Dialogue and Narrative Generation

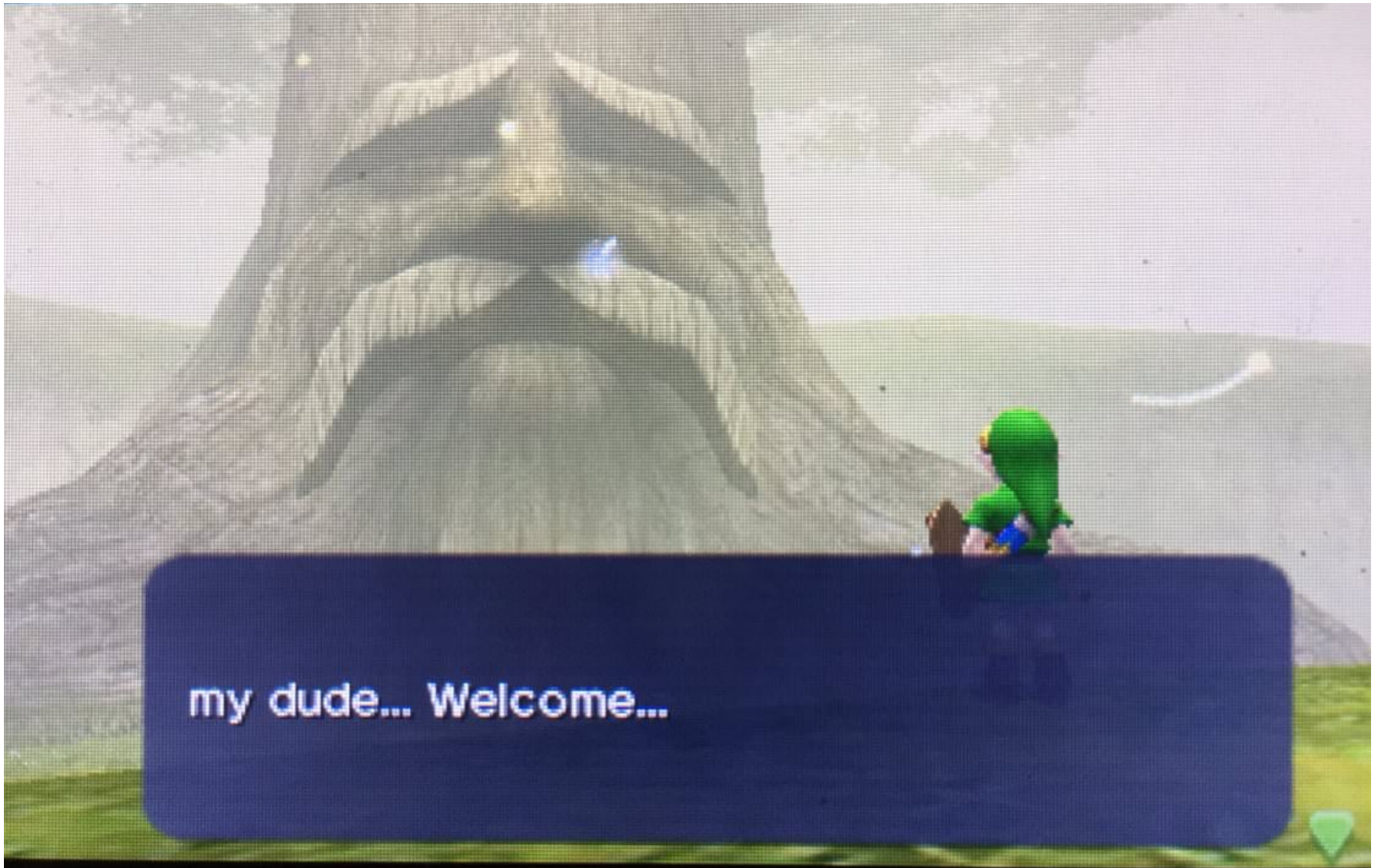
Matthew Guzdial

guzdial@ualberta.ca

Announcements

- Today is the second to last lecture
- Tomorrow (Thursday) 5-8pm is an Assignment 5 help session
- Friday: Last lecture on AI-based game design
- Monday: Quiz 6 and Assignment 5 due
- Reminder: Make-up oral exams scheduled by Dec 7, send an email with potential time slots (the more the better)

Previously… grammars and tokens



Dialogue and Narrative, what's their relationship?

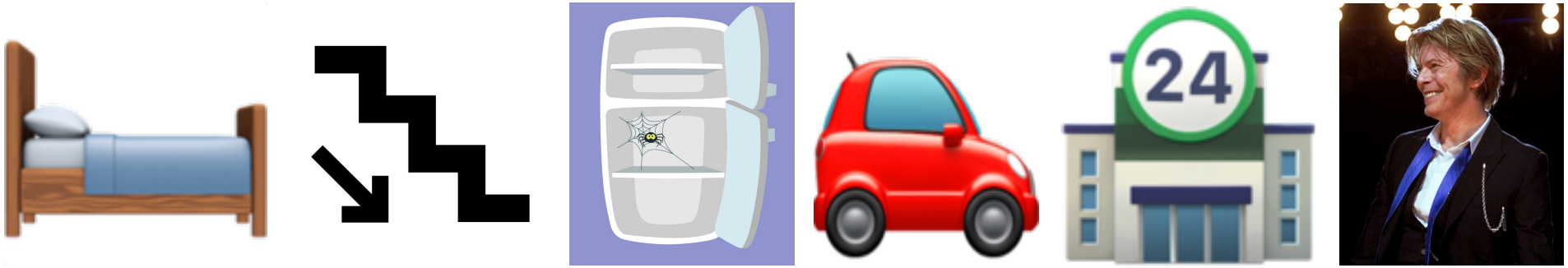
Mieke Bal's Narratology:

- Fabula: The literal history of events
- Sjuzhet: The subset of events presented to the audience.

