

Interactive Fiction and Text Generation

Instructor: Lara J. Martin (she/they)

TA: Duong Ta

<https://laramartin.net/interactive-fiction-class>

Who is Lara?

laramar@umbc.edu

laramartin.net

- BS CS & Linguistics @ Rutgers
- MS Language Technologies @ CMU
- PhD Human-Centered Computing @ GT
- CIFellows Postdoc @ UPenn
- Assistant Prof @ UMBC



https://upload.wikimedia.org/wikipedia/commons/a/a4/Map_of_USA_with_state_and_territory_names_2.png

What do I work on?

- Improving NLP Techniques for Cool Problems

- human-AI communication
 - Story generation / Dungeons & Dragons AI
 - Chatbots
- computer-mediated human-human communication
 - Speech processing
 - Augmentative and alternative communication (AAC)

Augmentative & Alternative Communication



INTERACTIVE FICTION
<https://banews24.com/lifestyle/2021/05/30/the-talking-dog-of-tiktok>

A	B	C	D	SPACE	END OF MESSAGE						
E	F	G	H	START OVER	I DON'T KNOW						
I	J	K	L	M	N						
O	P	Q <u>u</u>	R	S	T						
U	V	W	X	Y	Z						
1	2	3	4	5	6	7	8	9	Ø	YES	NO

Letter Board - AEIOU format

What do I work on?

■ Applied NLP

■ human-AI communication

- Story generation / Dungeons & Dragons AI
- Chatbots

■ computer-mediated human-human communication

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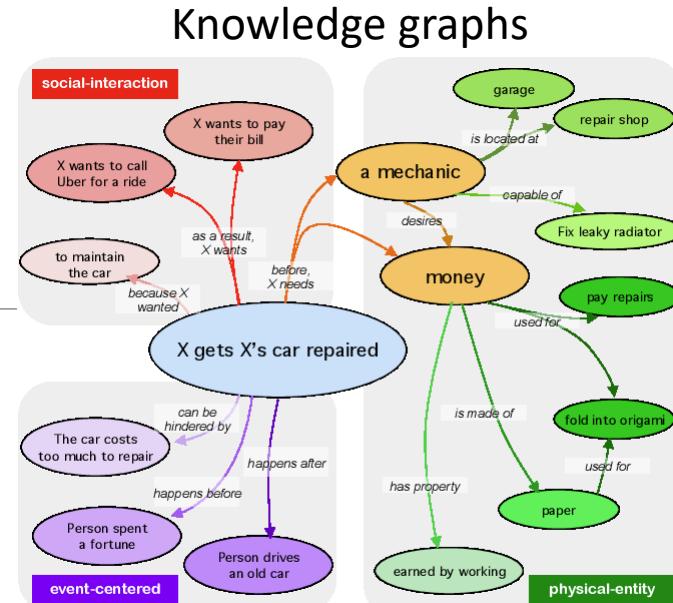
■ Using neurosymbolic methods

Neural networks

Neural language models

Old-school AI methods

Discrete, interpretable representations
that can help LMs



J. D. Hwang et al., "(COMET-)ATOMIC2020: On Symbolic and Neural Commonsense Knowledge Graphs," *AAAI Conference on Artificial Intelligence (AAAI)*, vol. 35, no. 7, pp. 6384–6392, 2021.
<https://ojs.aaai.org/index.php/AAAI/article/view/16792>

Creating structure from sentences

(subject, verb, direct object, modifier)

Original sentence: yoda uses the force to take apart the platform

Event: yoda use force Ø

Generalized Event: <PERSON>0 use-105.1 causal_agent.n.01 Ø

L. J. Martin et al., "Event Representations for Automated Story Generation with Deep Neural Nets," *AAAI*, vol. 32, no. 1, pp. 868–875, Apr. 2018, doi: [10.1609/aaai.v32i1.11430](https://doi.org/10.1609/aaai.v32i1.11430).

Icebreaker

What games have you been playing (and enjoying) lately? If it was good, what made it good? If it was bad, what made it bad?

Alternatively:

What book/TV show/etc. have you been reading/watching/etc. lately?

Learning Objectives

Identify key characteristics of interactive fiction

Develop an understanding of what it takes to make a simple IF game

Get a brief glimpse into what automated story generation is

Choose-Your-Own Adventures & TRPGs

Paper & Pencil Interactive Fiction

Dungeons & Dragons is a fantasy tabletop role playing game first published in 1974.



Dungeons and Dragons (D&D)

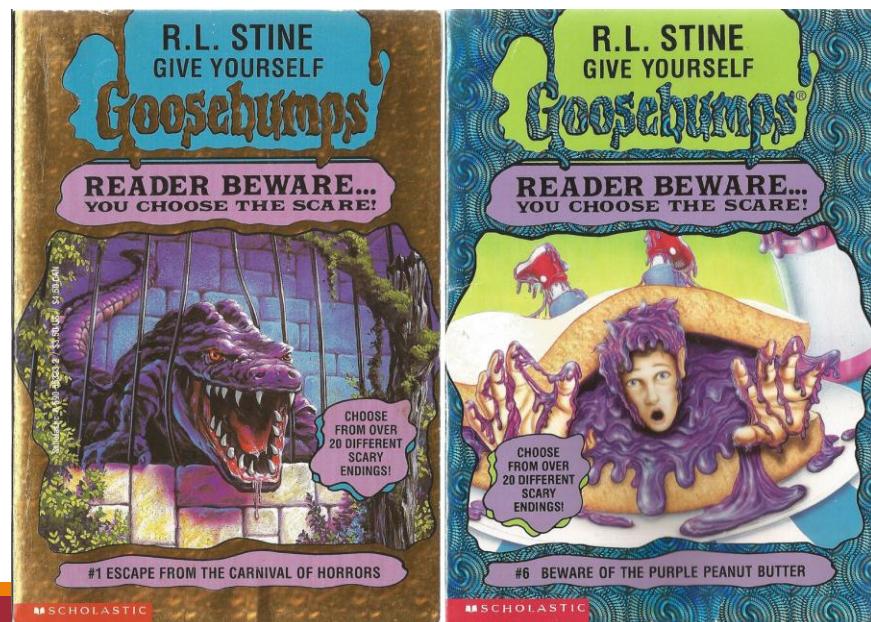
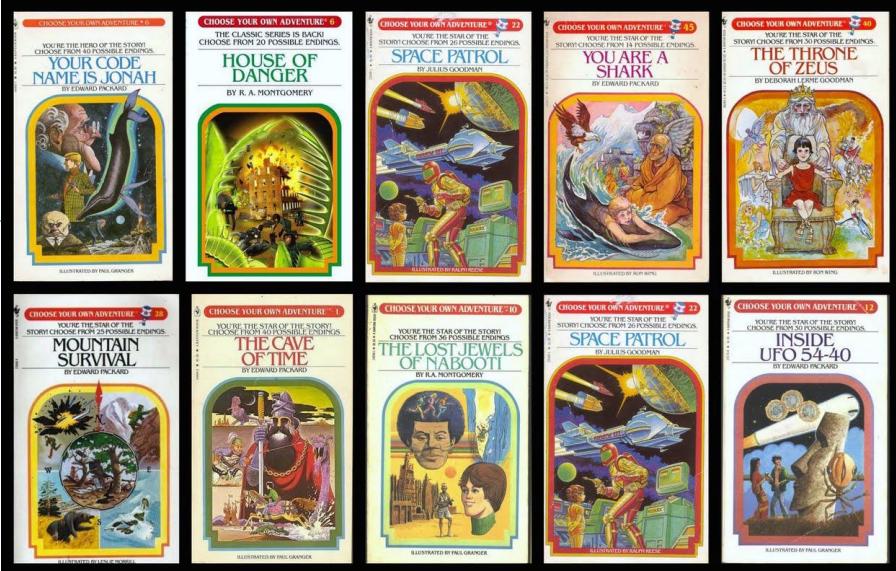
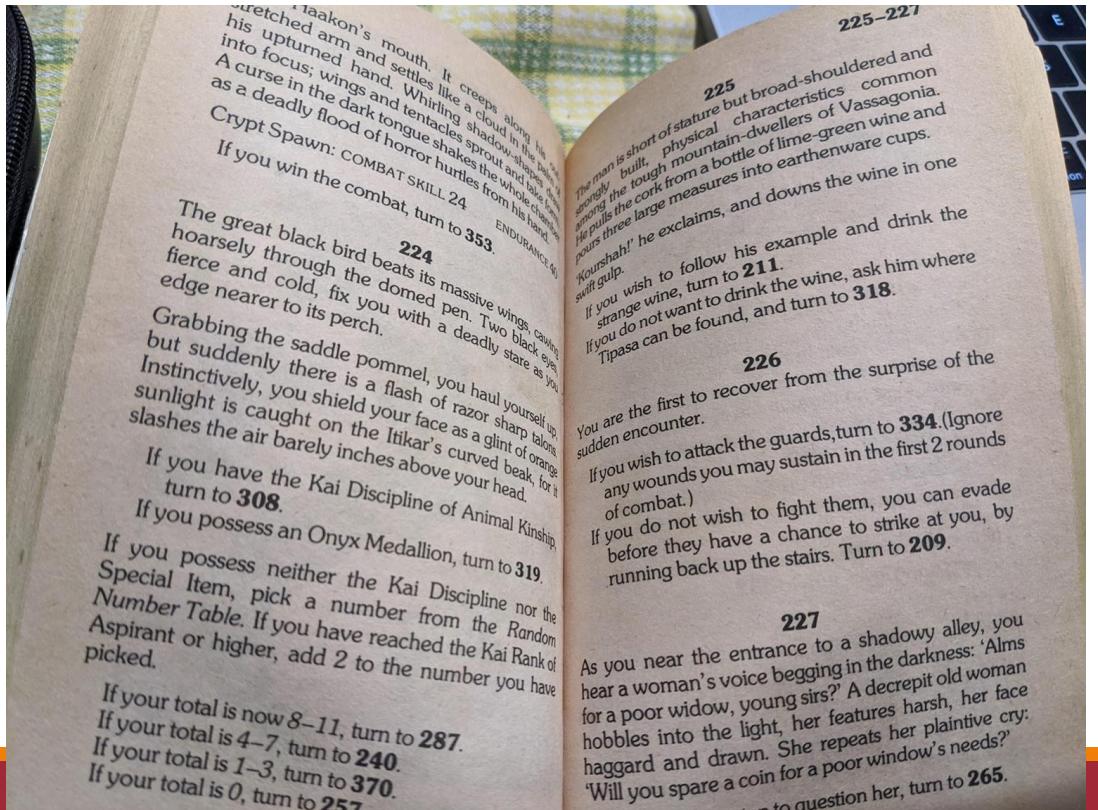
- An open world game in which the players assume the roles of characters in a story and can have them attempt any action they want.
- The game is controlled by a dungeon master, who uses tables, dice, and personal judgment to decide on the effect of a character's efforts.
- The players say what their characters do within the world of the campaign (over many play sessions).

