital games** and **computer art**

- Video game AI
 - Content creation for digital media
 - Supporting creative expression
1. Content generation (7 lectures)
 2. Ludic agents (5 lectures)
 3. Players (3 lectures)

Part One

Content Generation

- Computational creation of **beautiful** artefacts
- What have creativity and beauty got to do with ludic computing?
 - Computers can help overcome the **content creation** bottleneck for digital media (such as video games)
- Computers can support creative expression

Lecture 2

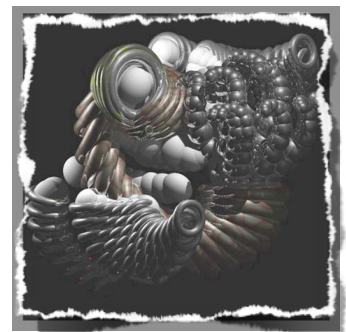
Computational Creativity

- Building software which takes on some of the creative responsibility in arts and science tasks
- Which AI techniques lend themselves to creative software?
 - Genetic programming, case-based reasoning, conceptual blending
- Methods for handing over creative responsibility
- How to assess progress?
 - Process vs. artefacts, measures of creativity

Lectures 3 and 4

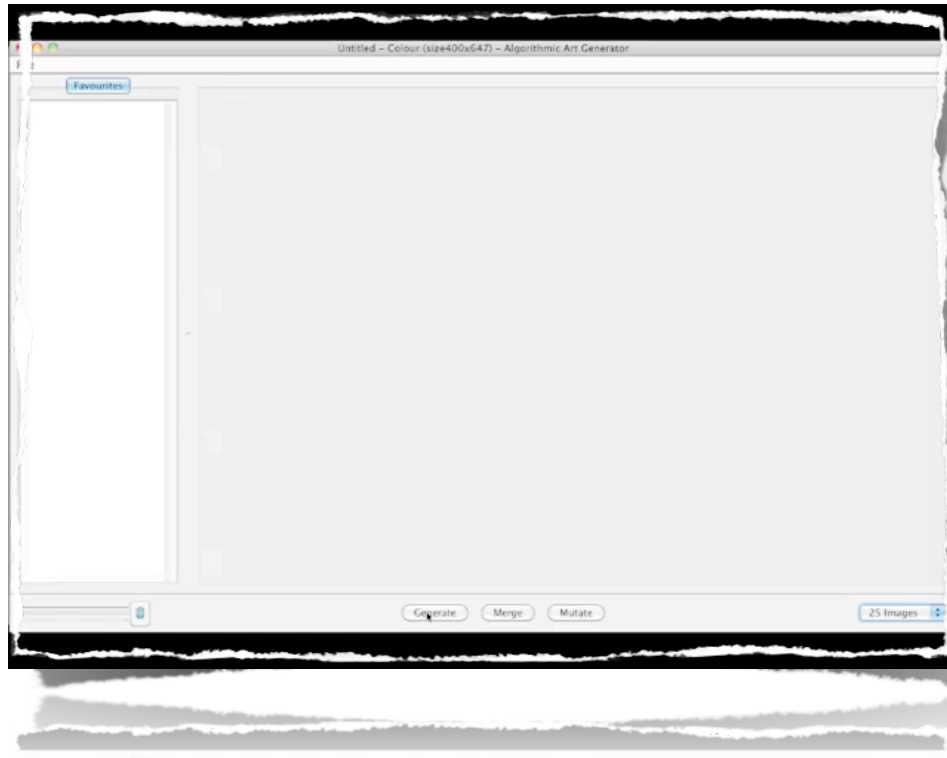
Evolutionary Design

- Genetic algorithms and genetic programming
 - Coding schemes
 - Fitness functions and selection mechanisms
 - Evolutionary operators: crossover and mutation
- Applications
 - Evolving building designs
 - User-guided evolutionary design
 - Computer art