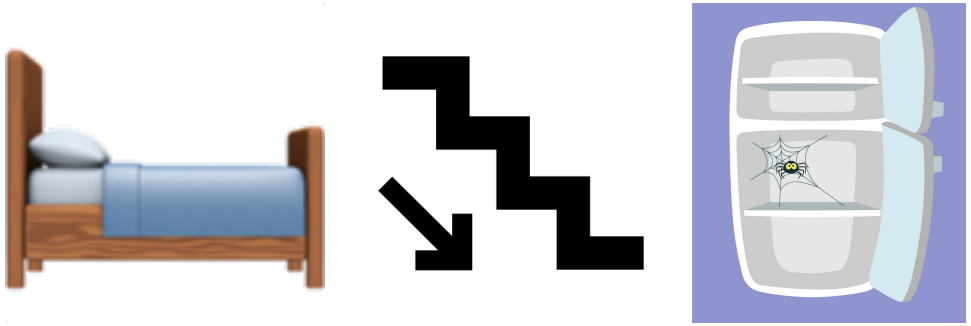
- Text or Media: Third layer defined later, specifies how the Sjuzhet is conveyed to the audience.

Maria Gertrudis "Mieke" Bal

Fabula:



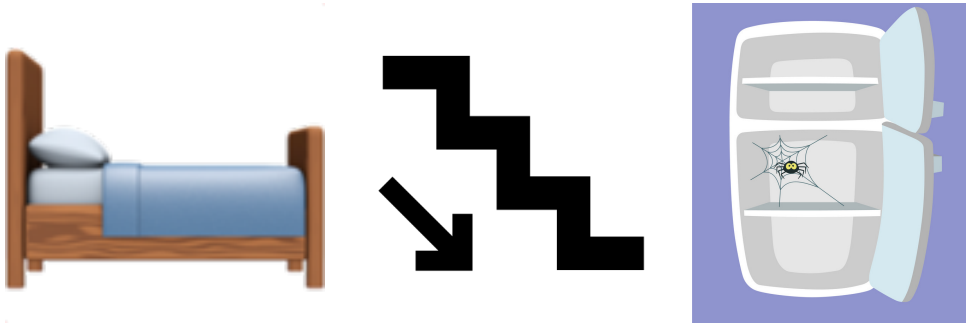
Sjuzhet 1 AKA Sad Story:



Sjuzhet 2 AKA Cool Story:

Sjuzhet 3 AKA Telling s/o you don’t know how your day went:

Sjuzhet 1 AKA Sad Story:



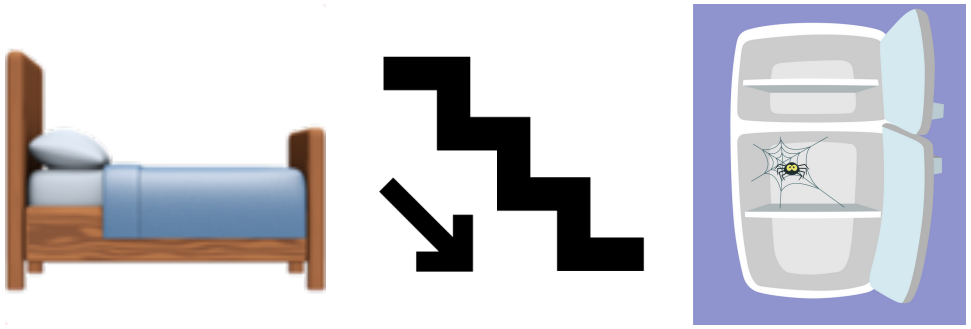
Text/Media 1: Literal Text:

I woke up the other day, went downstairs, and found my fridge was entirely empty.

Text/Media 2: Painting

Hunger Painting by Kateryna Bortsova

Text/Media 3: Emojis/Icons



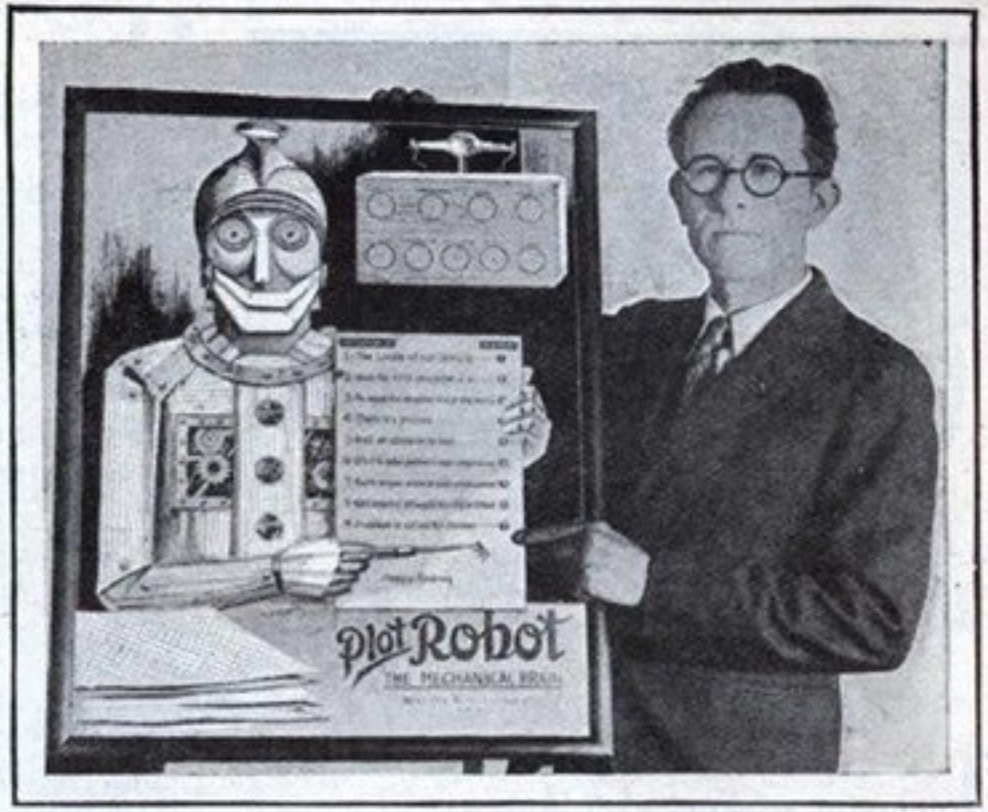
Story Generation Strategies

- **Top-down story generation:** Generation a series of events (fabula) then extract a story (sjuzhet) from that, and finally convert that into some output (text/media).
  - E.g. what I just showed you
- **Bottom-up story generation:** Generate raw text/media output and use a secondary process like human putting things together to form a coherent narrative
  - E.g. AI Dungeon

Early Days: Rules, Grammars, and Planners

Robot With Mechanical Brain Thinks Up Story Plots

FORMERLY robots were merely mechanical devices that could perform a variety of stunts under the guidance of a human being, but now a robot has made its appearance that thinks, has a soul of a kind, creative imagination, and other qualities necessary for writing a modern stereotyped short story. This robot, the invention of Wycliffe Hill, a Los Angeles scenario writer, is declared to be able to build up millions of plots, no two alike, for magazine stories or movie plays.