Old-School Interactive Fiction



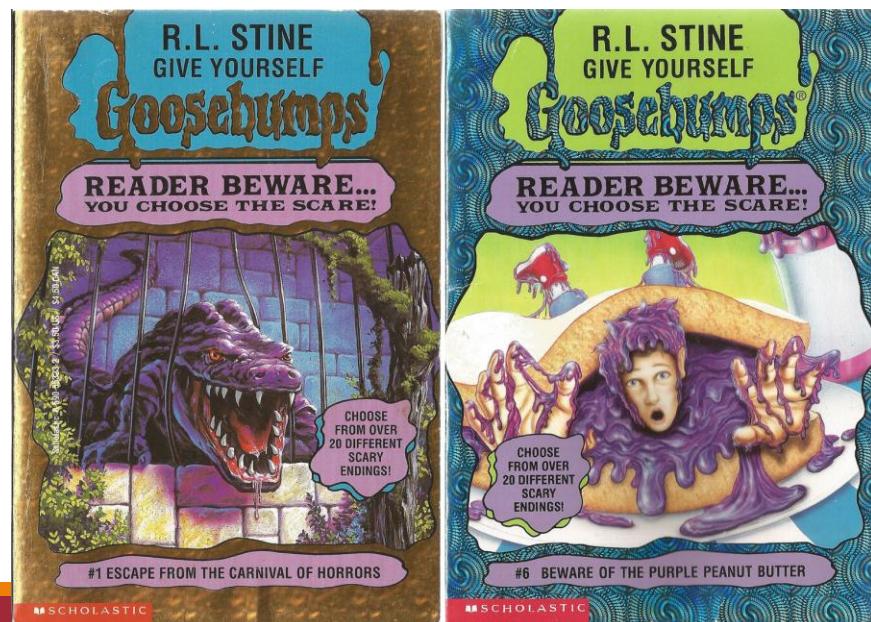
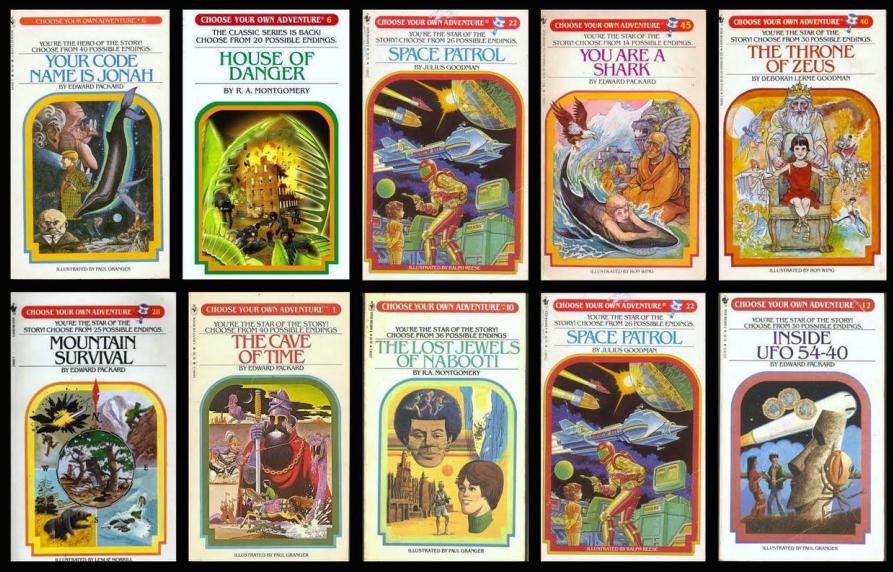
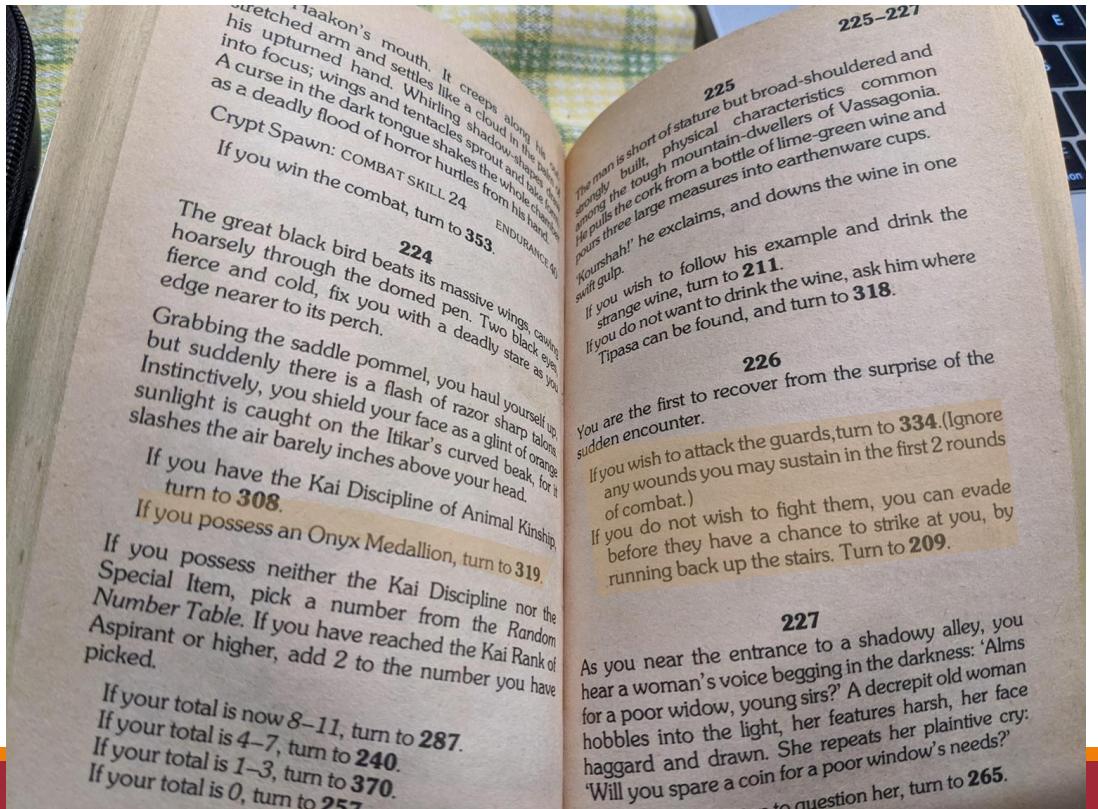
Paper Interactive Fiction

In the late 1970s, “Choose your own adventure” books grew in popularity.



Paper Interactive Fiction

In the late 1970s, “Choose your own adventure” books grew in popularity.