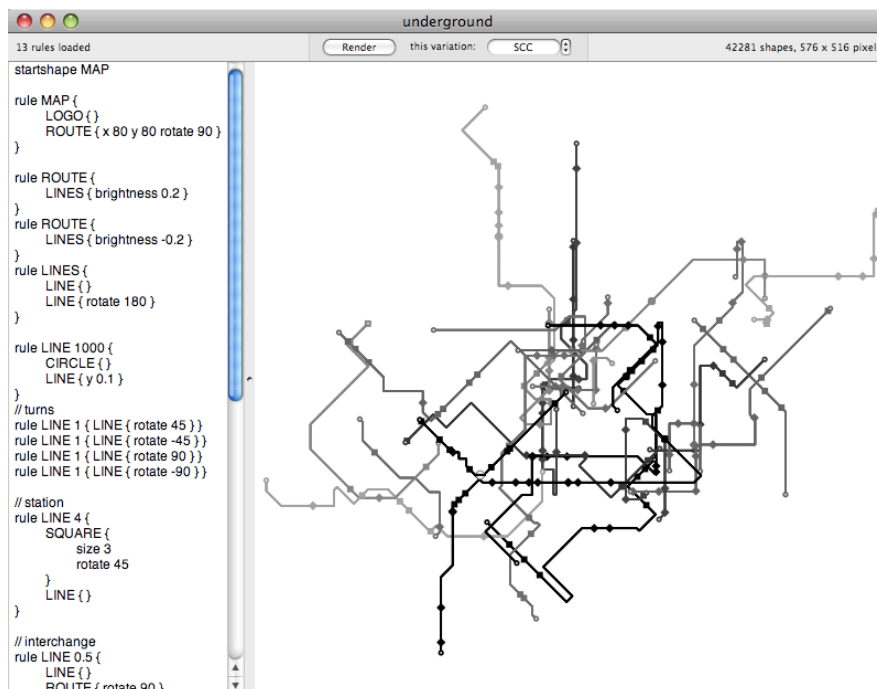
Lectures 3 and 4

Evolutionary Design



Lecture 5

Shape Grammars



Lecture 6

L-Systems

- Another approach to visual grammars
- Abstract art
- Vegetation/terrain generation
- City Generation (CityEngine and Subversion)



Lecture 7

Image Filters

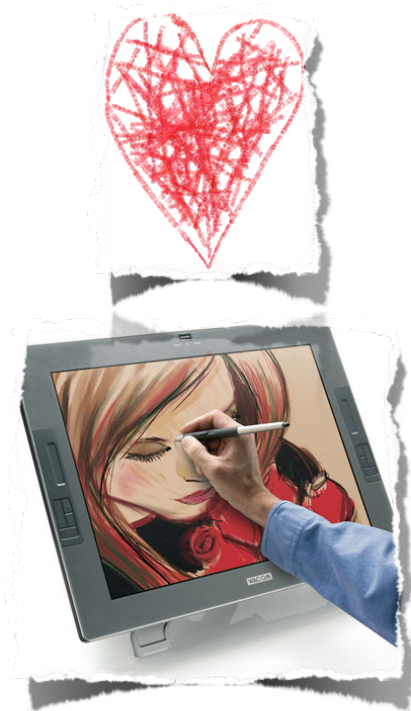
- Transforms, compositors & filter trees



Lecture 8

Non-photorealistic Rendering

- Simulating natural media
- Brush paths
- Watercolour and pencil simulation
- Image segmentation
- Rendering colour regions



Lecture 8

Non-photorealistic Rendering



Part Two

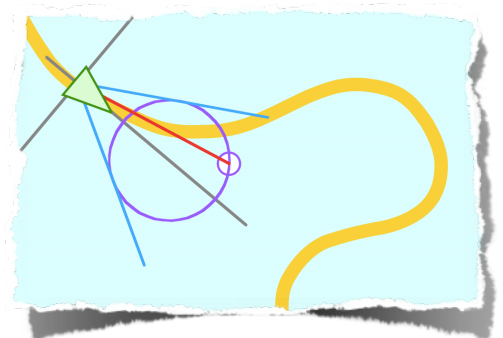
Ludic Agents

- AI agents that support playful interactions
- Game playing agents
 - Video games, board games, ...
- They often need to act intelligently in complex and dynamic virtual worlds
- More importantly, they need to entertain