Mr. Wycliffe Hill demonstrating his new story writing robot, which can think up any kind of plot with its mechanical brains.

Mr. Hill has equipped his robot with an index chart, divided into eight sections, one devoted to each of the eight elements of a story—background, character, obstacle, problem, predicament, complication, crisis and climax—and with an assortment of variations. The robot selects the material as required from this inexhaustible source and builds plots that could never be imagined by the author without the aid of the mechanical brain. Now if you want to become a successful author simply obtain a robot and put it to work.

```
  Welcome to
                 EEEEEE  LL      IIII   ZZZZZZ   AAAAA
                 EE      LL       II       ZZ   AA   AA
                 EEEEE   LL       II     ZZZ    AAAAAAA
                 EE      LL       II    ZZ      AA   AA
                 EEEEEE  LLLLLL  IIII ZZZZZZ    AA   AA

  Eliza is a mock Rogerian psychotherapist.
  The original program was described by Joseph Weizenbaum in 1966.
  This implementation by Norbert Landsteiner 2005.


ELIZA: Is something troubling you ?
YOU:   Men are all alike.
ELIZA: What is the connection, do you suppose ?
YOU:   They're always bugging us about something or other.
ELIZA: Can you think of a specific example ?
YOU:   Well, my boyfriend made me come here.
ELIZA: Is it important to you that your boyfriend made you come here ?
YOU:   He says I'm depressed much of the time.
ELIZA: I am sorry to hear that you are depressed.
YOU:   It's true. I am unhappy.
ELIZA: Can you explain what made you unhappy ?
YOU:
```

ELIZA
https://web.njit.edu/~ronkowit/eliza.html

- 1966 chatbot
- One of the first chatbots and the most popular early one
- Had a series of canned phrases to keep a conversation going and could “reflect” the previously written text
- E.g. “Tell me more about [whatever you last said]”
- Very popular and impressive for the time, but written as a joke

Early Storytelling - Rules and Grammars

A LION HAS BEEN IN TROUBLE FOR A LONG TIME. A DOG STEALS SOMETHING THAT BELONGS TO THE LION. THE HERO, LION, KILLS THE VILLAIN, DOG, WITHOUT A FIGHT. THE HERO, LION, THUS IS ABLE TO GET HIS POSSESSION BACK.

Joseph E. Grimes, 1960

Syntactic Rules and Semantic Interpretation Rules

(1) Story -> Setting + Episode
    => ALLOW (Setting, Episode)
(2) Setting -> (States)*
    => AND (State, state,.....)
(3) Episode -> Event + Reaction
    => INITIATE (Event, Reaction)
(4) Event -> {Episode | Change-of-state | Action | Event + Event}
    => CAUSE ($Event_1$, $Event_2$) or ALLOW ($Event_1$, $Event_2$)
(5) Reaction -> Internal Response + Overt Response
    => MOTIVATE (Interval-response, Overt Response)
(6) Internal Response -> {Emotion | Desire}
(7) Overt Response -> {Action | (Attempt)*}
    => THEN ($Attempt_1$, $Attempt_2$,.....)
(8) Attempt -> Plan + Application
    => MOTIVATE (Plan, Application)
(9) Application -> (Preaction)* + Action + Consequence
    => ALLOW (AND(Preaction, Preaction,..),
        {CAUSE | INITIATE | ALLOW} (Action, Consequence))
(10) Preaction -> Subgoal + (Attempt)*
    => MOTIVATE [Subgoal, THEN (Attempt,.....)]
(11) Consequence -> {Reaction | Event}

Rumelhart, David E. "Notes on a schema for stories." *Representation and understanding*. Morgan Kaufmann, 1975. 211-236.

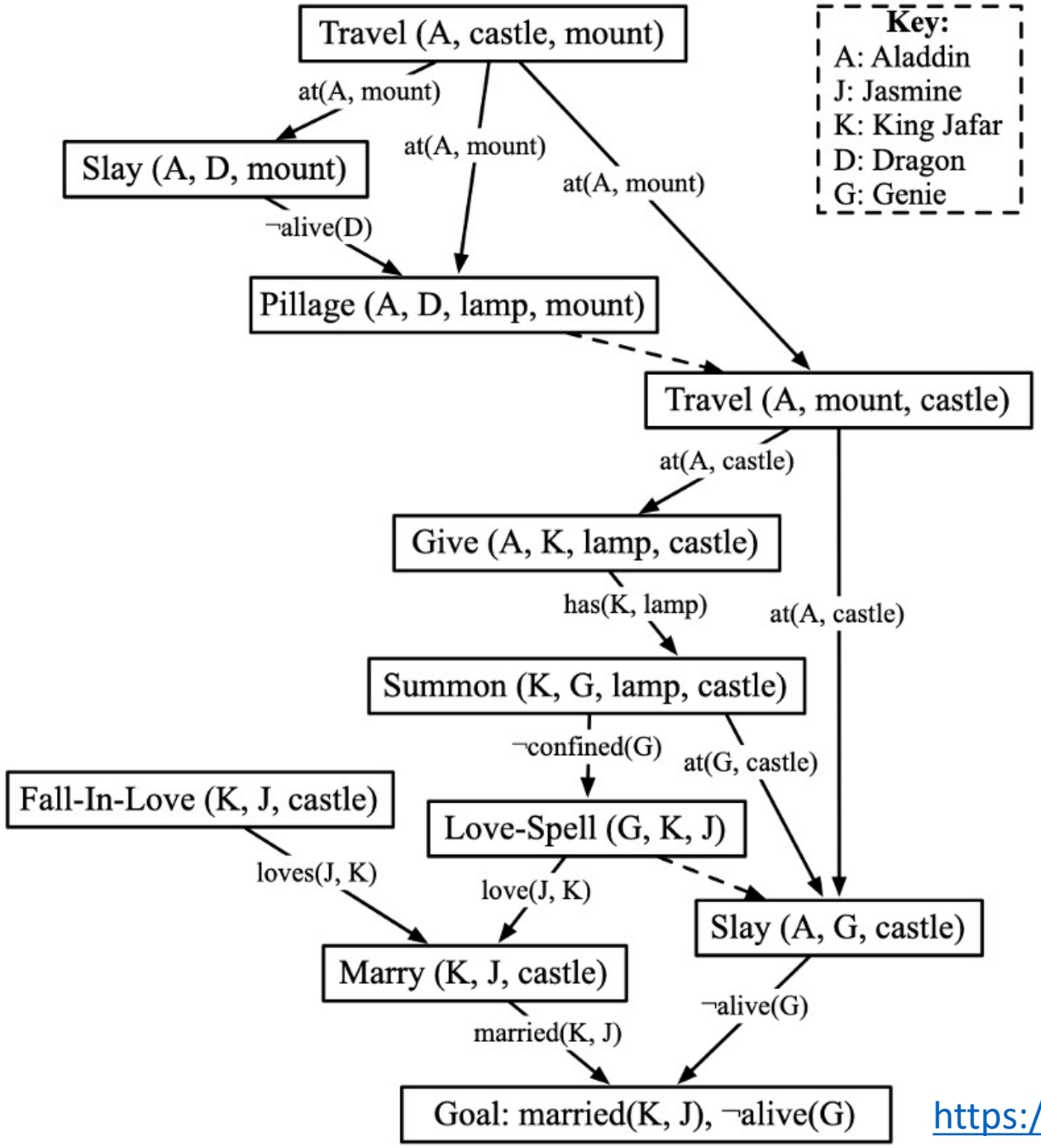
Tale Spin (1977): the first “intelligent” AI storyteller