CHOOSE YOUR OWN ADVENTURE™ 5

YOU'RE THE STAR OF THE STORY!
CHOOSE FROM 36 POSSIBLE ENDINGS

THE MYSTERY OF CHIMNEY ROCK

BY EDWARD PACKARD



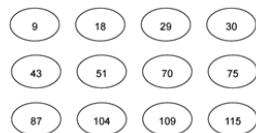
Special
Book
Fair
Edition

ILLUSTRATED BY PAUL GRANGER

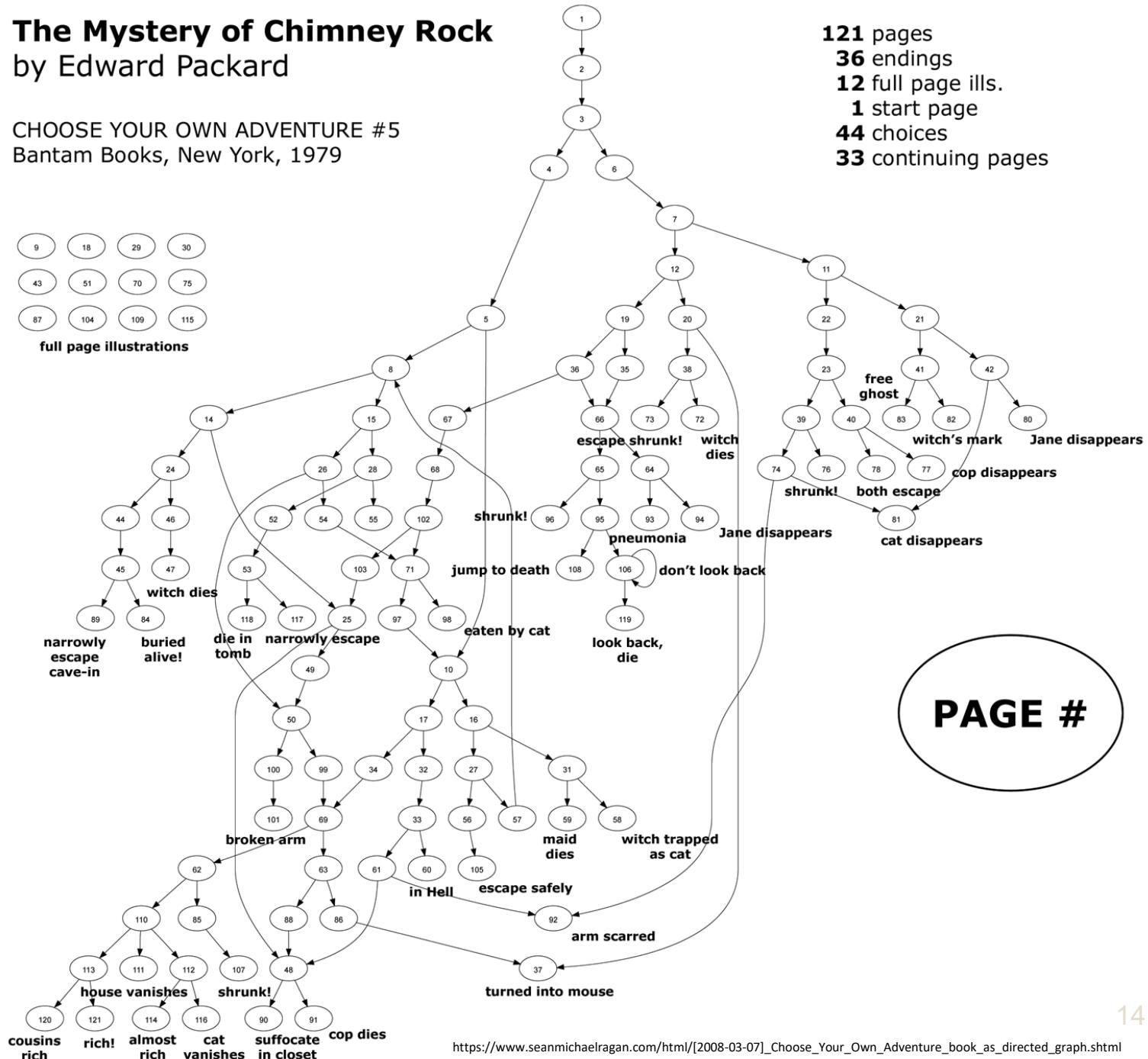
The Mystery of Chimney Rock

by Edward Packard

CHOOSE YOUR OWN ADVENTURE #5
Bantam Books, New York, 1979



full page illustrations

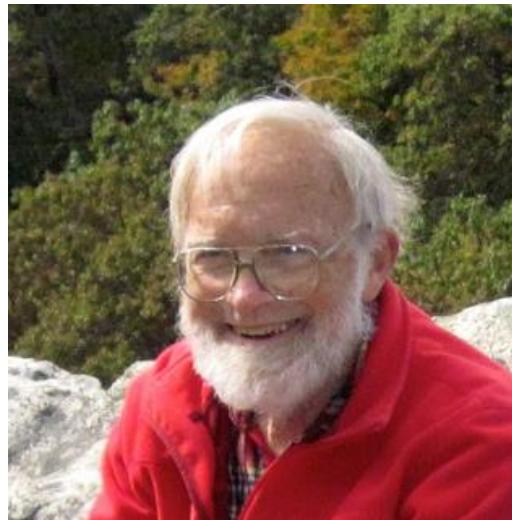


**121 pages
36 endings
12 full page illus.
1 start page
44 choices
33 continuing pages**

The Birth of Interactive Fiction Computer Games

Colossal Cave Adventure

Made in 1975 by Will Crowther



https://en.wikipedia.org/wiki/Colossal_Cave_Adventure#/media/File:Will_Crowther_Fall_2012.jpg

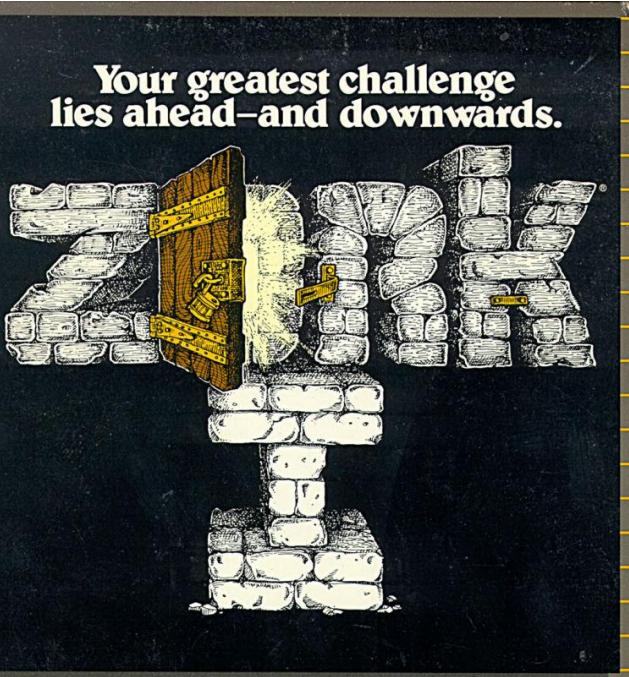


https://upload.wikimedia.org/wikipedia/commons/d/d8/Colossal_Cave_Adventure_on_VT100_terminal.jpg

It became a thing

Interactive Fiction/Text Adventure Games were the best-selling computer games of the 1980s. A company called Infocom created the most popular titles.