Lecture 9

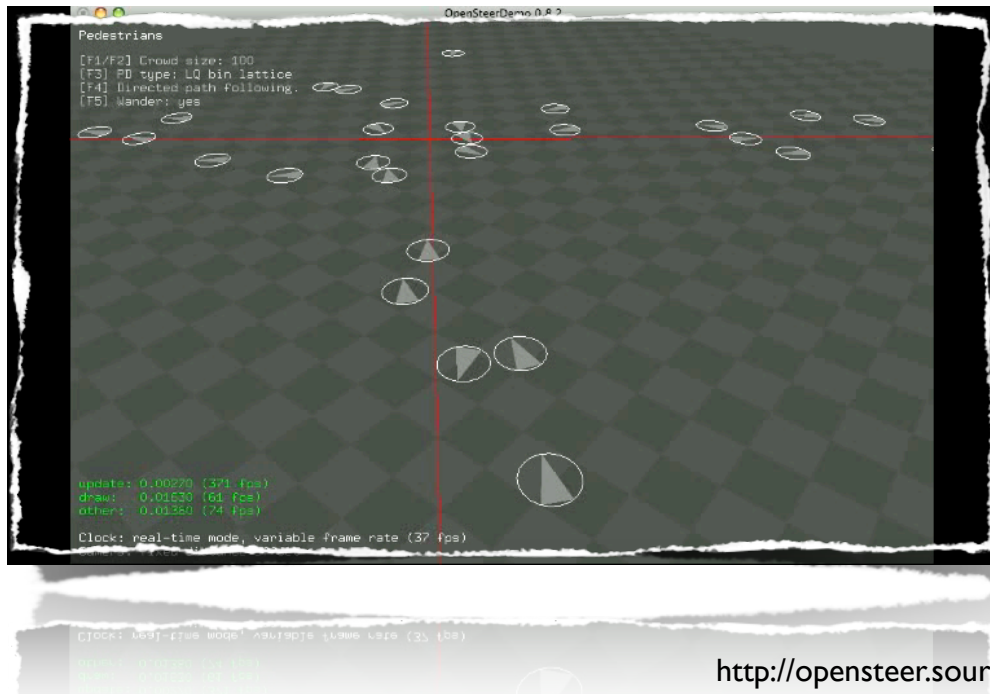
Steering Behaviours

- Reactive movement in games
- Reynold's steering paradigm
- Some basic behaviours in detail
- Combination techniques
- Emergent behaviour



Lecture 9

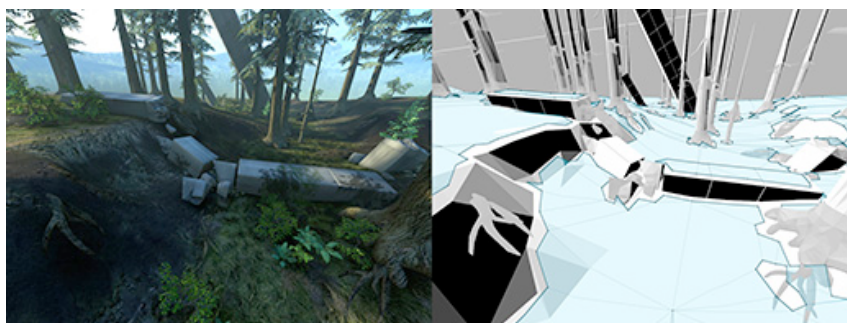
Steering Behaviours



Lecture 10

Pathfinding

- Using tiles, waypoints, navigation meshes
- Heuristic search over navigation graphs
- Precomputing paths



Lecture 11

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- ```

graph TD
 Root((?)) --> L1L[→]
 Root --> L1R[→]
 L1L --> L2L1[Door open?]
 L1L --> L2L2[Move (into room)]
 L1R --> L2R1[Move (to door)]
 L1R --> L2R2((?))
 L1R --> L2R3[Move (into room)]
 L2R2 --> L3R2L[→]
 L2R2 --> L3R2R[→]
 L3R2L --> L4R2L1[Door locked?]
 L3R2L --> L4R2L2[Open door]
 L3R2L --> L4R2L3[Barge door]
 L3R2R --> L4R2R1[Door open?]
 L3R2R --> L4R2R2[Door open?]