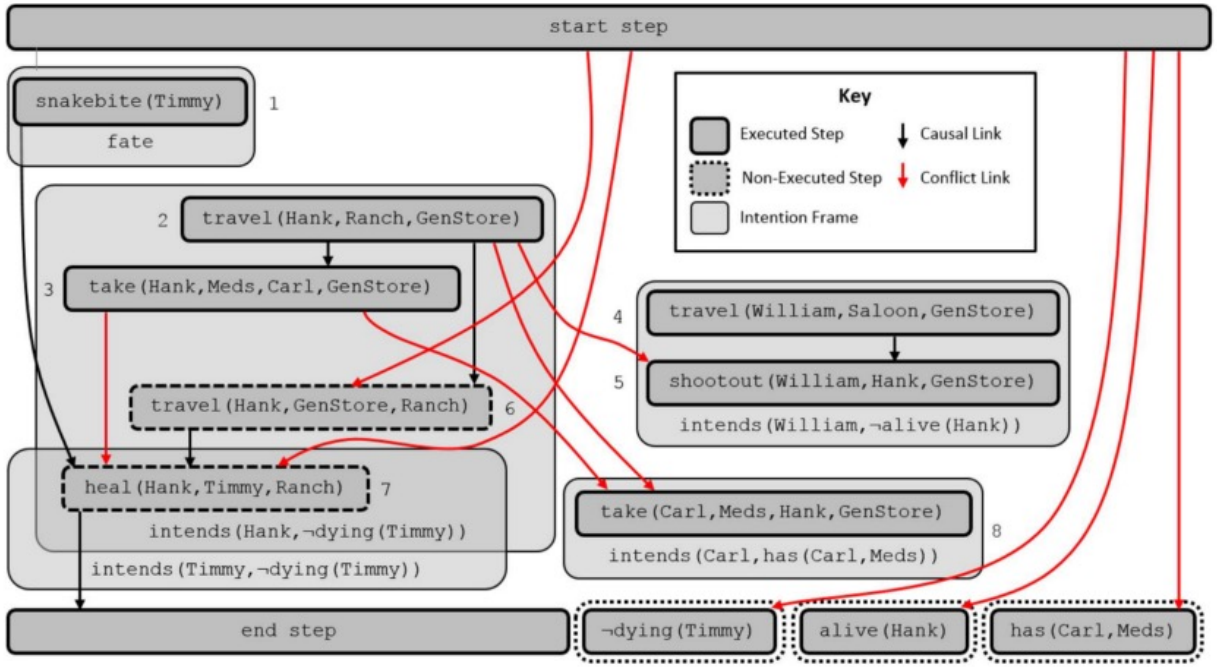
- AI agents with goals (“don’t die”) given an initial situation (“hungry”)
- AI agents come up with a series of actions to achieve their goals (Fabula).
- Every event/action is taken as the story (Sjuzhet)
- Print out to console in text form (Text)

Meehan, James R. "TALE-SPIN, An Interactive Program that Writes Stories." *Ijcai*. Vol. 77. 1977.

ONCE UPON A TIME GEORGE ANT LIVED NEAR A PATCH OF GROUND. THERE WAS A NEST IN AN ASH TREE. WILMA BIRD LIVED IN THE NEST. THERE WAS SOME WATER IN A RIVER. WILMA KNEW THAT THE WATER WAS IN THE RIVER. GEORGE KNEW THAT THE WATER WAS IN THE RIVER. ONE DAY WILMA WAS VERY THIRSTY. WILMA WANTED TO GET NEAR SOME WATER. WILMA FLEW FROM HER NEST ACROSS A MEADOW THROUGH A VALLEY TO THE RIVER. WILMA DRANK THE WATER. WILMA WAS NOT THIRSTY ANY MORE.

