Talking to Smart AI NPCs in Unreal Engine 5: The Future of Gaming & Artificial Intelligence

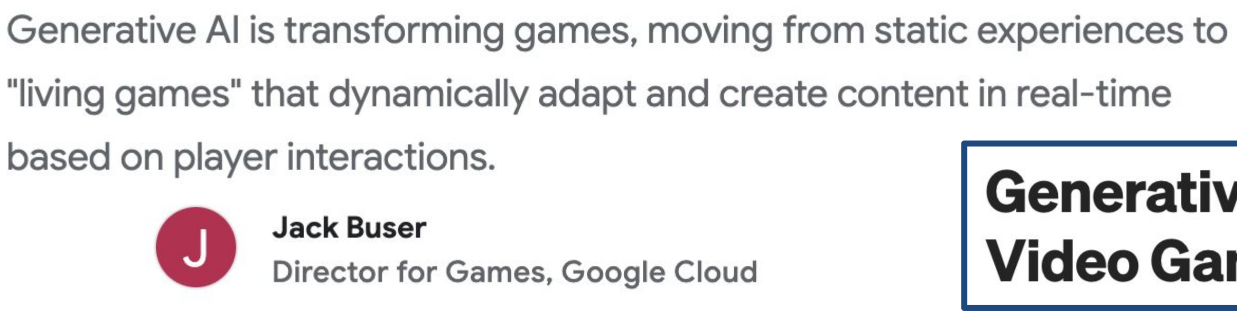
NVIDIA ACE for Games

Spark Life Into Virtual Characters
With Generative AI

It’s alive! The rise of generative non-player characters in video games

BY MARTIN SAS AND VICTORIA HENDRICKX - 10 MAY 2024

LLMs in Games

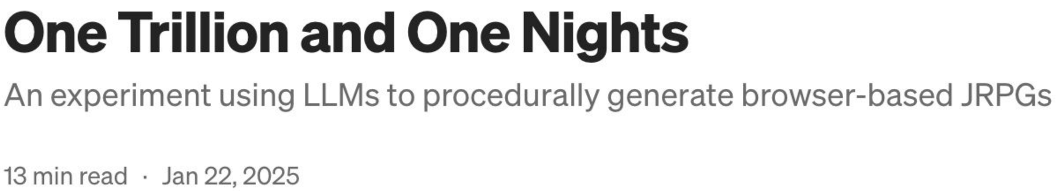


Generative AI is transforming games, moving from static experiences to "living games" that dynamically adapt and create content in real-time based on player interactions.

Jack Buser
Director for Games, Google Cloud

Generative AI Could Create the Video Games of Our Dreams

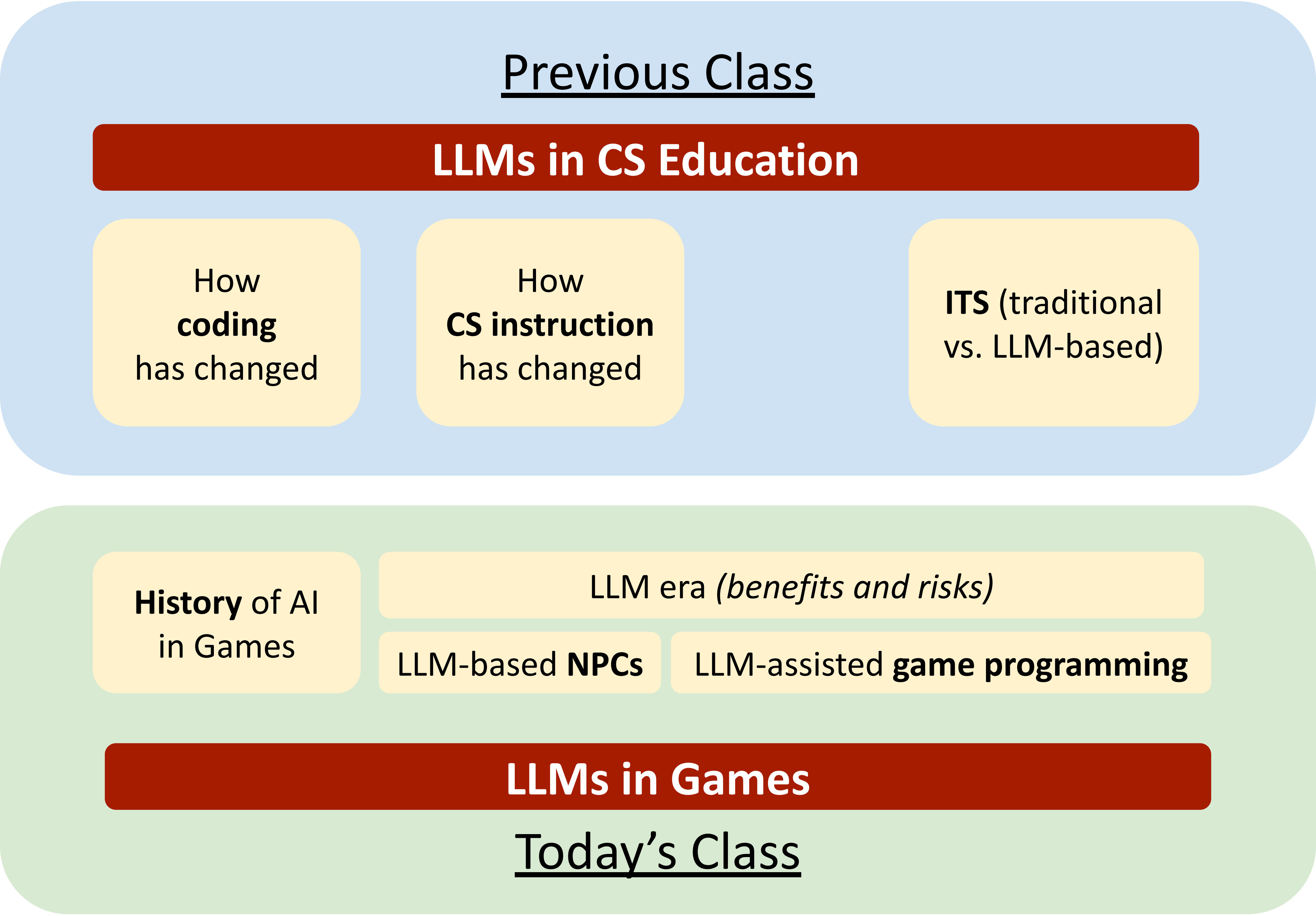
How I Built an LLM-Based Game from Scratch



One Trillion and One Nights

An experiment using LLMs to procedurally generate browser-based JRPGs

13 min read · Jan 22, 2025



Previous Class

LLMs in CS Education

How **coding** has changed

How **CS instruction** has changed

ITS (traditional vs. LLM-based)