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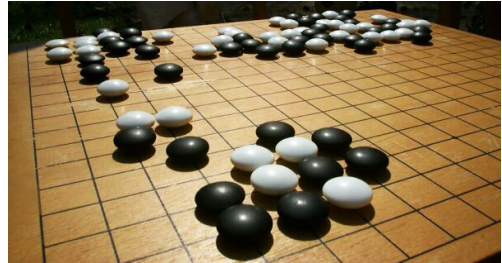
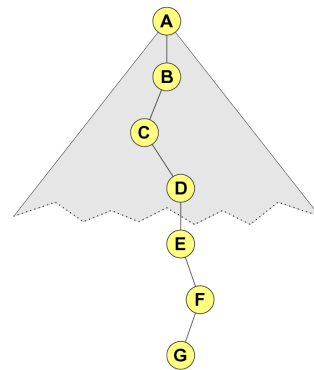
# Lecture 12

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## Lecture 16

# Monte Carlo Tree Search

- State-of-the-art game playing agents based on Monte Carlo methods
- Capable of beating professional Go players



## Part Three

# Players

- To build software for play we need to understand players
- What do they experience?
- What motivates them?
- How do we design for them? (And measure success?)

## Lecture 13

# Interactive Play

- What is play?
- Player experience of video games
- Theories of emotion & pleasure in games
- Altered states: immersion & flow



## Lecture 14

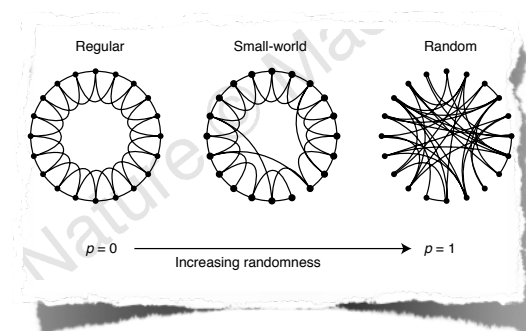
# Designing for Play

- How is designing a game different from designing any other interactive system?
- Game design theory
  - Design concepts and methods
- Evaluation methods
  - Measures of playful experience

# Lecture 15

## Social Networks

- Social networks & games
- Network measures and properties
- Degree distributions
- Applications: friendship, trust and recommendation networks; online communities; social gaming; etc.
- Models of network growth
- Diffusion of innovations



## Lecture Schedule

| Week | Thu 4pm                    | Fri 2pm                     |
|------|----------------------------|-----------------------------|
| 2    | 1. Introduction      2. CC |                             |
| 3    | 3. Evolutionary Design I   | 4. Evolutionary Design 2    |
| 4    | 5. Shape Grammars          | 6. L-Systems                |
| 5    | 7. Image Filters           | 8. NPR Rendering            |
| 6    | 9. Steering Behaviours     | 10. Pathfinding             |
| 7    | 11. Behaviour Trees        | 12. Adaptive Games          |
| 8    | 13. Interactive Play       | 14. Designing for Play      |
| 9    | 15. Social Networks        | 16. Monte Carlo Tree Search |
| 10   | 17. Revision lecture       |                             |

Subject to change!

# Logistics

- Guest lecturer: Cameron Browne
  - Computational Creativity Group ([ccg.doc.ic.ac.uk](http://ccg.doc.ic.ac.uk))
- Lectures: Thursday at 4pm in room 311 and Friday at 2pm in room 145
- Tutorial immediately after the 4pm lecture on Thursdays
  - No tutorial today
  - No lecture tomorrow
- Slides on web (at start of each week). No handouts

# Logistics

- No background required: AI, graphics and/or HCI would help
- Individual coursework
  - Two weeks in end February
  - Based on Ludic Agents material
- Exam
- <http://ccg.doc.ic.ac.uk/wiki/doku.php?id=ludic>

# Student Feedback

The module ran for the first time in 2009-10

- “Love it!”
- “Very enjoyable”
- “Best course of this year”
- “Too much material”
- “Lacked a bit of focus”
- “Too fluffy”

## Additional Reading

Context for the Module

- Buckland: Programming Game AI by Example. Wordware, 2005. ISBN 1556220782
- Salen & Zimmerman: Rules of Play: Game Design Fundamentals. MIT Press, 2003. ISBN 0262240459
- Strothotte and Schlechtweg: Non Photorealistic Computer Graphics: Modeling, Rendering and Animation. Morgan Kaufmann, 2002. ISBN 1558607870