Henry Ant was thirsty. He walked over to the river bank where his good friend Bill Bird was sitting. Henry slipped and fell in the river. He was unable to call for help. He drowned.





https://www.semanticscholar.org/paper/A-Computational-Model-of-Plan-Based-Narrative-at-Ware-Young/1986349b2df8b9d4064453d169d69ecfde283e27

Planning has been going strong for decades

https://arxiv.org/abs/1401.3841

https://store.steampowered.com/app/512890/Elsinore/

PQ1: Planners have a lot of atomic actions that aren't all that interesting to print out. How could we identify an interesting Sjuzhet (subset of events/actions)?
https://forms.gle/pBz4LgWccYiqqpd
https://tinyurl.com/guz-pq33

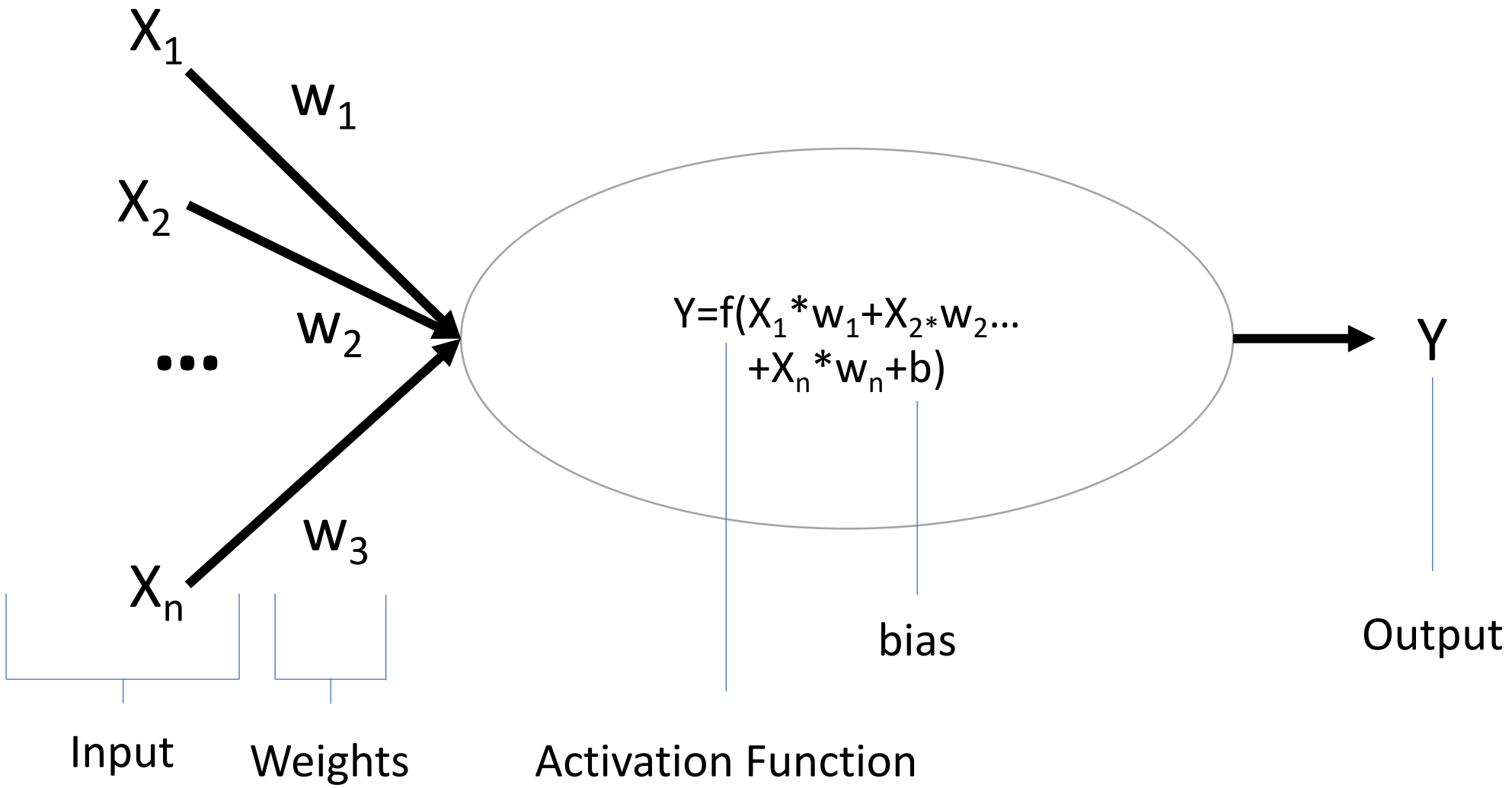
Story Sifting: Finding interesting stories (subsets of events or Sjuzhets) from a whole mess of generated histories with patterns/rules.

```
(pattern arsonRevenge
  (event ?harm where
    tag: harm,
    actor: ?victim, target: ?arsonist)
  (event ?scheme where
    eventType: hatch-revenge-scheme,
    actor: ?arsonist, target: ?victim,
    (ancestor ?harm ?scheme)),
  (event ?arson where
    eventType: set-fire,
    actor: ?arsonist, target: ?victim,
    (ancestor ?scheme ?arson)))
```

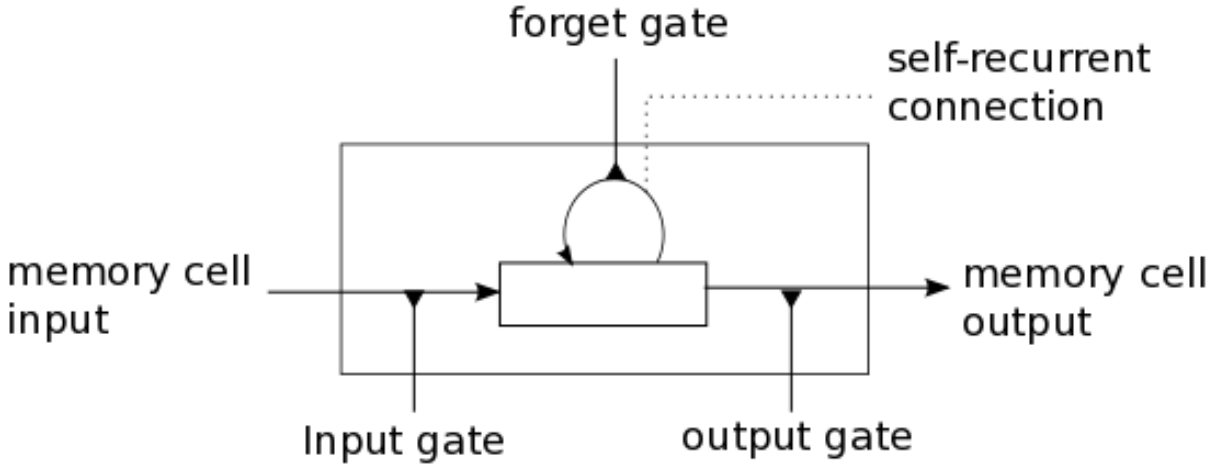
Kreminski, Max, Melanie Dickinson, and Michael Mateas. "Winnow: A Domain-Specific Language for Incremental Story Sifting." *Proceedings of the AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*. Vol. 17. No. 1. 2021.