History of AI in Games

LLM era *(benefits and risks)*

LLM-based **NPCs**

LLM-assisted **game programming**

LLMs in Games

Today’s Class

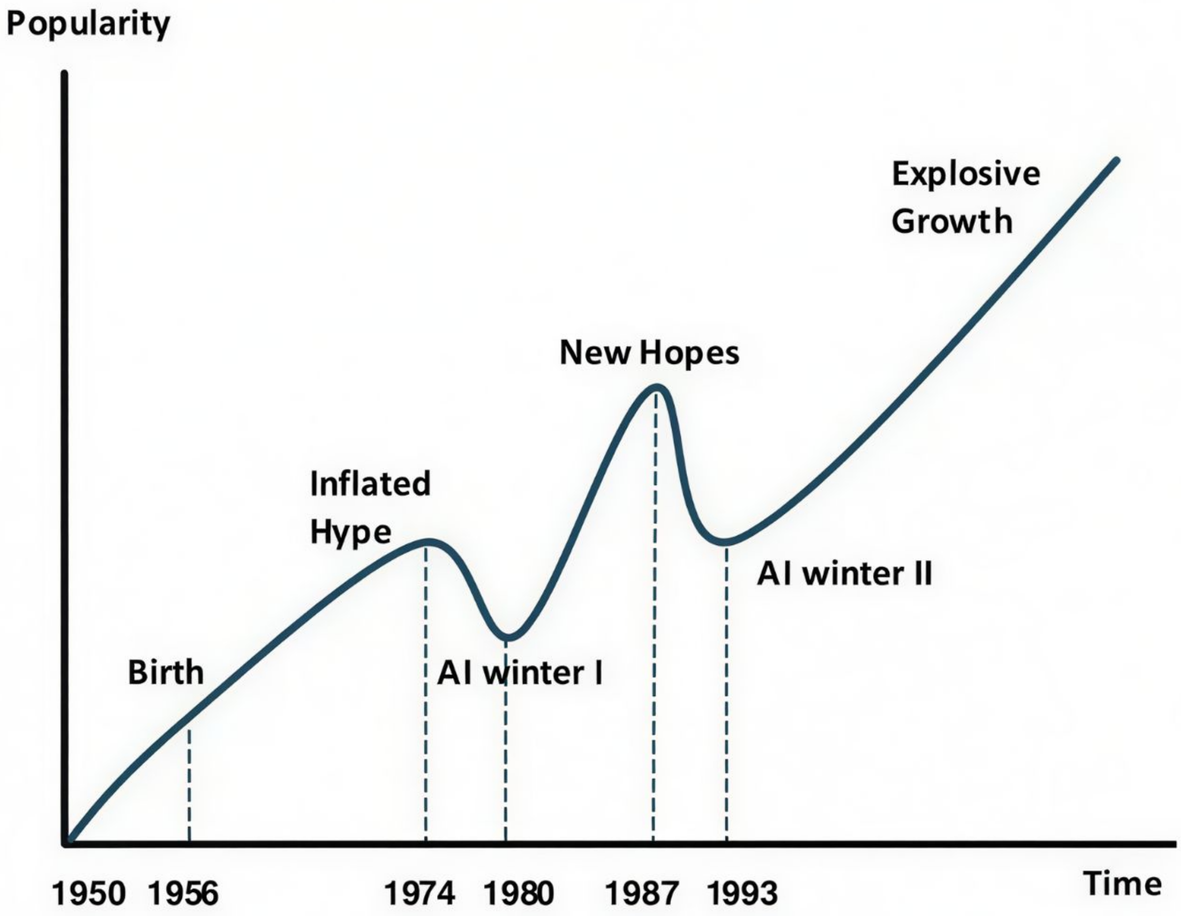
AI in Games

AI in video games includes the computational systems that:

- simulate strategic decision-making
- generate dynamic game behavior
- control non-player characters (NPCs)

AI has a long history in game development!

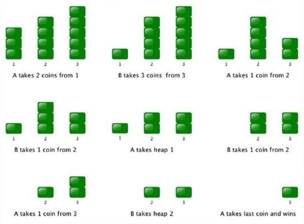
AI HAS A LONG HISTORY OF BEING “THE NEXT BIG THING”…

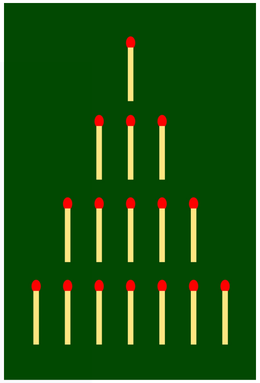


Timeline of AI Development

- **1950s-1960s**: First AI boom - the age of reasoning, prototype AI developed
- **1970s**: AI winter I
- **1980s-1990s**: Second AI boom: the age of Knowledge representation (appearance of expert systems capable of reproducing human decision-making)
- **1990s**: AI winter II
- **1997**: Deep Blue beats Gary Kasparov
- **2006**: University of Toronto develops Deep Learning
- **2011**: IBM’s Watson won Jeopardy
- **2016**: Go software based on Deep Learning beats world’s champions

AI in Games (1950 – 1980)

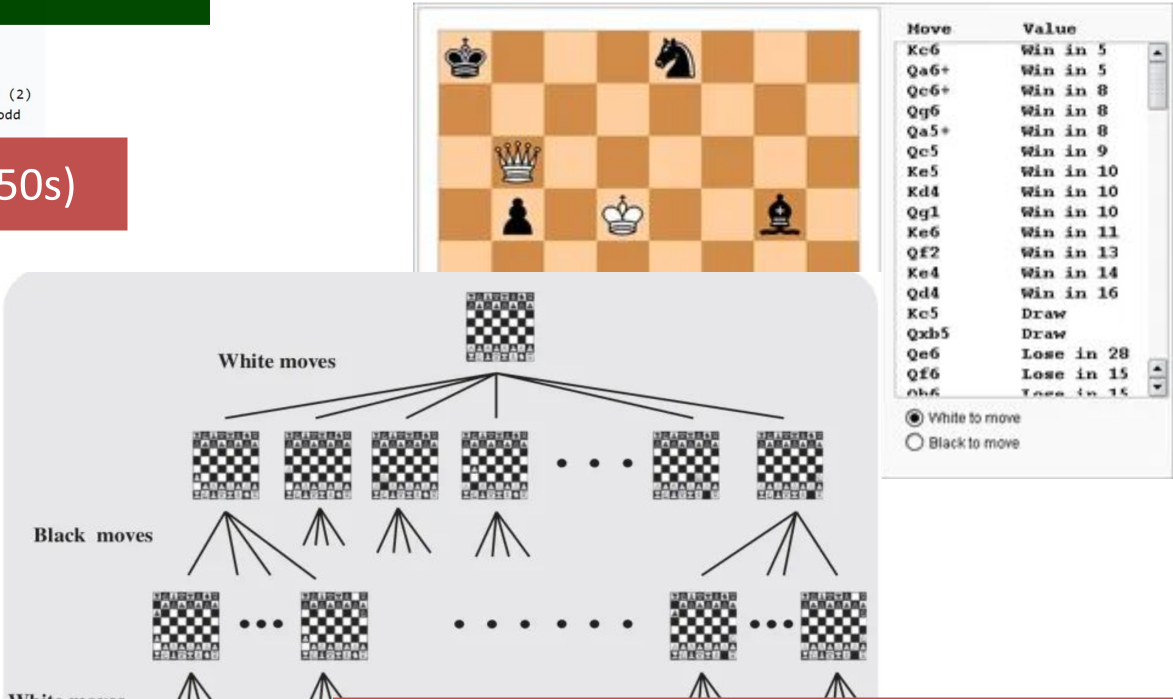




A B C nim-sum

3 4 5 $010_2=2_{10}$ I take 2 from A, leaving a sum of 000, so I will win.
1 4 5 $000_2=0_{10}$ You take 2 from C
1 4 3 $110_2=6_{10}$ I take 2 from B
1 2 3 $000_2=0_{10}$ You take 1 from C
1 2 2 $001_2=1_{10}$ I take 1 from A
0 2 2 $000_2=0_{10}$ You take 1 from C
0 2 1 $011_2=3_{10}$ The normal play strategy would be to take 1 from B, leaving an even number (2) heaps of size 1. For misère play, I take the entire B heap, to leave an odd number (1) of heaps of size 1.
0 0 1 $001_2=1_{10}$ Y