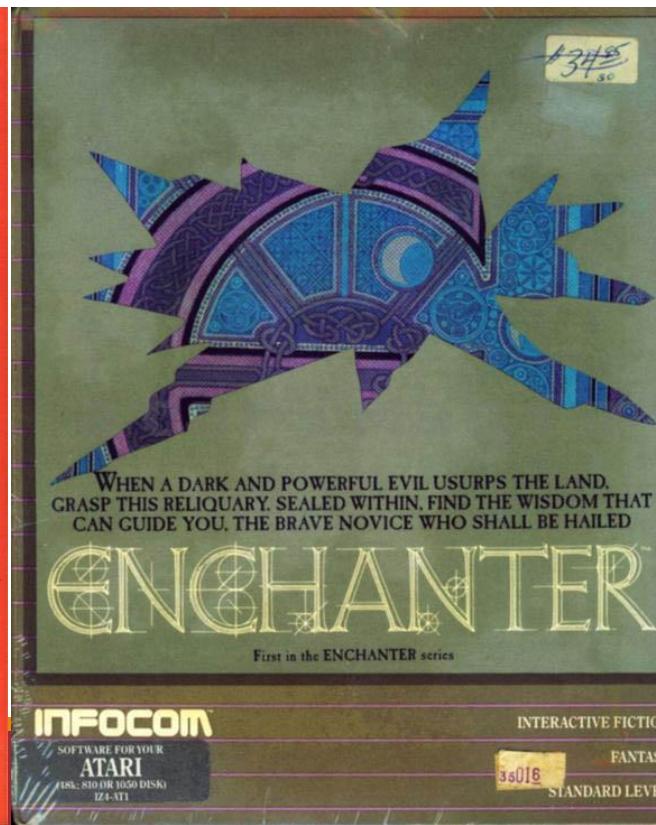
1979



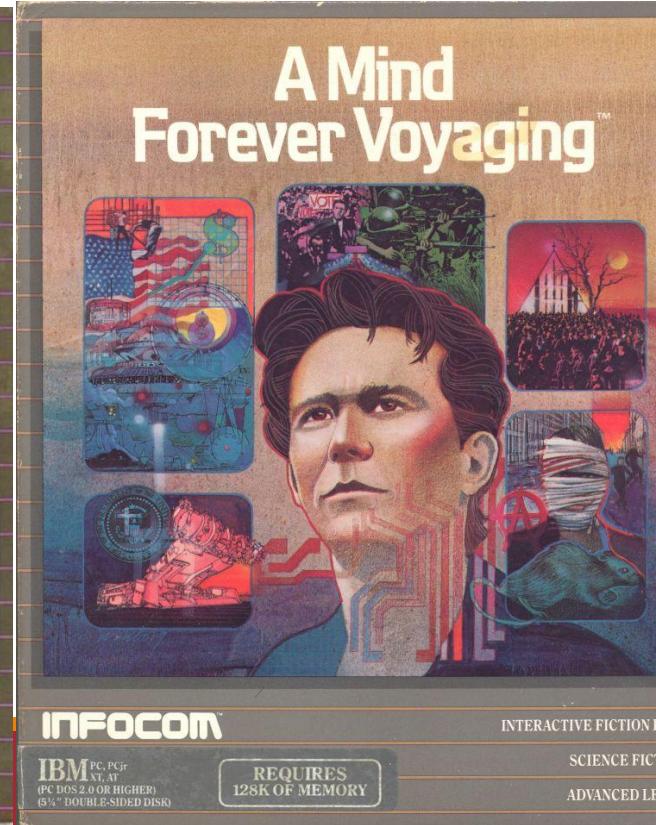
1983



1983



1985



ZORK I: The Great Underground Empire

Copyright (c) 1981, 1982, 1983 Infocom, Inc. All rights reserved.

ZORK is a registered trademark of Infocom, Inc.

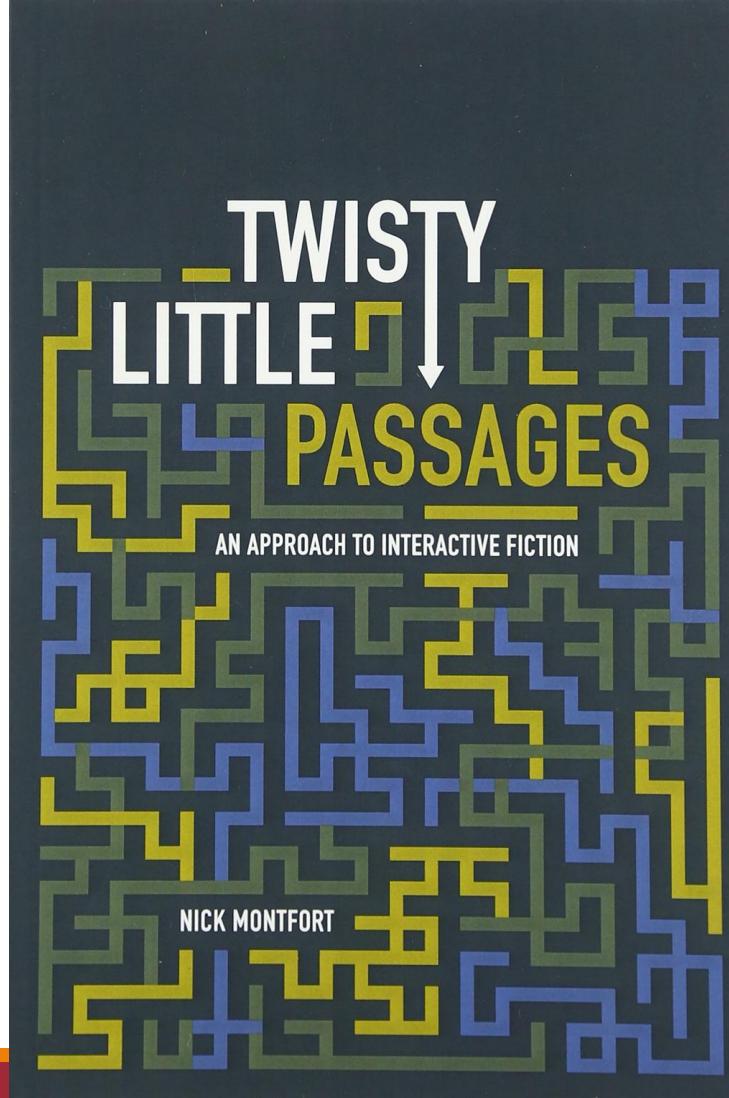
Revision 88 / Serial number 840726

West of House

You are standing in an open field west of a white house, with a boarded front door.

There is a small mailbox here.

Components of Interactive Fiction Games



- The **parser**, which is the component that analyzes natural language input in an interactive fiction work.
- The **world model**, which is setting of an interactive fiction work.

West of House

You are standing in an open field west of a white house, with a boarded front door.

There is a small mailbox here.

>get mailbox

It is securely anchored.

>get key

You can't see any key here!

>push mailbox

Pushing the small mailbox isn't notably helpful.

>pull mailbox

You can't move the small mailbox.

>kick mailbox

Kicking the small mailbox doesn't seem to work.

>Smell mailbox

It smells like a small mailbox.

>Leave the field

I don't know the word "field".

>where am i

I don't know the word "am".

>what am I supposed to do

I don't know the word "am".

The Parser

Commands

Players input simple sentences such as “get key” or “go east”, which are interpreted by a text parser. Parsers may vary in sophistication; the first text adventure parsers could only handle two-word sentences in the form of **verb-noun** pairs.

Action Words

Farmer and Mrs. Pig certainly have a lot of children. And they are all doing something.

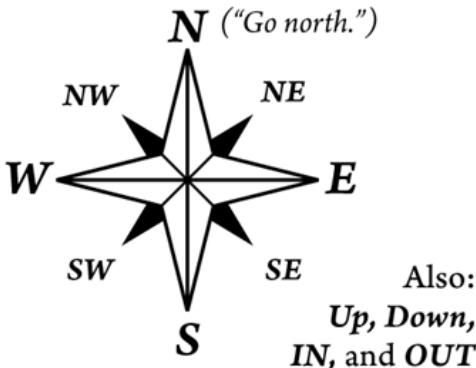


You just started up a game
and now you're staring at **(>|)**
text and a *blinking cursor*
and you *don't know what to do!*

Don't panic kids—
Crazy Uncle Zarf is here to help you
get started...

These commands are very common:
EXAMINE it **PUSH it**
TAKE it **PULL it**
DROP it **TURN it**
OPEN it **FEEL it**
PUT it IN something
PUT it ON something
When in doubt, examine more.

**Does the game intro suggest
ABOUT, INFO, HELP?**
Try them first!



You are standing in an open **field** west of a white **house**,
with a boarded front **door**. There is a small **mailbox*** here.

*Try opening!

You can try all sorts of commands
on the **things** you see.

Try the commands that make sense!
Doors are for opening; buttons are for pushing;
pie is for eating. (*Mmm, pie.*)



If you meet a person, these should work:

TALK TO name
ASK name ABOUT something
TELL name ABOUT something
GIVE something TO name
SHOW something TO name

*Each game has slightly different commands,
but they all look pretty much like these.*

You could also try:

EAT it **CLIMB it**
DRINK it **WAVE it**
FILL it **WEAR it**
SMELL it **TAKE it OFF**
LISTEN TO it **TURN it ON**
BREAK it **DIG IN it**
BURN it **ENTER it**
LOOK UNDER it **SEARCH it**
UNLOCK it WITH something
Or even:
LISTEN **JUMP**
SLEEP **PRAY**
WAKE UP **CURSE**
UNDO⁺ **SING**

⁺*Take back one move — handy!*

“What if I only want to
type one or two letters?”
◆◆◆

N/E/S/W/NE/SE/NW/SW: GO
in the indicated compass direction.

L: LOOK
around to see what is nearby.

X: EXAMINE
a thing in more detail.

I: take INVENTORY
of what you possess.

Z: WAIT
a turn without doing anything.

G: do the same thing AGAIN



*A service of the
People's Republic of Interactive Fiction:
<http://pr-if.org>*

Vocabulary

The original Zork I (1980) had a 600-word vocabulary.

Trinity (1986) could understand stand 2,120 different words.

Early Parsers



Adventure's verb-noun parser was extremely primitive but removed ambiguity.



Ambiguity means that there are multiple interpretations of a sentence, which denote distinct meanings.

