Designing Games around AI

Antonios Liapis and Michael Cook

Tutorial Roadmap

- AI in games, in research, in research games, in game research
- Making and breaking games
- Game design vocabulary
- AI-based game design patterns
- Brainstorming bit of the tutorial (crosses fingers)
- Getting out there

Instead of trying to solve hard AI problems posed by the needs/tropes of commercial or competition games...

AI can pose hard problems to game design and allow for new gameplay experiences.

Commercial vs Research

AI in Academia

- In theory, "to stay ten to fifteen years ahead of industry"
- In practice, this is hard to nail down. Where is the industry? What does 'ahead' mean?
- Academic AI:
 - Solution to a problem
 - Benchmark (competition)
 - Testbed for an algorithm
 - Performance Metric

AI in AAA Games

- Generally kept to what we know how to do well.
- Reduces risk, reduces implementation time.
- Tends towards AI techniques that are highly robust we want variety, but variety is hard to test, and AI often have unpleasant edge cases.
 Tends to be limited in purpose: outside of the memorable experiments, most AI in games is adversarial combat.



No-one likes generalizations!

Plenty of interaction between the communities.

Academia is commercial AI.

Commercial games *are* experimenting with AI.

Grow Home/Grow Up

Procedural animation system becomes quirky platforming mechanic.

Alien: Isolation

Experience persistent fear as a truly dynamic and reactive Alien uses its senses to hunt you down and respond to your every move.





Zoom Mark Target Back Exit Menu

[1] Map

TARGET SELECTION

Select a Target to hunt, or Zoom in to learn more information.



Strengths / Weaknesses Unknown

Target Located at Fort Morn.

ME: Shadow of Mordor

Game built around the procedurally generated bosses & their mechanics.

Menu



A Puzzling Present

Levels and game mechanics created by genetic algorithms.

Galactic Arms Race

Sarrin Maan

- WORK

Weapon particles and power adapted via collaborative interactive evolution.

Weapon 1

Weapon 2

Weapon 3

8000 8000

Xents [7]



Increased. You are healed, and your max hit points have increased. The door doesn't budge... You take 8 domage. You take 8 domage. You take 1 domage. Kobold takes 3 domage.

Unexplored

Cyclic dungeons generated by grammar-based systems.





A common concern: "Are we having impact on the games industry?"

Remember: you are part of the games industry.



Anyone can make games





It's not a big deal





It's the perfect time to start!

Source: WoCinTech

Designing Broken Games

Broken Is Good

- Major commercial developers, particularly ones targeting consoles, have continuously raised the bar for polished, perfect games. Eep!
- A lot of grassroots communities, particularly for PC games, will forgive a lack of polish if games are interesting, inspiring or innovative.
- These communities are huge, welcoming, vibrant and filled with creative people we can learn from and share ideas with.
- AI is often unappealing for game development because it is often broken so why not embrace it, and **make broken games!**



Glitch art

Using digital or analog errors for aesthetic purposes, either by corrupting digital data or by physically manipulating electronic devices)

ROM Check Fail

Engaging, genre-defying tech mashup. See also: *Multibowl* (coming soon) SCORE 71912

PERFORM PERFORMANCE

Goat Simulator

"MILLIONS OF BUGS! We're only eliminating the crashbugs, everything else is hilarious and we're keeping it"



Octodad

"Be surprised by the randomness of Octodad's flailing or express your own sense of humor by making Octodad do silly things."

TRESH PRODUCE

The hair heals you.

A Rogue Dream

"Like playing a game against the Internet"















You are in: Prison, Humboldt University of Berlin

It says:

The Right Honourable

The Right Honourable (The Rt Hon.) is an honorific style traditionally applied to certain persons and to certain collective bodies in the United Kingdom, Canada, Australia, New Zealand, some other Commonwealth realms, the Anglophone Caribbean, Mauritius and occasionally elsewhere.

The following people are mentioned in this book:

Margaret Thatcher Chris Patten

And the following place: Lincolnshire

Data Adventures

It is both unavoidable and desirable that a degree of absurdity in the resulting adventures remains.