Logic-based approaches (1950s)

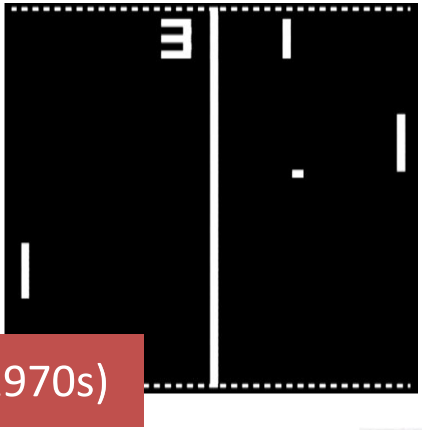


Move	Value
Kc6	Win in 5
Qa6+	Win in 5
Qc6+	Win in 8
Qg6	Win in 8
Qa5+	Win in 8
Qc5	Win in 9
Ke5	Win in 10
Kd4	Win in 10
Qg1	Win in 10
Ke6	Win in 11
Qf2	Win in 13
Ke4	Win in 14
Qd4	Win in 16
Kc5	Draw
Qxb5	Draw
Qe6	Lose in 28
Qf6	Lose in 15
Qh6	Lose in 15

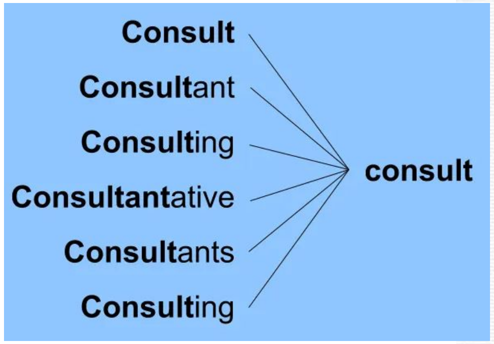
● White to move
○ Black to move

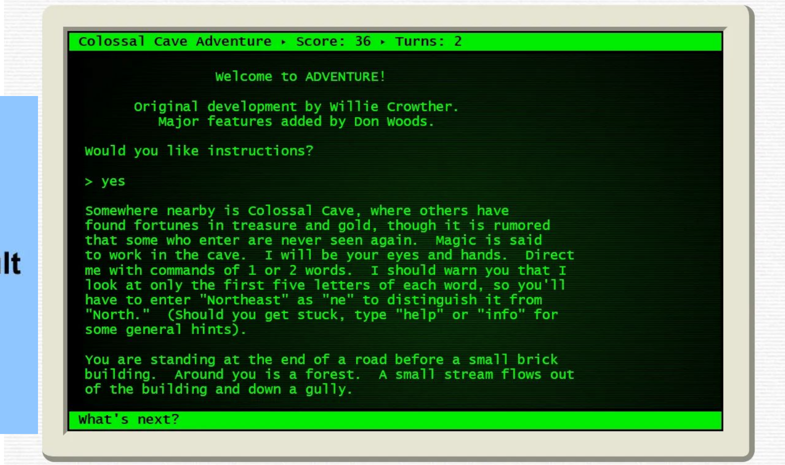
Selective search on data trees (1960s)

AI in Games (1950 – 1980)



Arcade: Movement patterns (1970s)





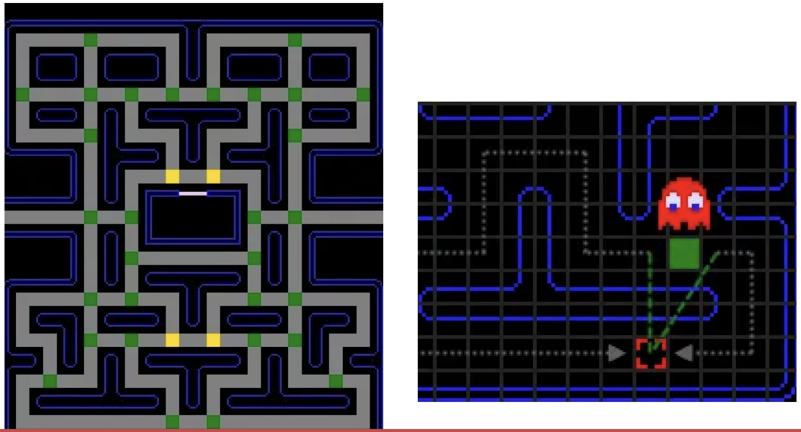
```
Colossal Cave Adventure ‣ Score: 36 ‣ Turns: 2

                 Welcome to ADVENTURE!

      Original development by Willie Crowther.
         Major features added by Don Woods.

Would you like instructions?

> yes

Somewhere nearby is Colossal Cave, where others have
found fortunes in treasure and gold, though it is rumored
that some who enter are never seen again.  Magic is said
to work in the cave.  I will be your eyes and hands.  Direct
me with commands of 1 or 2 words.  I should warn you that I
look at only the first five letters of each word, so you'll
have to enter "Northeast" as "ne" to distinguish it from
"North."  (Should you get stuck, type "help" or "info" for
some general hints).

You are standing at the end of a road before a small brick
building.  Around you is a forest.  A small stream flows out
of the building and down a gully.

What's next?
```

https://rickadams.org/adventure/advent/

First text-based (NLP?) adventure video game. (1976)

AI in Games (1950 – 1980)

AI patterns (tracking + following)
(late 1970s - early 1980s.)

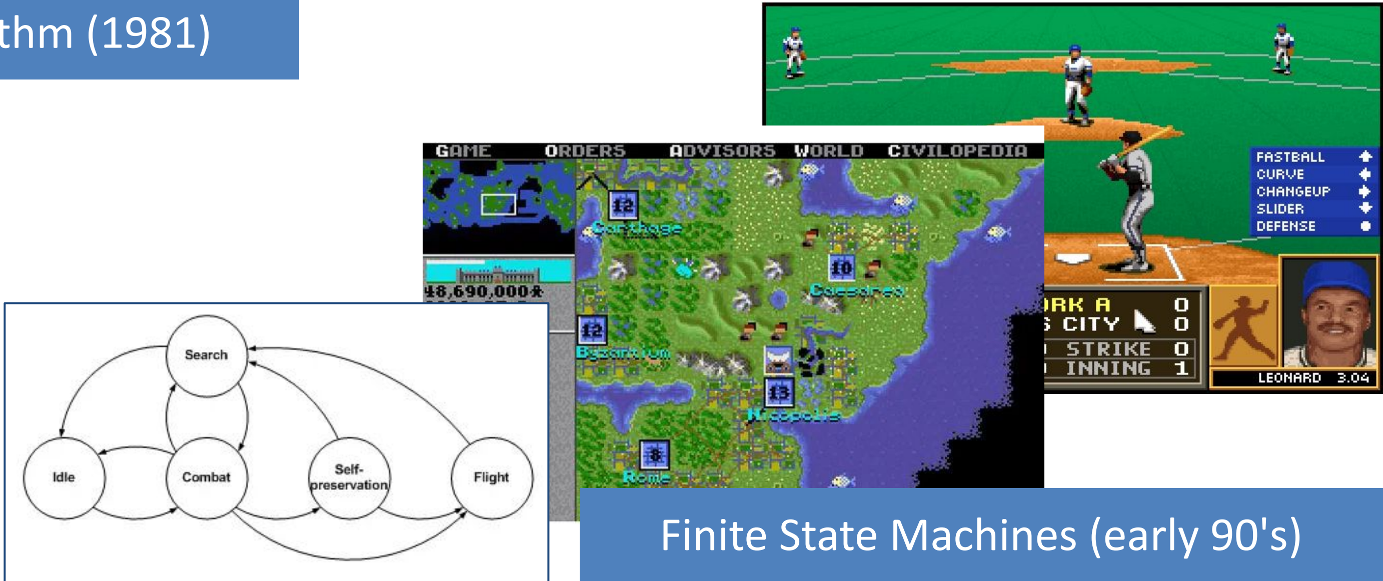


Intersection grid / Meshes (1980)

https://gameinternals.com/understanding-pac-man-ghost-behavior

AI in Games (1980 – 2000)