Lexical Ambiguity

The presence of two or more possible meanings within a single word.



"I saw her duck."

Syntactic Ambiguity

The presence of two or more possible meanings within a single sentence or sequence of words.



"The chicken is ready to eat."

Basic Natural Language Processing

Stop words: Function words like “the” could be stripped from user input, so that “GET THE LAMP” was sent to the parser as “GET LAMP”.

Prepositions: “LOOK AT” and “LOOK UNDER” were only considered different by the parser if they were implemented as separate verbs and mapped onto different actions.

Direct and indirect objects: Some parsers recognized direct and indirect objects like GIVE [THE BOOK] TO [CHRIS].

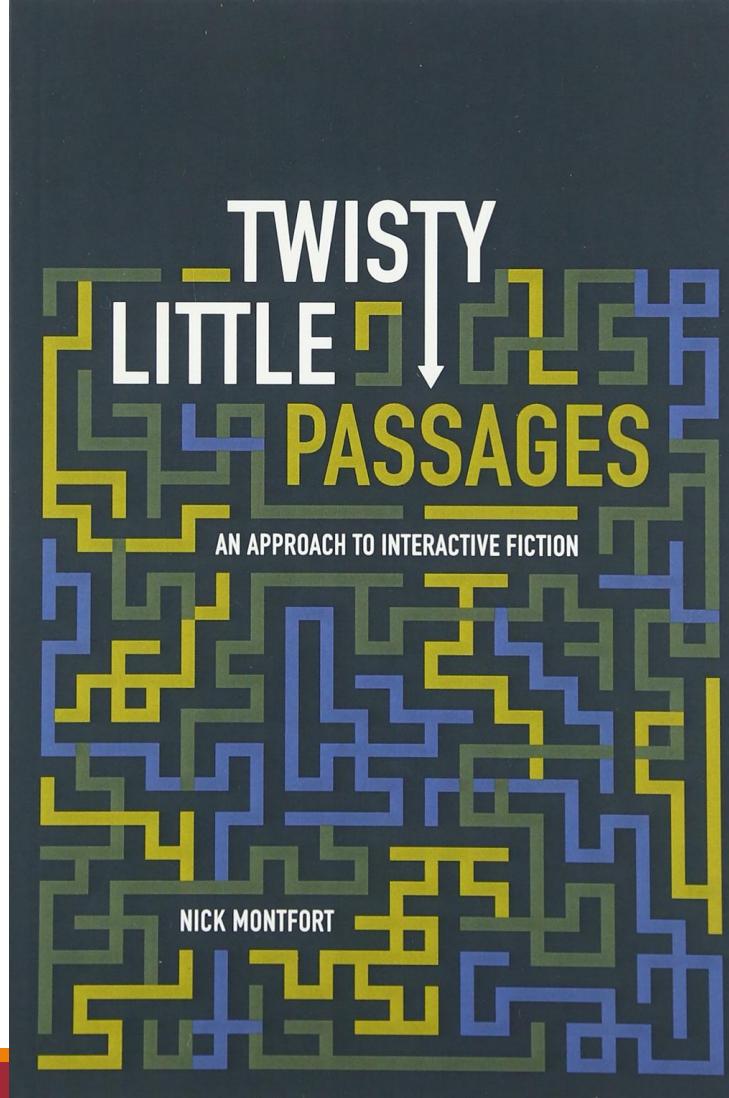
“open the red box with the green key then go north”.

Later parsers, such as those built on ZIL (Zork Implementation Language), could understand complete sentences. They could handle more complex inputs.

Why were parsers so bad?

-  **Limited computational resources.** Computers had ≤ 128 KB of memory
-  **Language is difficult.** There are many things that make human languages genuinely challenging for a computer to process.
-  **Keyword-based commands.** Only exact matches worked properly. No synonyms, no paraphrases.
-  **Everything was manual.** Game developers had to anticipate all possible commands and manually code the responses.
-  **No machine learning.** This was prior to the advent of machine learning based natural language processing

Components of Interactive Fiction Games



- The **parser**, which is the component that analyzes natural language input in an interactive fiction work.
- The **world model**, which is setting of an interactive fiction work.

World Model

It represents the physical environment, and things like

- Settings or locations
- Physical objects in each setting
- The player's character
- Non-player characters

It also represents and simulates the physical laws of the environment.

Locations

You are at a complex junction. A low hands and knees passage from the north joins a higher crawl from the east to make a walking passage going west. There is also a large room above. The air is damp here.

A location in *Colossal Cave Adventure*

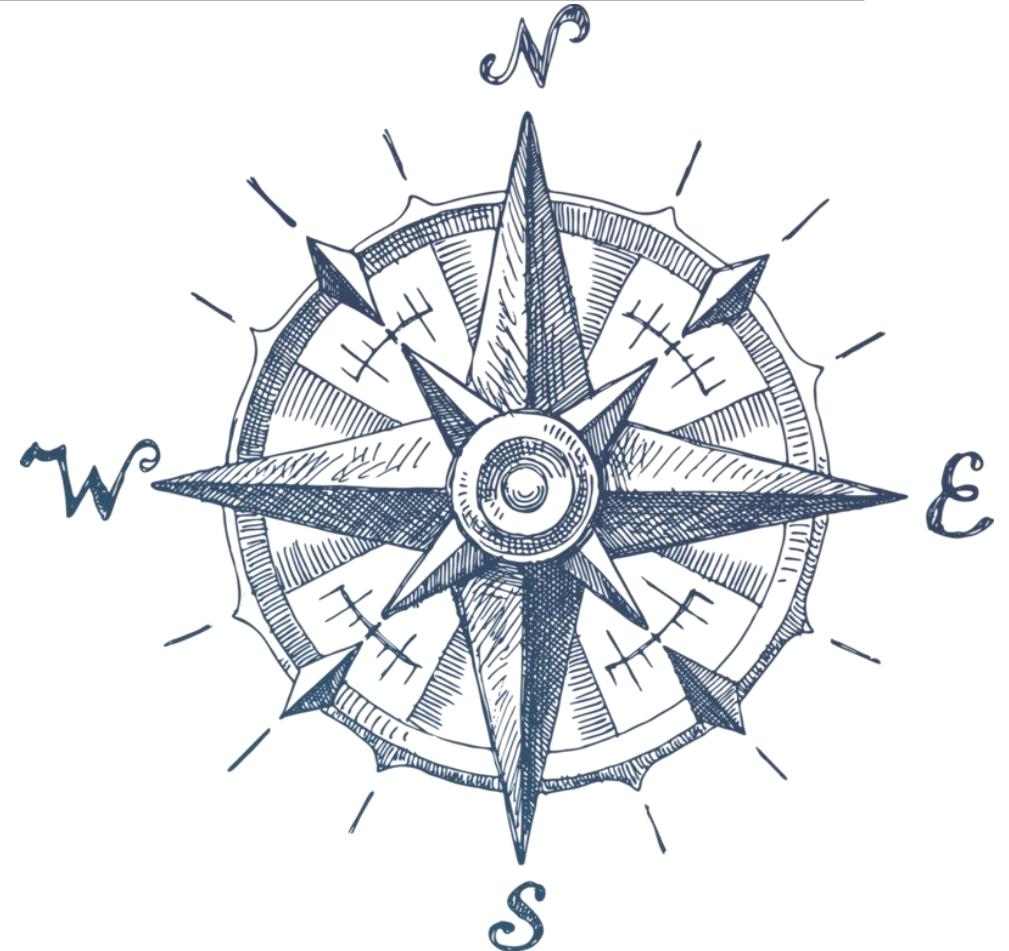
Navigation in a Text-based World

Cardinal Directions: Go North/South/East/West/
Northwest/Northeast/Southwest/Southeast
Also: Go Up, Down, In and Out

One letter commands were also supported:
N/E/S/W/NE/SE/NW/SW

Look/L: look around to see what is nearby

Not every direction is possible in every location.