SUSPECTED CODE SMUGGLER'S CODE



PRESS SPACE TO TRANSMIT

PACKAGES

Contrabot

Does this idea work? Let's see! (It didn't, but it only took 24 hours!)







What Are You Doing

Ambitious ideas are always clearer when they're playable!



CLAY

ť٦

PODS ACTIVATED: D

391FT - JUMP (2)

Built in just 12 hours. Simple, ugly, minimal - but playable...

Q∕W: -∕+ EROSION

R/5:

-/+ DENSITY

Tombs of Tomeria

FLIP SWITC

up Arro

RENEG

...developed into another game, still simple, less broken....

start game

- 1 Grey guy
- 2 Blue guy
- 3 Green guy
- 4 Brown guy

Broken Is Good

A lot of major games communities thrive on the unusual, the surprising, the weird, to entertain people with new experiences!

Broken Is Good

It makes your games human, and it makes your research relatable. People 'get' robots falling over more than they get a perfect game of Go.

It's A Big World Out There

Not everyone likes broken, but it's not all about mainstream impact - even 0.1% of the gaming

market is a vast group <mark>of pe</mark>ople.

Game Design Principles

Introduction

Game design vocabulary can help identify where the AI can be used.

Also helps communicating, documenting and testing game features!
Game Mechanics: methods invoked by agents, designed for interaction with the game state.





Miguel Sicart: Defining Game Mechanics (http://gamestudies.org/0802/articles/sicart

Game Rules: Causal relations between game elements and their consequence to particular game states.

NO ENTRY

Järvinen, A. (2008). Games without Frontiers: Theories and Methods for Game Studies and Design. Tampere: Tampere University Press. **Game Goals:** Mechanics are means to guide the player into particular behaviour by constraining the space of possible plans to attain goals.

> Järvinen, A. (2008). Games without Frontiers: Theories and Methods for Game Studies and Design. Tampere: Tampere University Press.



• Stay alive?

• Kill?

- Stay alive?
- Kill?
- Discover the truth?

• Stay alive?

- Kill?
- Discover the truth?
- Level up?

YOU HAVE REACHED

a la

314

 \oplus B | E C T I V E S The Breached Kee \Box Find the Bastic

- Stay alive?
- Kill?
- Discover the truth?
- Level up?
- Reach Point B?

- Stay alive?
- Kill?
- Discover the truth?
- Level up?
- Reach Point B?
- Earn a higher revenue?







Progression: What makes people keep playing?





* * / * * * //

• More levels?

FIDS







C RESISTANCE

ODGE MELEE ATTACKS

Progression: What makes people keep playing? - VERY FAST SPEED

- More levels?
- More enemies?



Silvermoon is Full Position in queue: 1012 Estimated time: 64 min

nge Realm

Progression: What makes people keep playing?

- More levels?
- More enemies?
- Rules changing?
- Multi-player challenge?

Aesthetics: When players apply the different mechanics on run-time and react on the output, emotional responses are evoked in the player.



Hunicke, R., LeBlanc, M., Zubek, R. 2004. MDA: A Formal Approach to Game Design and Game Research. Proceedings of the Challenges in Game AI Workshop, Nineteenth National Conference on Artificial Intelligence.

Sensation

Game as sense-pleasure

la Lug



Are you serious?



Challenge Game as obstacle course

Ē.

Ö۵

80

6

Ð

<Obsine@rd@renden>

Jenkins)rdo>

Fellowship Game as social framework

Baby B



Discovery Game as uncharted territory

Expression Game as self-discovery







Gameplay Loops:

- The player starts with a mental model that prompts them to...
- Apply an action to the game system and in return receives feedback that...
- Updates their mental model and starts the loop all over again. Or kicks off a new loop.

Daniel Cook, Loops and Arcs (http://www.lostgarden.com/2012/04/loops-and-arcs.html)

Gameplay Arcs:

- An arc is a broken loop you exit immediately
- The mental model changes once
- Can be used in a sequence of arcs ...
- ... or can be mixed with loops
- E.g. a level is an arc, but within it you must explore variations of the core gameplay loops

EXPOSITION

INTRODUCE THE CENTRAL CHALLENGE

TENSION & COMPLICATION

COMPLICATE THE STORY WITH UNEXPECTED OR DEEPENING TURNS

RESOLUTION

RESOLVE THE TENSION DRIVING THE STORY

Daniel Cook, Loops and Arcs (http://www.lostgarden.com/2012/04/loops-and-arcs.html)

OK, so where does the AI go?