Early Pathfinding:
Dijkstra’s algorithm (1981)



Finite State Machines (early 90's)

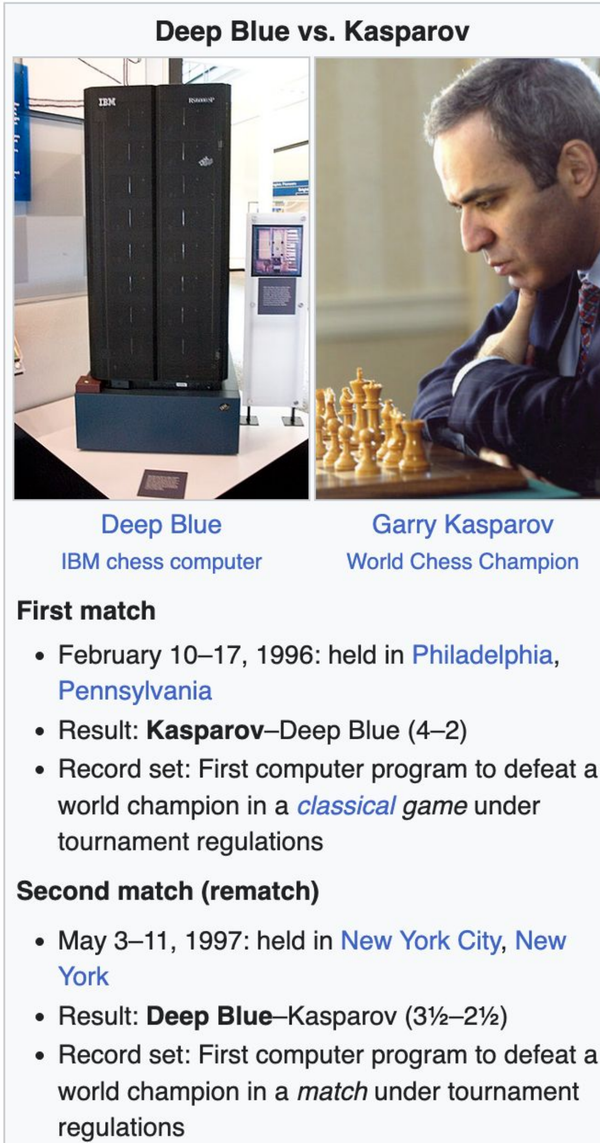
AI in Games (1980 – 2000)

AI "Stupidity": originally meant to constraining AI capabilities to adju difficulty levels. This might inadver

- repetitive behaviors
- abnormal actions in situation unfo developers
- reduced player immersion

"Cheating" AI: AI opponents often cheating (e.g., AI's actions sometin overly smart)

- Notable in early versions of the Civ



Deep Blue vs. Kasparov

Deep Blue
IBM chess computer

Garry Kasparov
World Chess Champion

First match

- February 10–17, 1996: held in Philadelphia, Pennsylvania
- Result: **Kasparov**–Deep Blue (4–2)
- Record set: First computer program to defeat a world champion in a *classical game* under tournament regulations

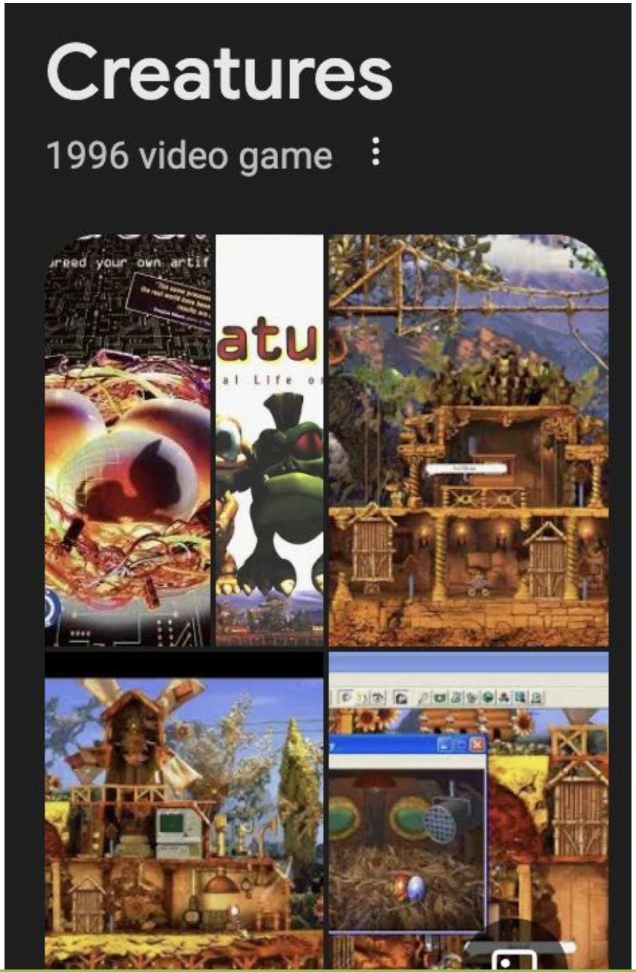
Second match (rematch)

- May 3–11, 1997: held in New York City, New York
- Result: **Deep Blue**–Kasparov (3½–2½)
- Record set: First computer program to defeat a world champion in a *match* under tournament regulations

AI in Games (2000 – pre-LLMs)

An AI simulation where users could hatch *norns* (small furry animals), teach them how to behave, or leave them to learn on their own.

Each *norn* has a several-layer **neural network** representing its brain.