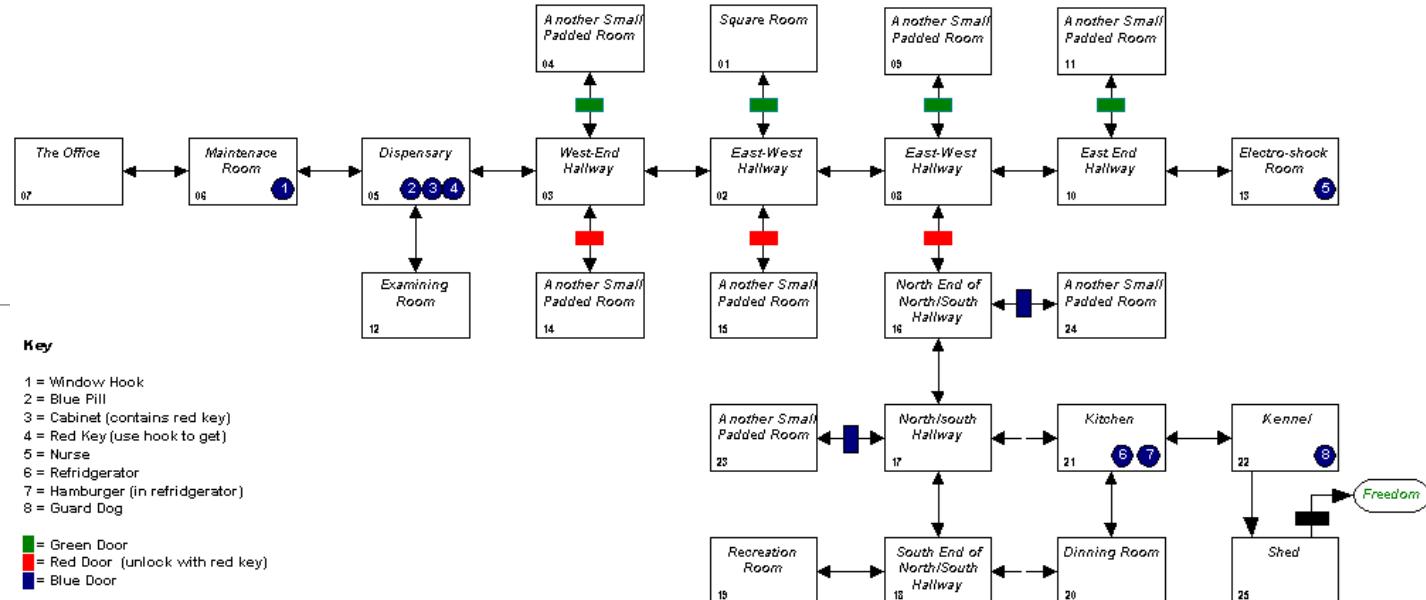
Colossal Cave Adventure

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.

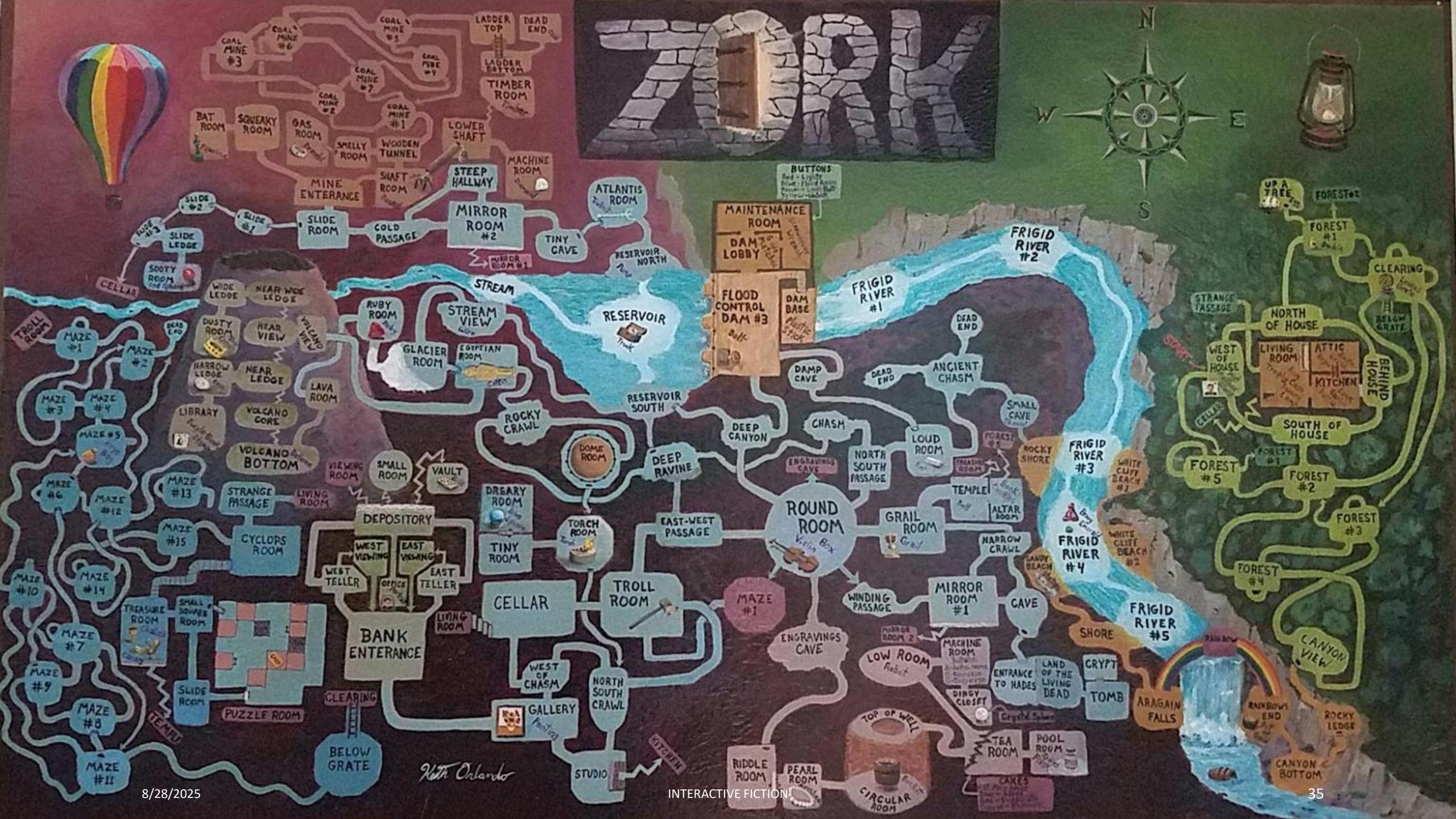
> go south

You are in a valley in the forest beside a stream tumbling along a rocky bed.

As a Data Structure



- You can implement an IF game as a directed graph.
- Each location in a node in the graph.
- Edges are connections to adjacent locations.
- Edges are labeled with the direction.
- Possible commands at a location are the labels of the outward edges.
- Locations can hold Objects.



Objects

In Adventure, instead of a realistic simulation of caving, the author placed five treasures within as an incentive to explore the cave.

The player had to figure out how to get past a snake to move deeper into the cave. The player is attacked by dwarves and their treasure is stolen by a pirate.

Examine Lamp

Items represent things in the game world. Usually they are mentioned in the description of a location like:

You are on the dungeon stairs. From above, you can make out some of the king's guards talking about current events. Someone's left an old lamp here.

Players can inspect them with the “EXAMINE” command.

> EXAMINE LAMP

This old lamp seems like it's seen some use. It ran out of oil ages ago.

Get Lamp

Players can pick up objects in the world, and they are added to the player's inventory with the "GET" command. The inventory is the set of things that the player has collected along the way.

Oftentimes, they are used to solve puzzles. For instance, you must have a lamp in your inventory in order to explore a dark cave.

To list all items that you have, you can issue the "INVENTORY" command (or just the letter "I").

Light lamp

Objects often have special commands associated with them. For instance, in order to solve the darkness puzzle you must say “LIGHT LAMP”.

Some special commands require more than one object in your inventory.

On the table is an elongated brown sack, smelling of hot...
A clear glass bottle is here.

The glass bottle contains:

A quantity of water.

>w

You are in the living room. There is a door to the east
is a wooden door with strange gothic lettering, which ap-
nailed shut.

In the center of the room is a large oriental rug.

There is a trophy case here.

On hooks above the mantelpiece hangs an elvish sword of

A battery-powered brass lantern is on the trophy case.

There is an issue of US NEWS & DUNGEON REPORT dated 28-J-

>get sword

Taken.

>break egg with sword

You rather indelicate handling of the egg has caused it some damage.

The egg is now open.

There is a golden clockwork canary nestled in the egg. It seems to
have recently had a bad experience. The mountings for its jewel-like
eyes are empty, and its silver beak is crumpled. Through a cracked
crystal window below its left wing you can see the remains of
intricate machinery. It is not clear what result winding it would
have, as the mainspring appears sprung.



FreakingNews.com

Object properties

Containment: Objects may have contents (the bottle can have wine in it)

Weight: Objects have weight (some objects might be too heavy to lift)

Position: An object may be in, on, or under another object

People are objects too

In Zork, a handful of living opponents thwart the adventurer: **the troll**, who stays put in a single room and serves as an obstacle; **the vampire bat**, who can carry off the adventurer; **the cyclops**, who can dine on the adventurer; and **the thief**, who wanders around the underground areas stealing items from the adventurer.

These people/opponents can be implemented as objects too. People objects often have a special command for dialogue via “TALK TO”.