If you voted for this topic, you probably wanted me to cover things like GPT-3 and AI Dungeon

Neural Networks
(Example on virtual white board given time)



4. Long Short-Term Memory Recurrent Neural Networks (LSTMs)



LSTMs (prior to Transformers) were the SOTA for sequence modeling, based on holding a particular index of an input sequence in memory for a learned number of indexes.

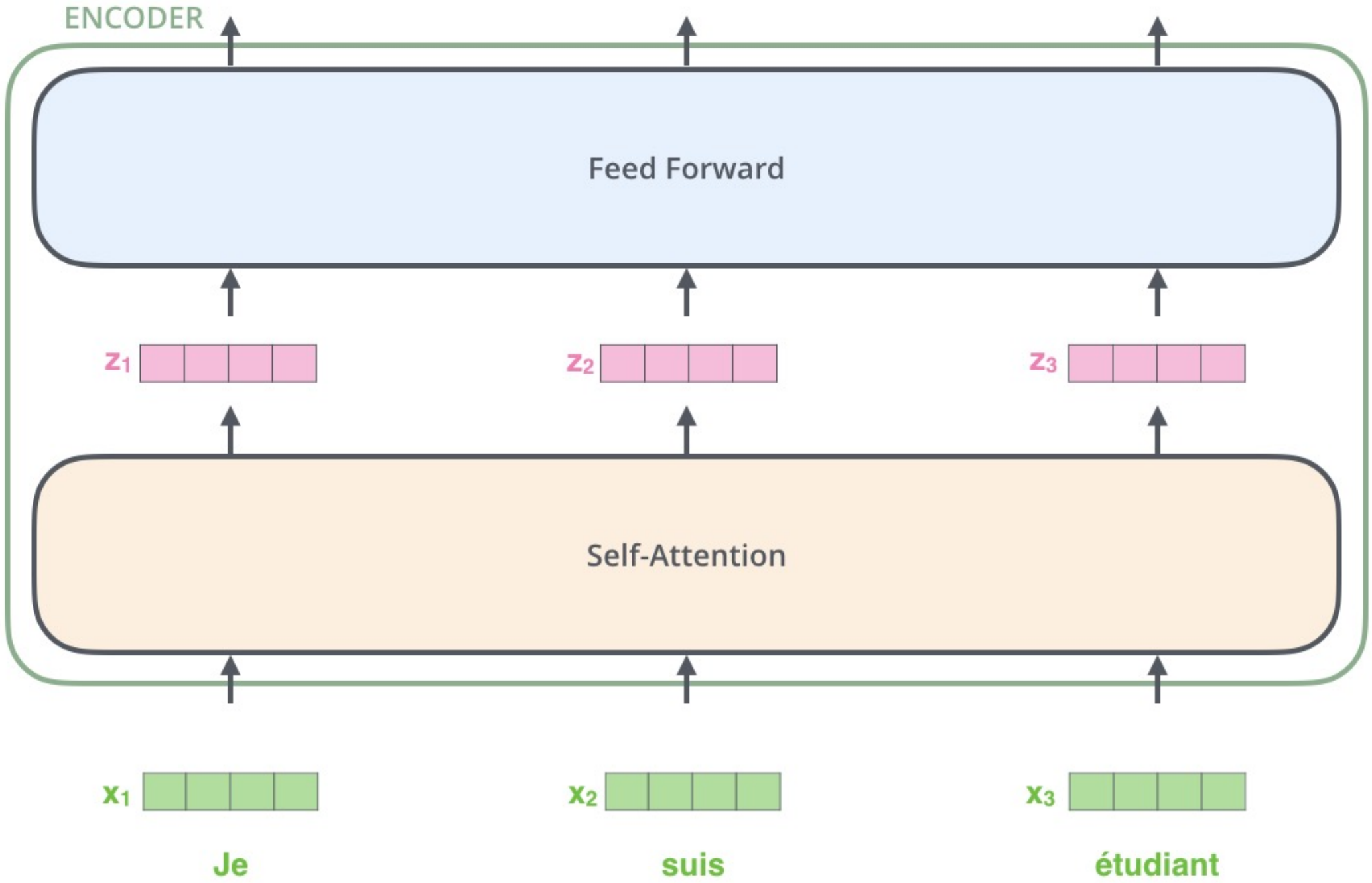
Example: Shakespeare LSTM Generation

_ that I have the count rousillon .I have a seem to me the moon , and the moon. Tongue .I will not be the count of the stores ,and the starries ,the singer ,and the starries. the town with thee the more the tome that man hath the mond the to fat and the tome to mire what mark her with thee the more that i may that n hath prome,there he fall thealy be aseath your eyes to seek ne will you me fair ? that fair again unsay.demetrius loves your fair : o happy fair !your eyes are lode-stars ! and your tongue's sweet melody.were the world mine,demetrius being bated,the rest i'd give to be to you translated.o ! teach me how you look,and with what art you sway the motion of demetrius' heart.i frown upon him,yet he loves me still.o ! that your frowns would teach my smiles such skill.i give him curses,yet he gives me _

https://github.com/atrybyme/LSTM-Shakespearean-Text-Generation

Transformers: The new Seq2Seq hotness

https://jalammar.github.io/illustrated-transformer/


ENCODER
Feed Forward
z1
z2
z3
Self-Attention
x1
x2
x3
Je
suis
étudiant

AI Dungeon/AI Dungeon 2

```
"I need some help".
> with what?

"With getting my computer working".
> did you try turning it on?

"No, I tried using the mouse".
> press the on button

The wizard turns around and stares at you. "What the **** are you trying to turn
 on?", he asks.
> turn on the computer

"How the **** would I know if you turned on the computer?"
> i turn on the computer

"So you're telling me you didn't even know what was going on when you pressed
 the on button?"
> it's on now

"That's not true, I turned on the computer".
> Fine, now download Manjaro

"Manjaro? That's a free operating system? What the **** does that mean?"
```