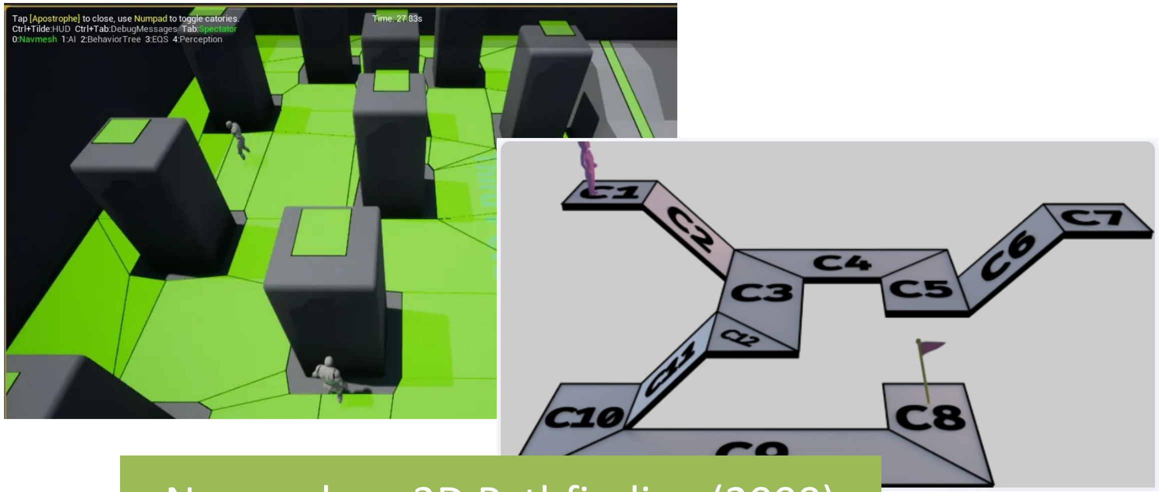


Creatures

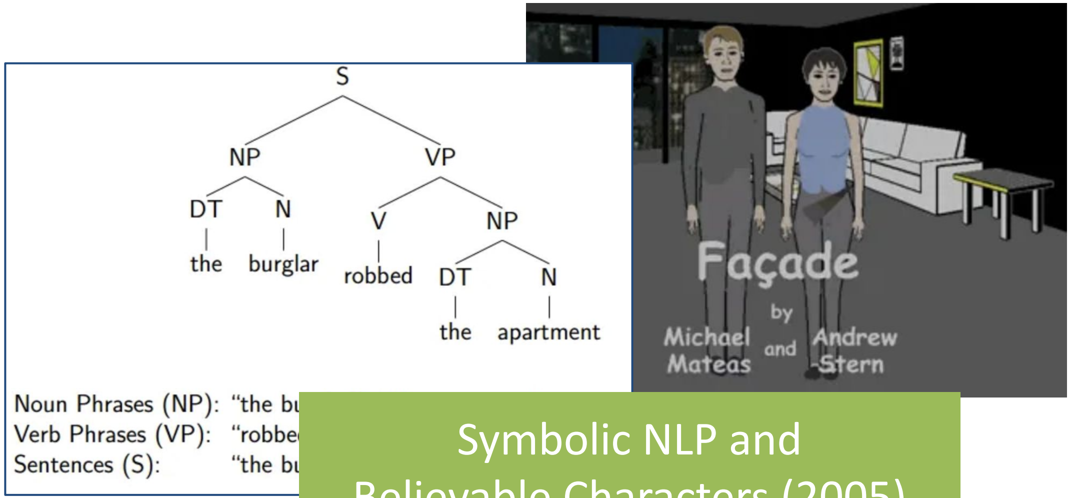
1996 video game

Neural Networks: First successful application after 2nd AI Winter

AI in Games (2000 – pre-LLMs)

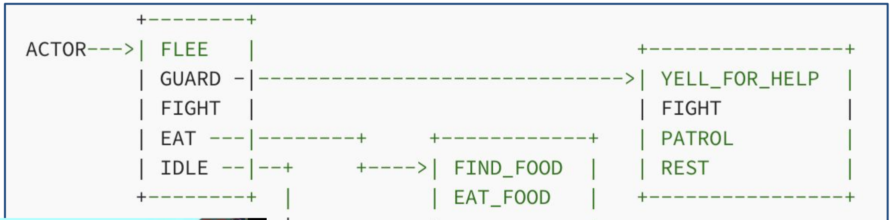

Tap [Apostrophe] to close, use Numpad to toggle catories.
Ctrl+Tilde:HUD Ctrl+Tab:DebugMessages Tab:Spectator
0:Navmesh 1:AI 2:BehaviorTree 3:EQS 4:Perception
Time: 27.83s
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12

Navmeshes: 3D Pathfinding (2000)



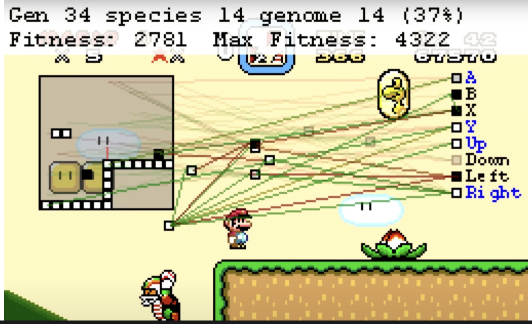
Symbolic NLP and
Believable Characters (2005)

AI in Games (2000 – pre-LLMs)

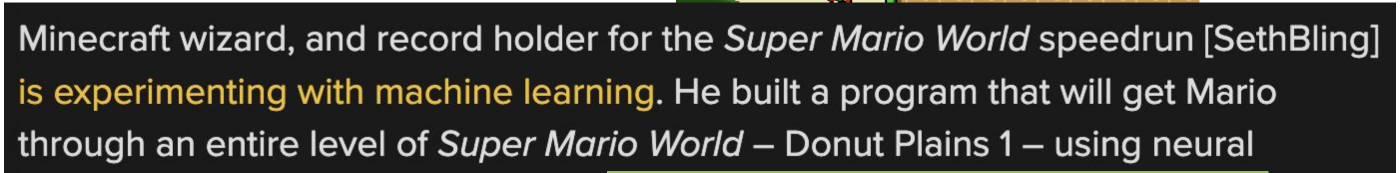


```
               +--------+
ACTOR--->| FLEE    |                                +----------------+
         | GUARD -|------------------------------>| YELL_FOR_HELP  |
         | FIGHT   |                               | FIGHT          |
         | EAT ---|--------+      +-------------+  | PATROL         |
         | IDLE --|--+      +---->| FIND_FOOD   |  | REST           |
         +--------+  |            | EAT_FOOD    |  +----------------+
                     |            +-------------+
                     |
                     |  +--------+
                     +->| PLAY   |--+    +---------+
                        | REST   |  +-->| FLIP    |
                        +--------+      | ROLL    |
                                        | DANCE   |
                                        +---------+
```

Behavior Trees and Procedural Generation (2008)



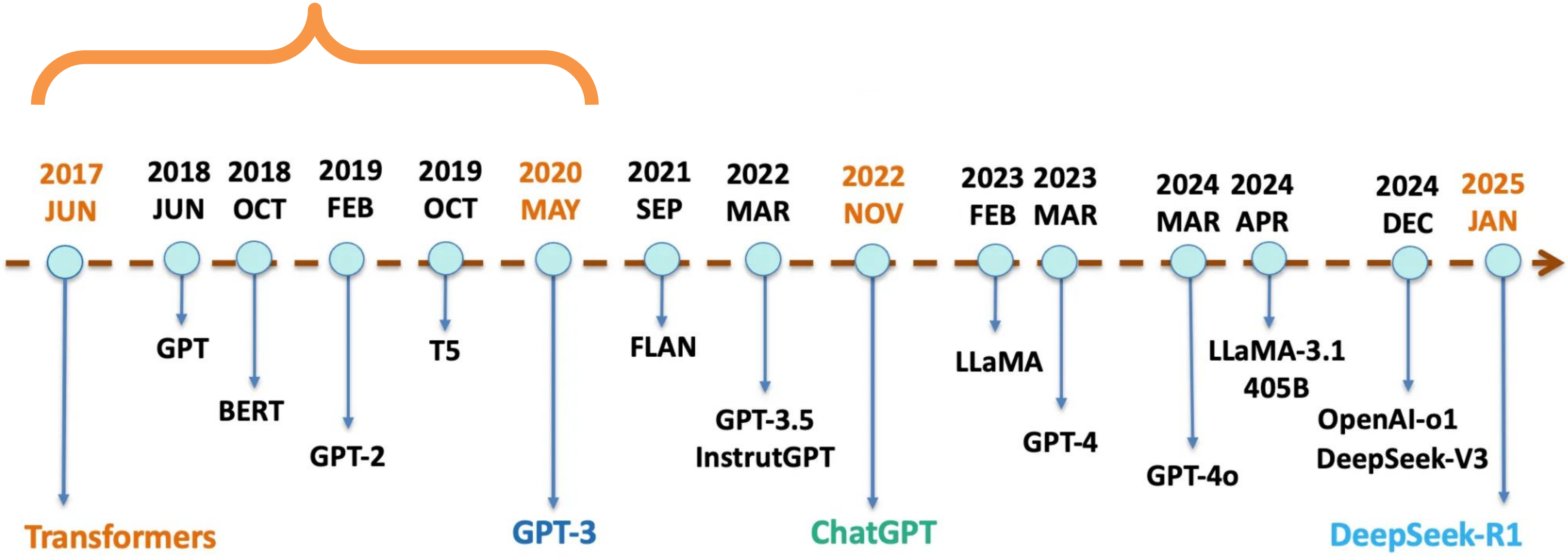
Gen 34 species 14 genome 14 (37%)
Fitness: 2781 Max Fitness: 4322



