Modelling and Transformation

Statechart Modelling of Computer Controlled Characters

Overview

- Introduction
- Specifying NPC behaviour
  - About the game
  - Specifying in statecharts
- Using the statecharts
- Conclusion
- Demo
- Question

Universiteit Antwerpen

INTRODUCTION

Universiteit Antwerpen

SPECIFYING NPC BEHAVIOUR

Universiteit Antwerpen

About the game

- Humans vs Infected
  - Infected dies after 100s
  - Human becomes infected if touched
  - Last man standing
  ⟹ Humans run away, Infected chase

Universiteit Antwerpen

Different abstraction levels

- Based on [1]
- Allows for modular statecharts
  - Keeps them interchangable
  - Reusable
  - Simple,
- Statecharts made in atom³
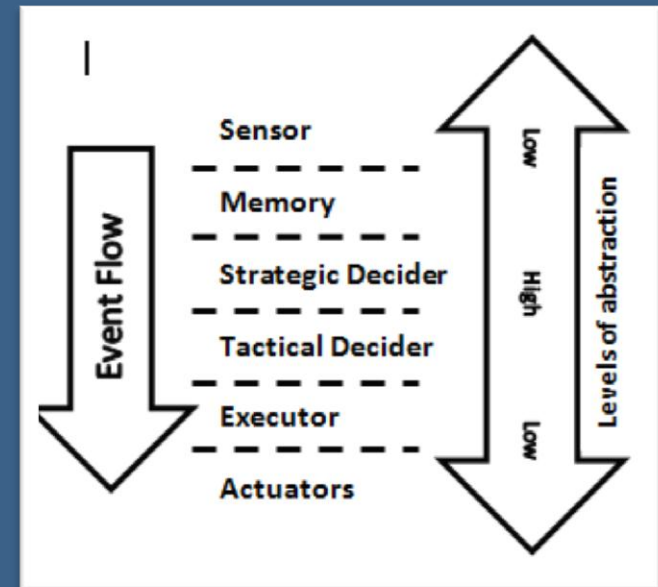
[1] - Model-Based Design of Computer-Controlled Game Character Behavior - Kienzle, Jörg, Denault, Alexandre , Vangheluwe, Hans – 2007 - Springer Berlin / Heidelberg
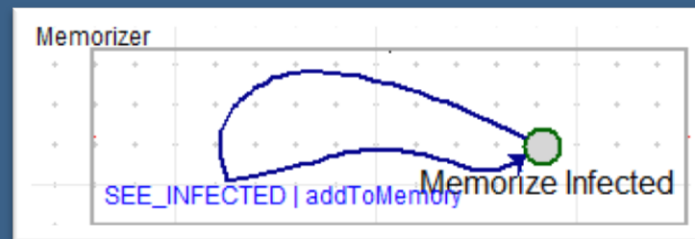
Universiteit Antwerpen