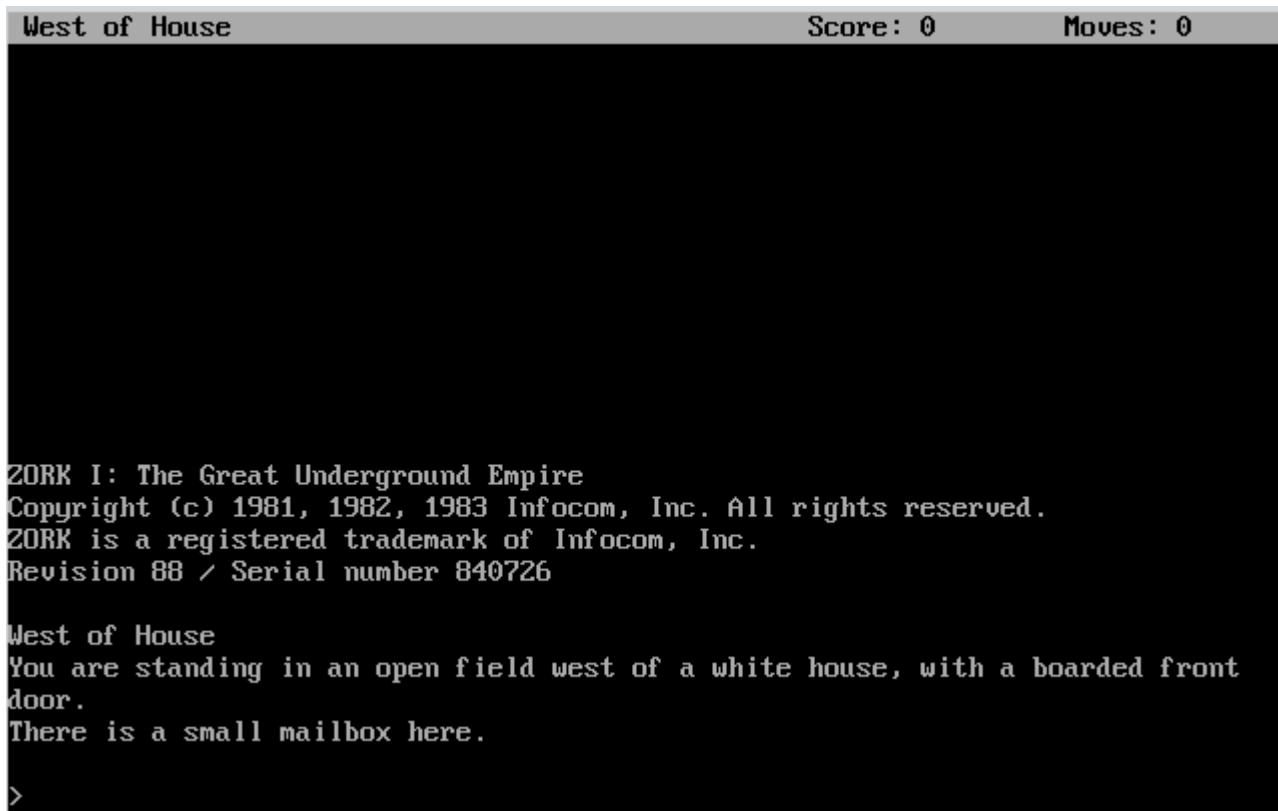
In-class Activity: Play a Game (5 min)

<https://playminigames.net/game/zork-1-the-great-underground-empire>

(or just Google “zork online” and pick any of them)

And answer these questions:

1. What commands did you try that didn't work?
2. How does this experience differ from reading a (non-interactive) story?



Puzzles

In most interactive fiction, puzzles (sorts of challenges or obstacles) are part of the world the player character moves through. In order to complete the IF work, the interactor must figure out how to meet these challenges.

Puzzle Solutions

The solutions may be arrived at through the player character's senses or by having the player character manipulate things in the surroundings and then observe the results to determine the workings of the world.

Most interactive fiction does not have great replay value. You cannot simply "replay" a riddle if you know its answer.

However, once you learn to play a board game, the knowledge gained from playing it once game doesn't ruin the experience of playing it again.

Zork's diamond machine

In the coal mine, the player character finds a machine with a tiny slot in the top of it. What this machine does, and how to turn it on, is unclear.

The solution is to put some coal into the machine, and then turn on the machine using the screwdriver. This results in the coal being compressed with great force producing a diamond.

The player can act as scientist and put anything inside, then observe the results.

Guess the Verb

A few puzzles require the player “guess the verb” and perform an action that would not be obvious from the commands available. The game's parser does not understand unless the player uses a particular way to phrase the command (sometimes non-obvious).

For example, if there is a crate to be opened with a crowbar and the only way to open it is to "**pry crate with crowbar**", other actions like "**open crate with crowbar**" give a misleading response. Usually this is a deficiency in the parser.

Some games like Ad Verbum by Nick Montfort intentionally include guess-the-verb puzzles to good effect in contexts where the puzzles are explicitly about language.

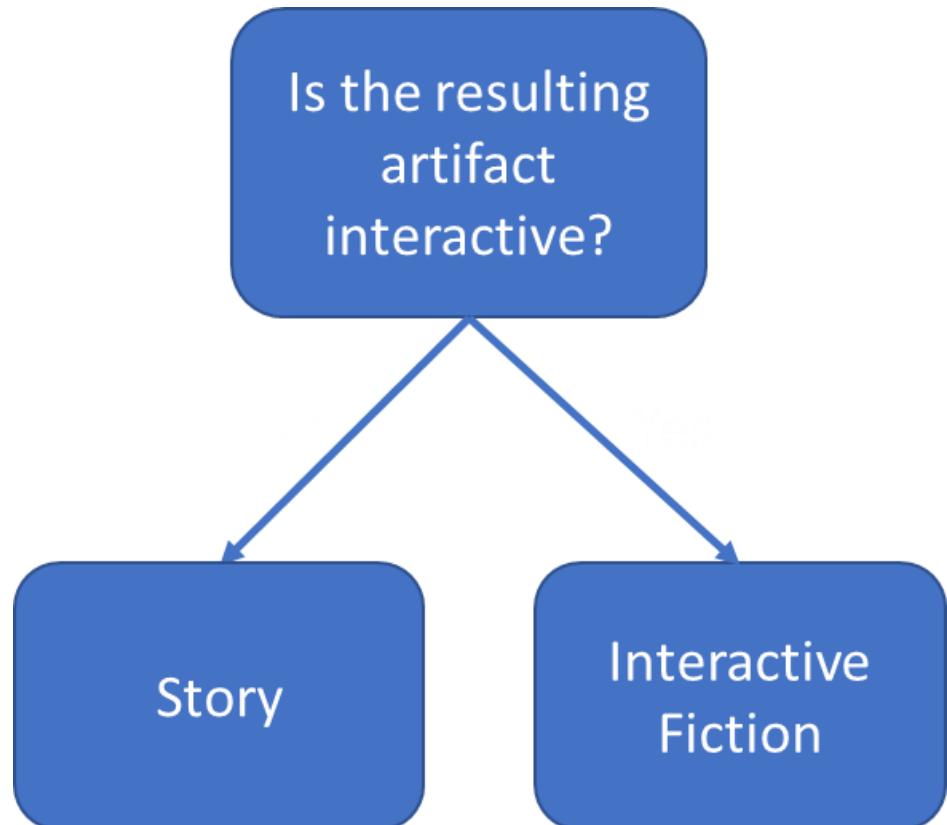
IF Summary

1. What's the difference between TTRPGs like D&D and Choose-Your-Own-Adventure games?
2. Why were IF commands so simple?
3. What makes IF games hard to win?