Minecraft wizard, and record holder for the *Super Mario World* speedrun [SethBling] is experimenting with machine learning. He built a program that will get Mario through an entire level of *Super Mario World* – Donut Plains 1 – using neural networks and genetic algorithms.

Reinforcement Learning (2015)

The dawn of transformers for Language Modelling (2017-2020s)



Breakout #1 – AI / LLM Uses in Games

Group with your neighbor(s) and **pick a game that everyone knows**

Where could you **use AI** in that game?

Where could you **specifically use LLMs**?

Discuss and record on Gradescope!

GenAI in Video Games

- **Generate game content** (e.g., quests texts, descriptions, texts, character backgrounds)
- **Procedural generation** (automatically generate levels, environments, quests – e.g., MarioGPT)
- **Adaptive game environments** (e.g., dynamic changes in weather, terrain)
- **Localization** (e.g., quickly generate localized content in different languages, cultures, player preferences)

GenAI in Video Games: Smart NPCs

Traditional NPCs were scripted with pre-defined dialogues and behaviors.

Smart NPCs, using LLMs, can respond dynamically to the player’s choices.

They could even have their own personality, ethics, and long-term memory!

Breakout #2 – Smart NPCs

First discussion:

- What are some **benefits** of smart NPCs?
- What are some **risks** associated with smart NPCs?

Second discussion:

Now, think of a game you've played.

Why or why not would AI NPCs work in that game?

Discuss with your neighbor(s) and record on Gradescope!

Smart NPCs

Benefits

- Players can play with AI partners with matching level of skills
- Make the game more realistic, more dynamic responses

Risks

- LLM-based NPCs might use outside knowledge that is not related to the game (hallucinations)
- LLM NPCs can be tricked to break the game rules / narrative rules

Smart NPCs

Benefits

- Boost player immersion (more realistic and emotionally engaging interactions)
- Personalization (custom quests, difficulty, rewards, etc.)
- Scalability or less repetitive experiences (automatically create new dialogues, quests, events, etc.)

Risks – They're unpredictable!

- AI NPCs could say stuff that accidentally break the game narrative or rules
- AI NPCs could be rude, biased, offensive
- AI NPCs could support player cheating (they could be tricked to spill secrets)
- Some players could have "relationships" with AI NPCs instead of other human players

Fun Video :)

Youtube: I Tried to Convince Intelligent AI NPCs They are Living in a Simulation

Breakout #3 – Game Programming

LLMs have changed the ways people code!

What are some **benefits** of using LLMs for game programming?

What are some **risks** of using LLMs for game programming?

Discuss with your neighbor(s) and record on Gradescope!

Using LLMs for Game Programming

Benefits

Time and cost efficient

Faster to get an MVP → more ideas

Risks

Could break your coding convention

LLMs could make some coding mistakes

Security concerns (e.g., remote control the player's computer)

Programmers overly on LLMs to code → hard to make edits to their code later

Using LLMs for Game Programming

Benefits

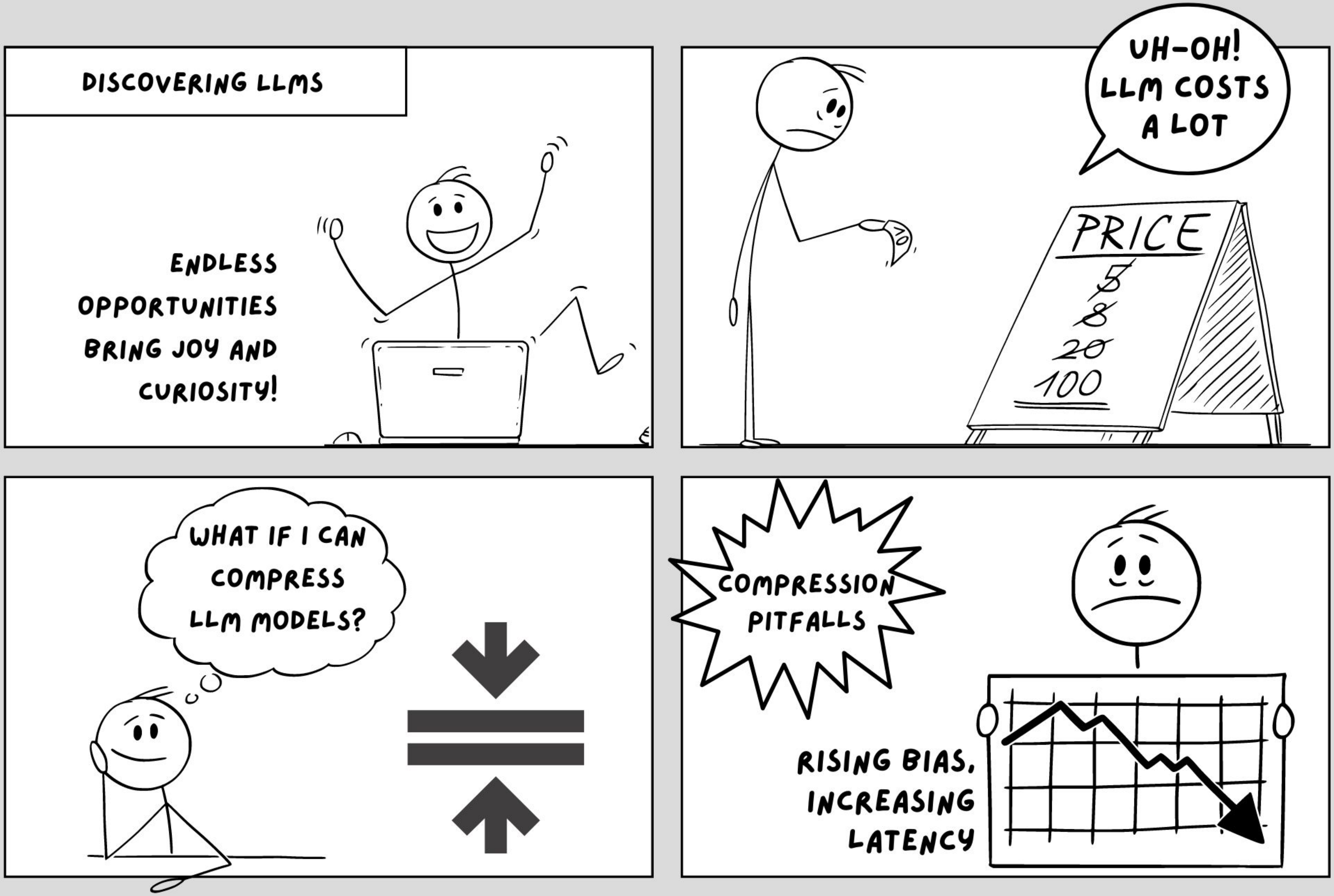
Automatically generating assets, code, content can:

- Increase process efficiency
- Provide endless resources
- Increase profits???