Sensor

- Eyes
- Same for healthy and infected
- Event generated if something is spotted

Universiteit Antwerpen
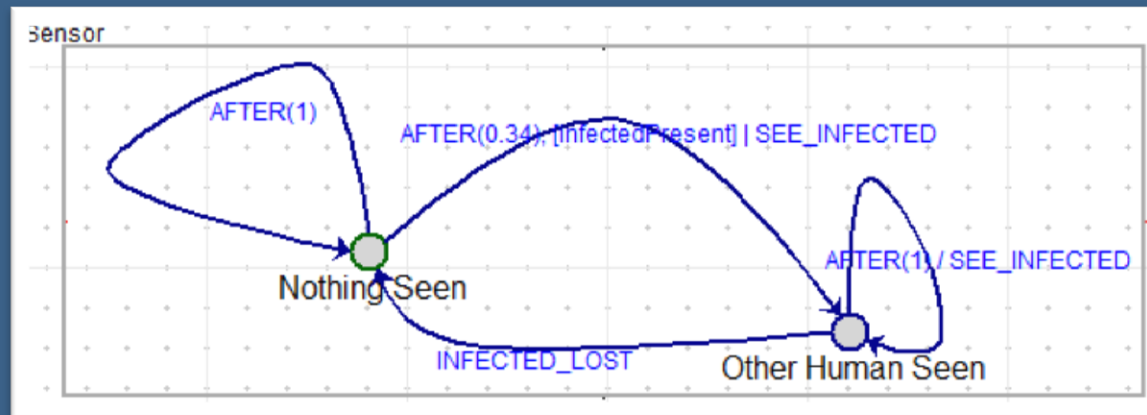
Memory

- Well… Memory
- Remembers where we saw something
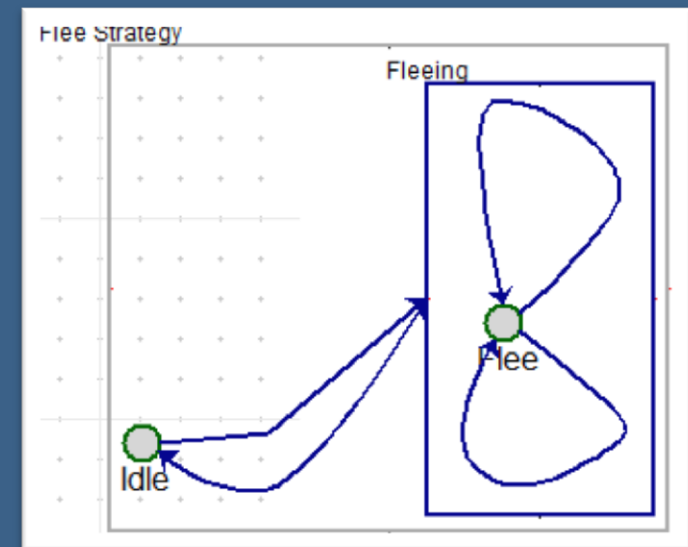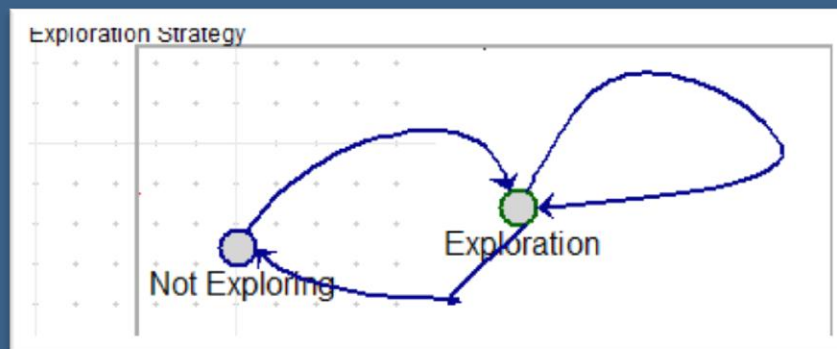

Universiteit Antwerpen

Strategic Decider

- Behave in a certain way
  - Because of certain events
- Different for healthy and infected
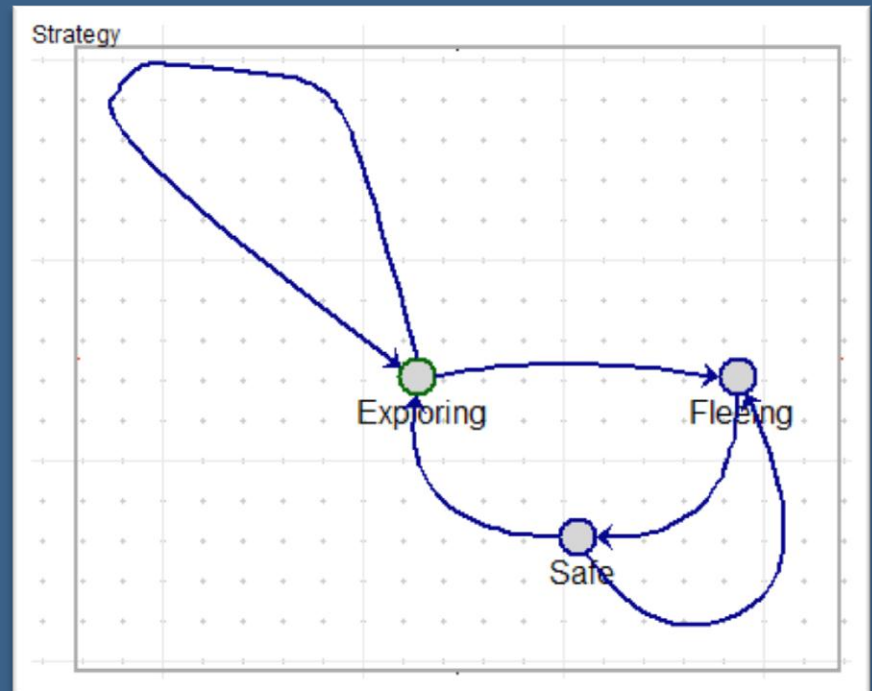
Tactical Decider