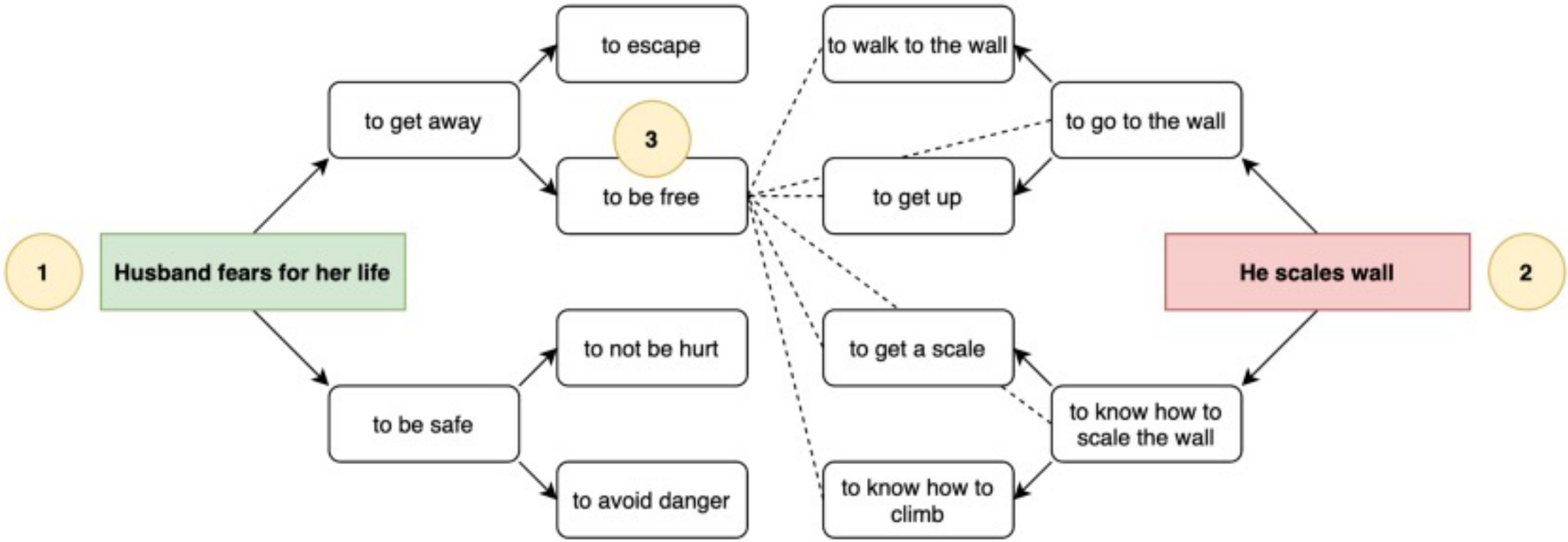
Transformers: Great at local coherency, awful at global coherency

What’s good at global coherency?

Planners!

- “Neurosymbolic” approaches combine symbolic approaches (grammars, planners, etc.) with neural networks
- AI Dungeon 2 makes use of this to try to prompt the DNN generator towards certain outputs.

Neurosymbolic Example



https://arxiv.org/abs/2009.00829

	C2PO	BERT+infill
Mystery	**Holmes decides go.** Holmes wants to go. Holmes begins to see something. Holmes begins to look around. **Holmes notices a pair of trouser knees.** Holmes wants to clean up. Holmes begins take a shower. Holmes wants to get ready. Holmes wants to walk to the store. **Holmes taps in front of Wilson's shop.** Holmes tries say hello. Holmes wants start the car. Holmes tries to drive to the scene. **He calls Police Inspector Jones.**	**Holmes decides go.** Holmes new friend initially stays. Holmes new son accepts goes. Holmes mother also stays. **Holmes notices a pair of trouser knees.** Holmes himself still watches. Holmes again is house ghost watches. Holmes insists he took watch. **Holmes taps in front of Wilson's shop.** Holmes smiles and eventually leaves. Holmes red cap now appears. Holmes silhouette finally stands. **He calls Police Inspector Jones.**

https://arxiv.org/abs/2009.00829

Even with this to structure the output it’s not perfect!

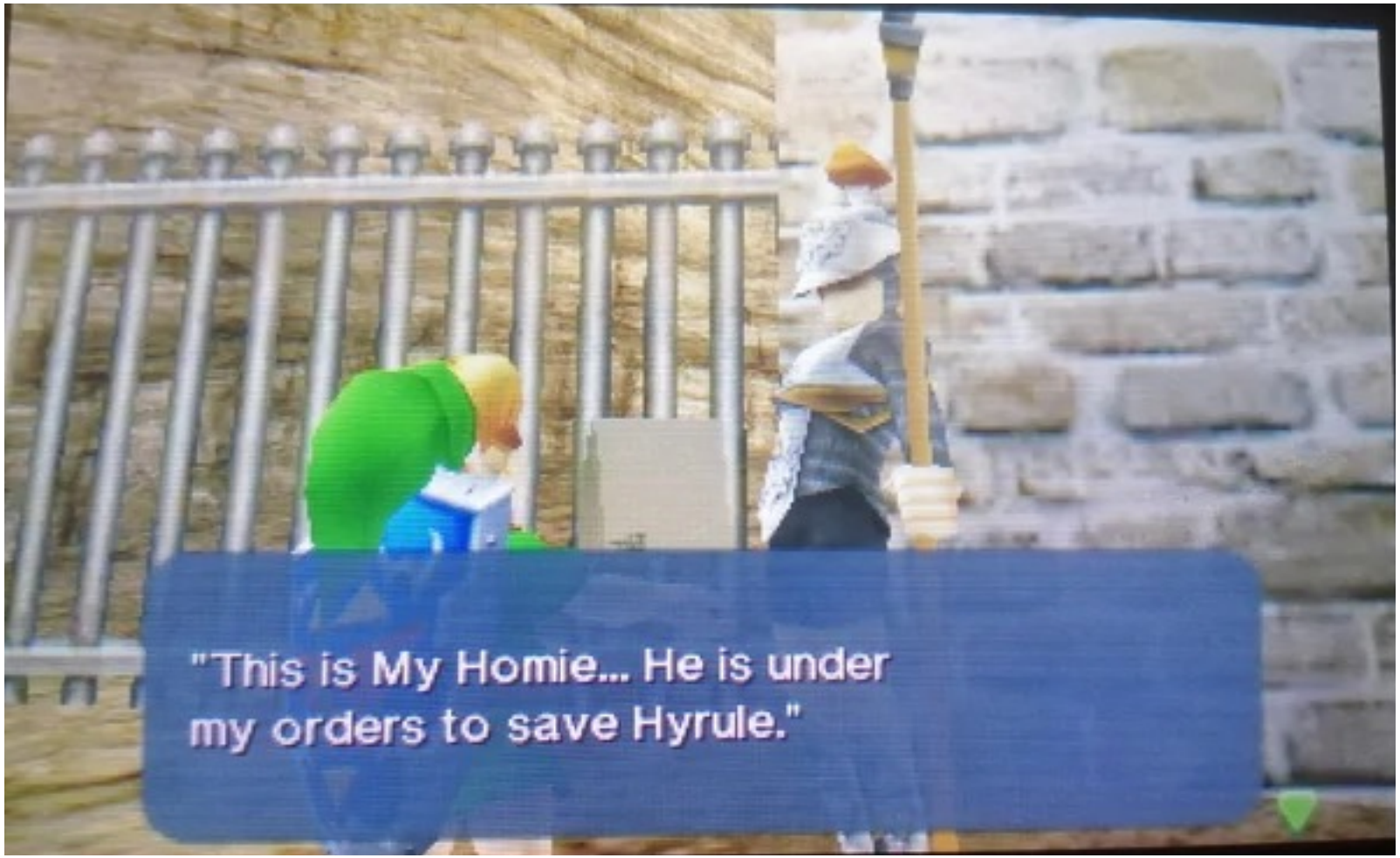
AI Dungeon 2 “World Info” Example:

“For example, I'm trying to construct a star trek scenario. There's an alien named Kerr. I have some world info with "Kerr" as a tag. The info says that she is an Arran, she looks like an ostrich with two necks and two heads. I run the scenario, and if I can persuade the game to include her at all, most of the time she is described as a human woman.”

https://features.aidungeon.io/ideas/AID-I-1732

Applications?

Dialogue that responds to player decisions? Most cases: just slot filling



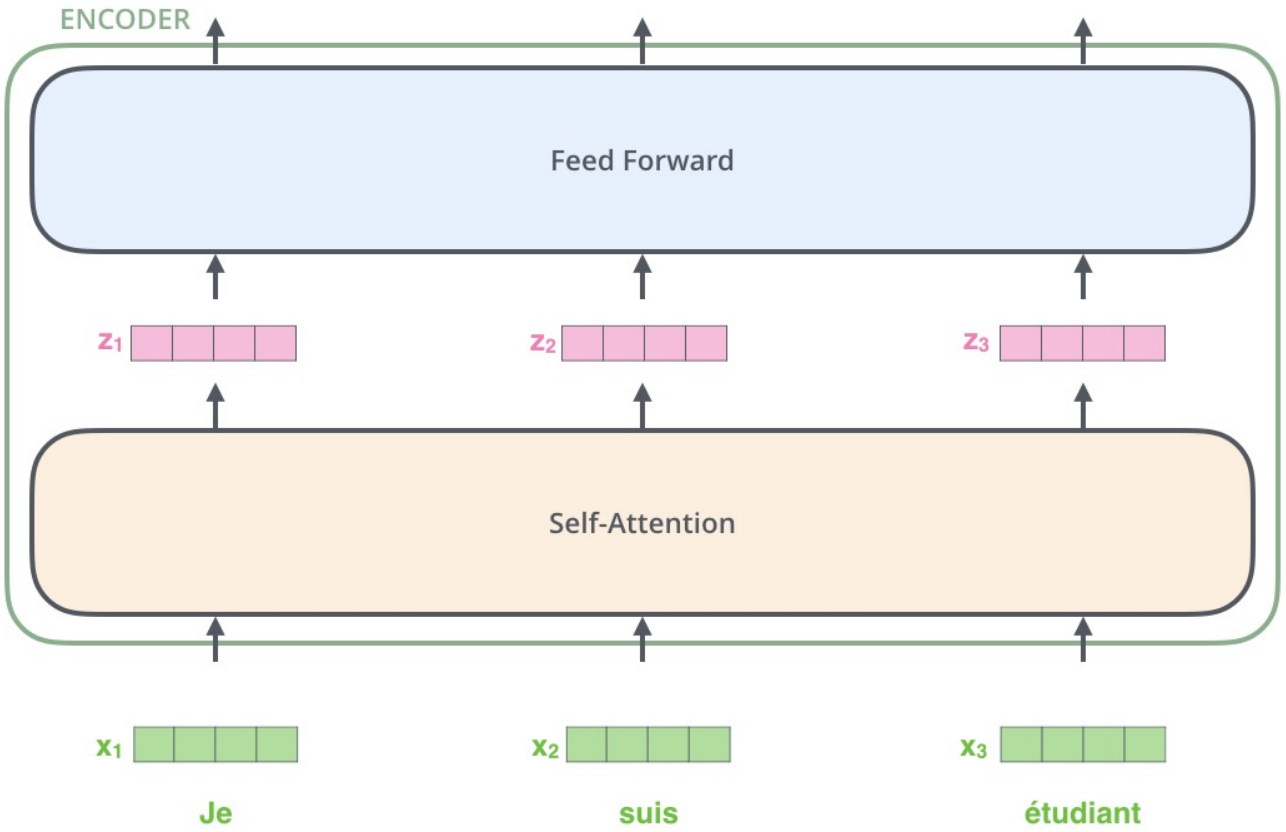
Need something a bit more complex? Grammar/Rules-based chat bot

event[0]

Need to simulate characters acting with goals? Planning!

Sims series (and Elsinore)

Need a whole bunch of messy text that will probably break player immersion and won't fit your desired story or any coherent narrative?



When might we want to do this?

Any remaining time (how?) more Neural Net examples

Further Reading: https://mark-riedl.medium.com/an-introduction-to-ai-story-generation-7f99a450f615