Risks

- Ethical and copyright concerns
- Limit career growth for developers (less skillful people could lose their job)
- Lower game quality (if using LLMs in irresponsible ways)
- Hidden costs???

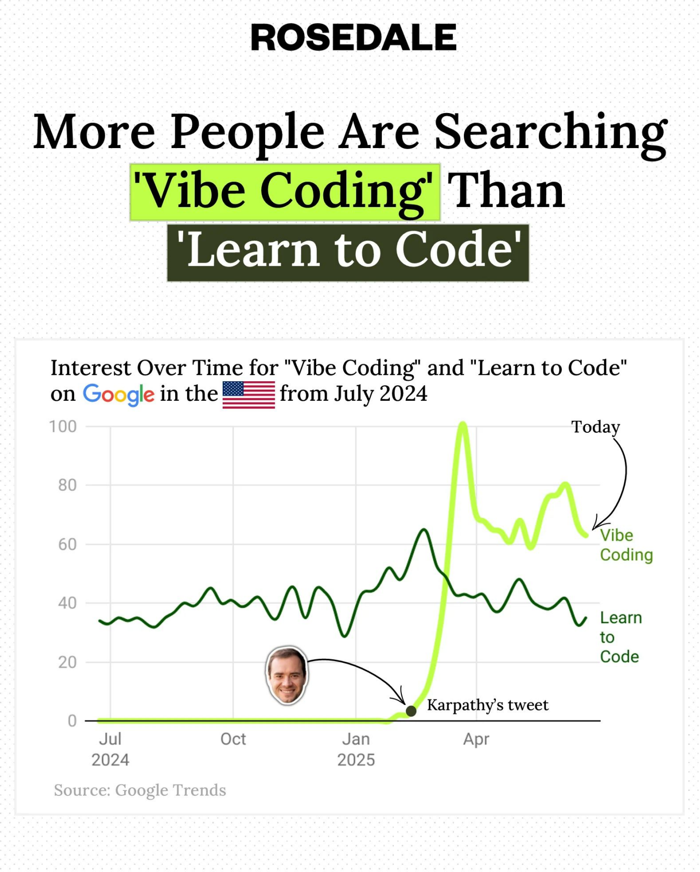
HIDDEN COSTS OF DEPLOYING LLMS


DISCOVERING LLMS
ENDLESS OPPORTUNITIES BRING JOY AND CURIOSITY!
UH-OH! LLM COSTS A LOT
PRICE
~~5~~
~~8~~
~~20~~
100
WHAT IF I CAN COMPRESS LLM MODELS?
COMPRESSION PITFALLS
RISING BIAS, INCREASING LATENCY

“Vibe Coding”

Creating a software with minimal effort, where the developer:

- Describes a project or task to an LLM and asks it to generate code
- Doesn’t review, test, or understand all the code generated



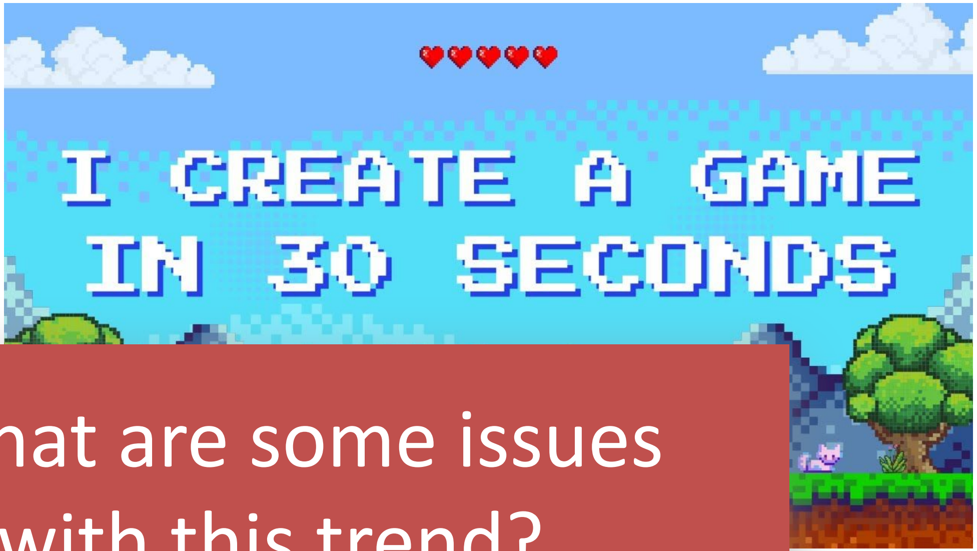
ROSEDALE

More People Are Searching 'Vibe Coding' Than 'Learn to Code'

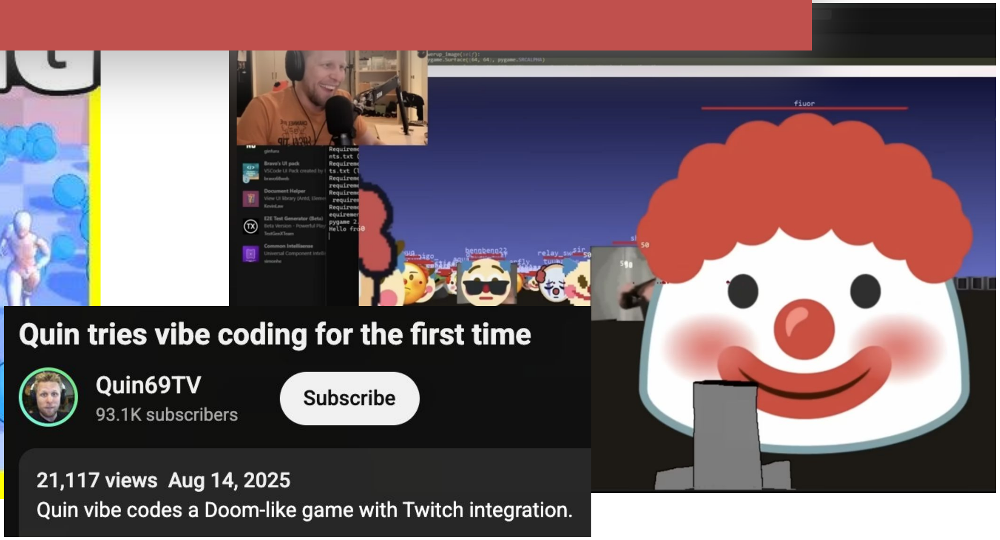
Interest Over Time for "Vibe Coding" and "Learn to Code" on Google in the 🇺🇸 from July 2024

Source: Google Trends

“Vibe Coding a Video Game” Trend



Discussion: What are some issues associated with this trend?