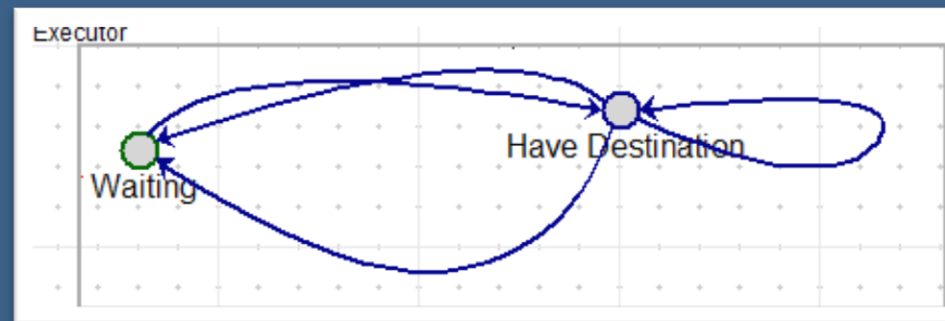- Specifying each behaviour
  - How do I attack? Flee?

Universiteit Antwerpen

Executor

- I'm exploring...what do I have to do?
  - Translate behaviour into actuator events

Actuator

- Feet
  - Moving or not?

Universiteit Antwerpen
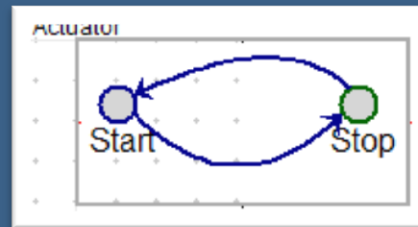
Putting it all together

- All orthogonal components
  - Put together in one composite component
- Allows behaviour like:
  - After 100 seconds, die.
    - Independent of what you are doing
  - If touched, become infected
- Obligated because of framework

Universiteit Antwerpen

USING THE STATECHARTS

Universiteit Antwerpen

To python code

- Uses SCC[2]
- Every entity represented by actor
  - "Attach" compiled statechart to actor
  - Updated every pass of main loop (±33 ms)
    - Has to be finished!
    - Game hangs if not
      - Did not happen in this case..

[2]: Thomas Huining Feng – SCC -http://msdl.cs.mcgill.ca/people/tfeng/uml/scc/

Universiteit Antwerpen

Timing issues?

- Statechat can "miss" events
  - For example: reaching a waypoint
  - Normally: If reached, next loop detected
  - But: Takes 2 or 3 loops
    - Entity keeps moving..possibly no longer at waypoint

- Possibly caused by framework?
  - If no timing specified on guards: Hangs

Universiteit Antwerpen

Solution?

- Generate event in code
- Correct the deviation
- Just take it into account when designing
  - Avoid the problem!

CONCLUSION

Universiteit Antwerpen

Pros

- Easier to develop
  - Can be used by non-programmers!
- Higher abstraction
  - No knowledge of specific algorithms needed
- Reusable
- Easy to adapt
- Easy to represent complex structures and interactions

Universiteit Antwerpen

Cons

- Still code needed for specific algorithms
  - Maybe the algorithm can be represented on a higher level?
- Scalable: 50 entities made the game crash
  - Depends on the framework used?

Universiteit Antwerpen

Do what when?

- Made the mistake: coding first, statecharts later
  - Should have been the other way around!
- Where do statecharts stop and does code begin?

Universiteit Antwerpen

Conclusion

- Very usable for this type of problem
  - Some quirks, but can be solved

Universiteit Antwerpen

How we are all going to die..
DEMO

Universiteit Antwerpen

Thank you for your attention.
QUESTIONS?

Universiteit Antwerpen