Can we put AI in the middle of a game loop?

Can we put AI as a reward mechanism (i.e. aesthetic)?

Can the AI handle the progression?

- PCG has been generating **levels**, **enemies** and **quests** for a while now
- \circ $\,$ AI changing the enemy behavior or the rules?

Interaction with the AI a central mechanic

• Let's try it out...















GO SHOPPING

AI as a Game Design Pattern

Introduction

AI can play multiple roles in a game

Let's try to identify them...

... and then try to see how we can use each algorithm for such purposes.

Mike Treanor, Alex Zook, Mirjam P Eladhari, Julian Togelius, Gillian Smith, Michael Cook, Tommy Thompson, Brian Magerko, John Levine, Adam Smith. AI-Based Game Design Patterns. Proceedings of the 2015 Conference on the Foundations of Digital Games (FDG 2015).
AI is Visualized

- In this pattern, the player gets a visual representation of some aspect of the underlying AI state.
- Gives players a glimpse into systems that are normally hidden away.

Third Eye Crime: The player sees a visualisation of AI character pathfinding, allowing them to plan out their movement and avoid detection. (*Moonshot Games, 2014*)

A RUMBLER. NICE.

THIS THING'LL MAKE A HELLUVA RACKET WHEN I DROP IT.



AI as Role-Model

- In this pattern, the AI acts as a guide for the player to mimic or follow in some way.
- Makes the player focus more on AI behaviour and highlights its weaknesses, but also converts those weaknesses/strangeness into gameplay.

Practice Sniper mode: you vs nobody

Any 7 of 8 Missions

- Bug Ambassador Contact Double Agent Transfer Microfilm Swap Statue Inspect 3 Stat----Seduce Targe : Purloin Gues List
- Fingerprint Ambassador

Spy Party: One player blends in with AI NPCs while the 2nd player must identify the first player and shoot them. (*Chris Hecker, 2009*)

chat: /help, Enter/y/t, i, PageUp, Esc



AI as Trainee

- Players teach or train by example, in order to get the AI to behave in a particular way to solve a general set of challenges.
- Communicating the effect or efficacy of training is difficult humour is useful to defuse failure or confusion.
- A subgenre that never quite got started, but is perhaps ripe for a revival?

Black and White 2: The god player must train a creature in order to look after the village and fight off enemy creatures. (*Lionhead*, 2005)

AI is Editable

- In this pattern, part of an AI system is exposed to the player and can be directly altered or changed. The AI system is typically core to gameplay.
- This pattern has huge flexibility, but designing the right interface and explaining to the player can be a challenge.



Cygnus Albha 3 Gas World

> **Galactic Arms Race:** In one game mode, players could directly edit the weights of a genetic algorithm responsible for evolving weapons.

(Evolutionary Games, 2010)

🙏 Ship



MeepEep Level: 200 XP: 4699 Credits: 123364 Delsota Starcrusher III Shield: 28000 / 28000 Armor: 29090 / 36000 Hull: 32000 / 32000



😤 Weapons





Target

Sgt. Tolus [76] Human Level: 76 Delsota Solarstriker IX Shield: 7600 / 7600 Armor: 15200 / 15200 Hull: 30400 / 30400 Target: null FPS:60



AI is Guided

- The player helps a simple AI agent survive in a hazardous world.
- Note that this is similar to 'AI as Trainee' but much more direct the player may be able to directly order the AI to do certain things, for example.

The Sims 4: Although Sims autonomously go about their life, the player can intervene with actions to improve or alter their fate, in small or significant ways. (*Maxis, 2014*)

Mon. 6:43 AM

OMFORTABL

\$292,742

GRADE SCHOOL C STUDENT Vacation available: Class in 2 hours 3 days 8:00 AM - 3:00 PM SMTWTFS Grade Requirements: Ideal Mood: Performance: Focused Daily Task: Homework (Not Started) Get 1 Skill to Level 2

AI as Co-Creator

• Both the player and the AI system take part in completing a creative task.