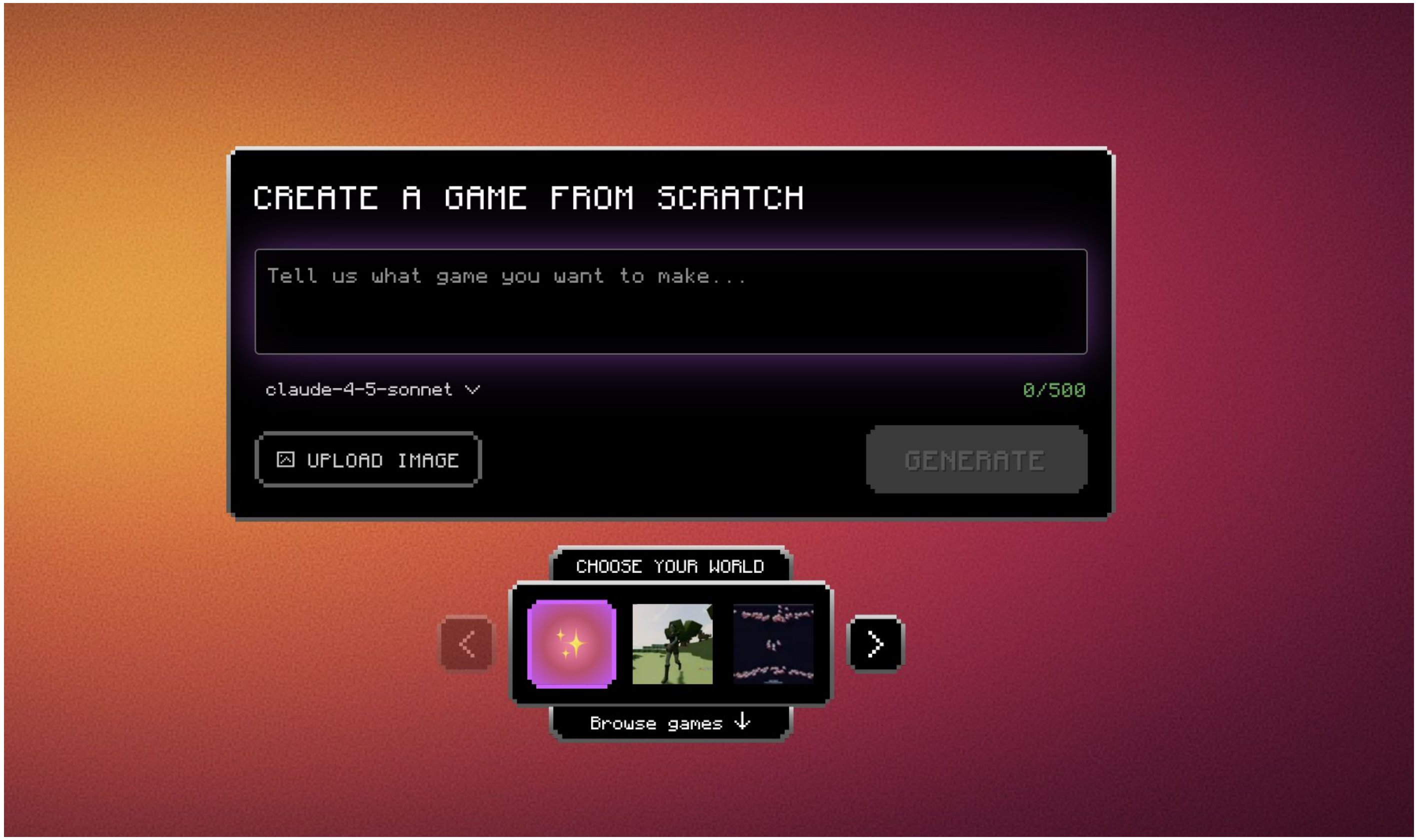


Quin tries vibe coding for the first time

21,117 views Aug 14, 2025
Quin vibe codes a Doom-like game with Twitch integration.

Breakout #4

Let’s try something fun :)



CREATE A GAME FROM SCRATCH

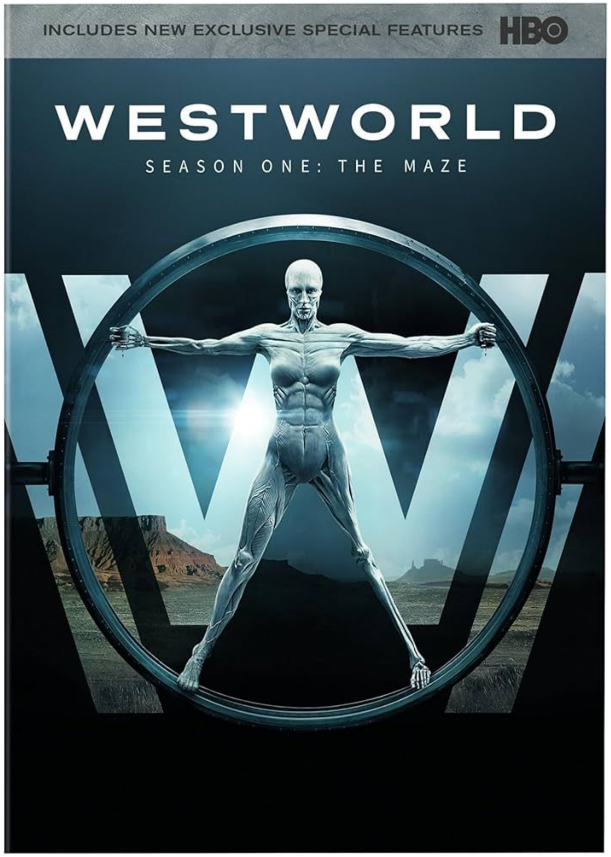
Tell us what game you want to make...

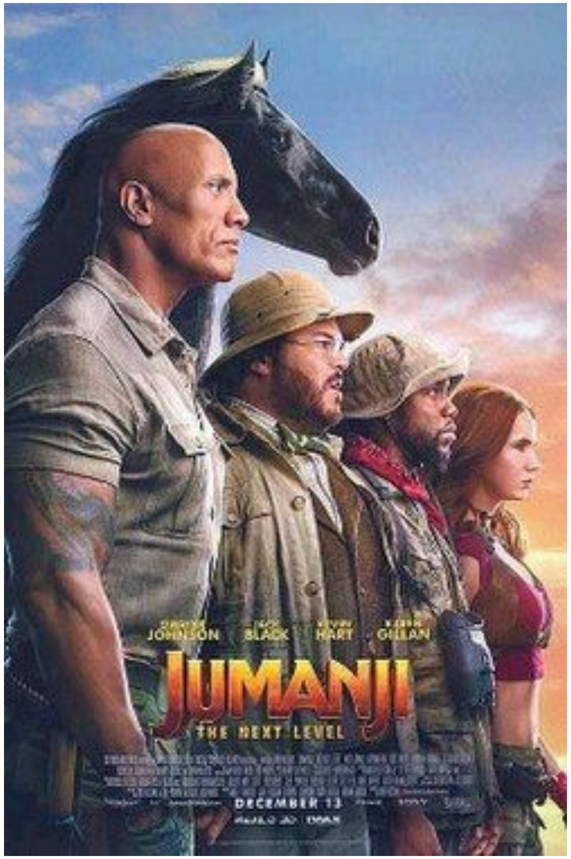
claude-4-5-sonnet

0/500

https://rosebud.ai/

Smart NPCs in movies :)





Wednesday: Flask Talk

Duration: 4-8 minutes

Grading:

- Describe the game well (with polished pictures and using vocabulary we learned in class)
- Presentation quality (volume of voice, clearness, slide quality)

Format: Using Zoom for the presentation

- Still need to be in-person unless you have special permission
- Make sure your group will have a computer that can connect to Zoom to present