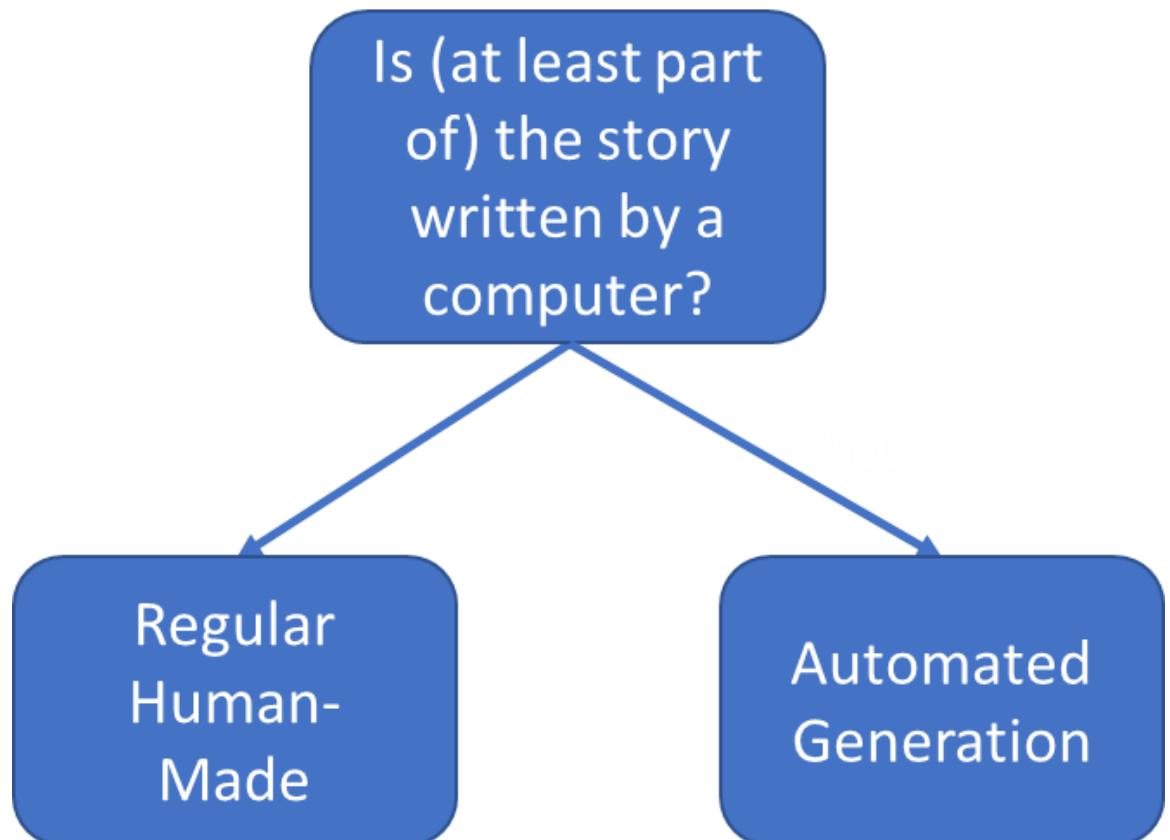
Automated Story Generation

Interactive Fiction vs Automated Story Generation

What is it?



How was it made?



Early Systems

TALE-SPIN (1977):

One day,
JOE WAS THIRSTY.
JOE WANTED NOT TO BE THIRSTY.
JOE WANTED TO BE NEAR THE WATER.

UNIVERSE (1984):

>> LIZ tells NEIL she doesn't love him
working on goal – (WORRY-ABOUT
NEIL) – using plan BE-CONCERNED
Possible candidates – MARLENA JULIE
DOUG ROMAN DON CHRIS KAYLA
Using Marlena for WORRIER
>> MARLENA is worried about NEIL

Common Automated Story Generation Methods

Using a neural network to generate the next, likely word. Thus, creating stories one word at a time.

More in Module 1: Large Language Models!

Using plots to decide which path to take (like the computer is playing a Choose-Your-Own adventure game!)

More in Module 2: Scripts and Guided Generation!

Course Overview

Materials

Mostly on course website: <https://laramartin.net/interactive-fiction-class/>

Submissions and grades are on Blackboard

No textbook!

You will probably need to purchase credit for OpenAI API. Let me know if you need financial help with this.

Academic Integrity

- If you feel the need to cheat on the assignment to do well on it, please talk to me or Ta first. We can work it out ahead of time, but once you cheat it's hard to do anything.

If you cheat or plagiarize, you...

- aren't learning anything
- wasting money paying for tuition
- will get an F on the assignment (at the very least)

More details on course website

If you want to use LLMs for assignments

- If it's explicitly part of the assignment, follow the assignment instructions
- Otherwise, make sure you're saying that you used it
- Always:
 - Provide your prompt and the original generation (along with how you edited it)
 - Make sure that you're not avoiding the learning objectives by using it
- If you **do not** say you're using it and I notice, that is an academic integrity violation
- It's okay to use grammar tools (e.g., spell check or Grammarly) or small-scale prediction (e.g., next word prediction, tab completion), provided that they don't change the **substance** of your work

Course-Long Learning Objectives

1. See the components of what goes into creating text-based games and automatically generating stories.
2. Understand the strengths and weaknesses of neural language models (LMs) for storytelling.
3. Implement and appraise the value of (a) conditioned generation, (b) planning, and (c) schemata in story generation/interactive fiction playing.
4. Combine and argue for the appropriate components of a working story generation system or interactive fiction–playing system.
5. Create your own story generation system or interactive fiction–playing system.

Topics

Introduction to IF and Automated Story Generation (Module 0)

Large Language Models (Module 1)

Scripts and Guided Generation (Module 2)

Search and Planning (Module 3)

Commonsense Reasoning + Schemas (Module 4)

Dialog, Agents, Characters (Module 5)

Bonus material (Module 6)

Evaluation

Potential guest speaker from Hidden Door

Grading

Assignment	491 (undergrad)	691 (grad)
Homework 0	7%	7%
Homework 1	12%	12%
Homework 2	12%	12%
Homework 3	12%	12%
Homework 4	12%	12%
Project	30%	30%
Knowledge Checks	15%	5%
Paper Presentation	-	10%

Policies

Everyone has 5 free late days (3 max per homework)

- No excuse needed/no need to tell me you're using them

You can collaborate on homeworks (1-2 people) and the project (3-5 people),
not the knowledge checks or grad presentation

Knowledge Checks

Quick in-class activities or polls to test your understanding

I try to give feedback on them (sometimes in bulk, sometimes individual)

Not graded for accuracy (1 = you did it, 0 = you didn't)

You can make it up anytime, no need to let us know

Just submit it on Blackboard

Lowest 2 grades dropped (i.e., you're allowed to miss two without making it up)

Active Learning

My classes are interactive by nature

Interactive learning can feel like you're not learning as much (because you're less bored probably), but you're actually learning more than you would with just a lecture [1,2]

If this is not your style, now's the time to drop the class

[1] T. Blyznyuk and T. Kachak, "Benefits of Interactive Learning for Students' Critical Thinking Skills Improvement", *jpnu*, vol. 11, no. 1, pp. 94–102, Mar. 2024.
<https://journals.pnu.edu.ua/index.php/jpnu/article/view/7840>

[2] S. Freeman, S.L. Eddy, M. McDonough, M.K. Smith, N. Okoroafor, H. Jordt, & M.P. Wenderoth, Active learning increases student performance in science, engineering, and mathematics, Proc. Natl. Acad. Sci. U.S.A. 111 (23) 8410-8415, <https://doi.org/10.1073/pnas.1319030111> (2014).

Class Project

Create either a cool demo or research a problem relevant to class

Groups of 3-5 people

There will be 4 deadlines throughout the semester

Each deadline builds on the previous

Grad Student Presentations

Prepare an 8-minute presentation on a paper from the reading list or another paper relevant to the module you are assigned

Your presentation should summarize the work and analyze

Module ranking is due 9/5

How to Contact Us

Email us with specific questions

- Instructor: laramar@umbc.edu
- TA: dta1@umbc.edu

Disclaimer about POTS

I have a disability called Postural Orthostatic Tachycardia Syndrome (POTS)

- It means that my blood doesn't always go where I need it to go (such as my head)
- It's a *dynamic disability*, meaning that it's worse some days than others

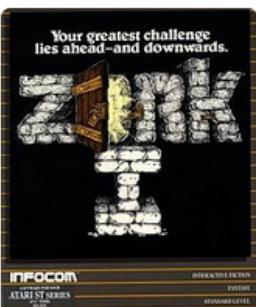
How does it affect this class?

- I will be lecturing sitting down
- I might get brain fog and have trouble thinking or recalling words

Office Hours

Thursdays 3:15-5 PM EST in ITE 342-A

Or by appointment: <https://calendly.com/laramar/schedule>



Zork, an early interactive fiction game released in 1977.

This assignment is due on Monday, September 9, 2024 at 11:59PM EST.

You can download the materials for this assignment here:

- Text Adventure Game starter code (Zip file)
- Parsely: Preview n' Play Edition (this contains the Action Castle game).
- Text from Action Castle

Homework 1: Build a Text-Adventure Game

Instructions

In this homework assignment, you will write your own classic text adventure game. This homework can be completed in groups of up to 5 people. You will implement two text adventure games. One will be a re-implementation of the **Action Castle** game, and one will be a game that you design yourself. The game that you design can be on any topic, or can tell any story of your choice. We will play the games that you design during class, and part of your grade will be awarded based on how creative/exciting your classmates think your game is.

If your team has more than 2 members, you complete extensions to keep the amount of work comparable to smaller teams.

<https://laramartin.net/interactive-fiction-class/homeworks/text-adventure-game/text-adventure-game.html>

Using our Starter code

We have provided [starter code for a basic text adventure game](#). I recommend using Visual Studio Code for this homework. You should get started by reviewing the [HW1_Tutorial.ipynb](#) which introduces the concepts in our starter code.

Environment Setup

First download the zip file, then create a virtual environment and install the dependencies.

```
$ unzip IF-Class-HW1.zip  
$ cd IF-Class/HW1/  
$ python3 -mvenv venv  
$ source venv/bin/activate  
(venv) $ pip install .
```