Viewpoints AI: Using a Kinect camera, a human and a projected AI dancer improvise physical movements in response to one another. (Adam Lab, 2014)

AI as Adversary

- In this pattern, the AI attempts to beat the player at a game, or outright defeat them in another way.
- A very standard and common pattern.

Chess: A fully symmetrical game where the AI must plan better than the human. *(6th Century India)*

THE

3000

CHESSMASTER.

Соругіда+© 1986-1991 на хортнома тоосномки

AI as Villain

- In this pattern, the AI takes on the role of a foil to the player delaying them, complicating their path, heightening drama.
- Weaker than an adversary, although they can mix. Here, the primary interest is in creating an interesting story about the player's relationship with the villain.

Alien: Isolation: PR heavily focused on the relationship between the player and a single alien, emphasis on its intelligence and ability to learn (...) (*Creative Assembly, 2014*)

AI as Spectacle

• In this pattern, complex AI systems become something that is satisfying to watch, even with little or no interaction.

Virtual Aquarium: AI moves fish and they react to the environment (other AI fish or a human user feeding them).

Using Patterns Generatively

We can use these patterns as templates to inspire new game ideas.

Basic idea:

- Pick a pattern
- Pick an AI technique
- Mash it all together until it starts to look like an idea

Let's try it out!

A quick glance at AI algorithms

Let's look at AI domains and design games on them

The ten game AI/CI areas identified during the Dagstuhl seminar:

- 1. Non-player character (NPC) behavior learning
- 2. Search and planning
- 3. Player modeling
- 4. Games as AI benchmarks
- 5. Procedural content generation
- 6. Computational narrative
- 7. Believable agents
- 8. AI-assisted game design
- 9. General game AI
- 10. AI in commercial games

Georgios N. Yannakakis and Julian Togelius. A Panorama of Artificial and Computational Intelligence in Games. IEEE Transactions on Computational Intelligence and AI in Games: 7 (4).

NPC behavior learning



Search and Planning



Player Modeling



Games as AI benchmarks





Computational Narrative

Believable Agents



General Game AI



Getting Out There



Tweet More

Follow devs, engage, share, be friendly. People are interested in you!

#screenshotsaturday

Great people to follow: @christerkatilia @emshort @ramiismail @tanyaxshort



Start Small(er)

Think of the most minimal game that shows off your idea. Then cut that idea in half. Some games need a bit to get going, but many are fun with just 5 mins of gameplay.

Stream Your Work

A great form of outreach, easier than ever before, and can be a great learning experience for you!



Don't Overthink The Art

Buy cheap art packs (like Oryx's amazing sprites) or use simple shapes and geometry.

Emphasise what makes your idea *your idea*. Get to the idea *fast*.

New art packs on **procjam.com/art**...



Don't Overthink The Engine

As long as people can play it, *nothing else matters*.

You don't need to use Unity! You can probably make a game in any language you know right now.

Collect
Jam

Enter jams - they help you finish projects, try new ideas, and find a community.

They don't require 24/7 crunch - this is a myth!





Here's Some We Made Earlier PROCJAM.COM - This Oct/Nov AI-JAM.COM - March 2017 (TBC)



earch games & creators

wus 🖡 🛤 Get app

WSE

es	Game assets
	Soundtracks
ical games	Comics
s	Misc

MES BY PRICE

le	Free games
D	Top sellers
less	\$15 or less

MES BY PLATFORM

lows	OS X
¢	Android
	iOS

M THE ITCH.IO BLOG



255









Put Your Stuff Online

Don't tunnel-vision on Steam - itch.io hosts your work for free, gives great analytics, lets you do tiered access, and has an amazing community.



Have Fun

If you're not enjoying this, if it gets stressful, if your workload rises: don't force it.

Ultimately, this should be fun! Don't let it rule you :)



www.procjam.com

www.exag.org

www.ai-jam.com

or... the start of the conference?