

# THEAiTRE



THEAiTRE: Interactive generation of theatre play scripts





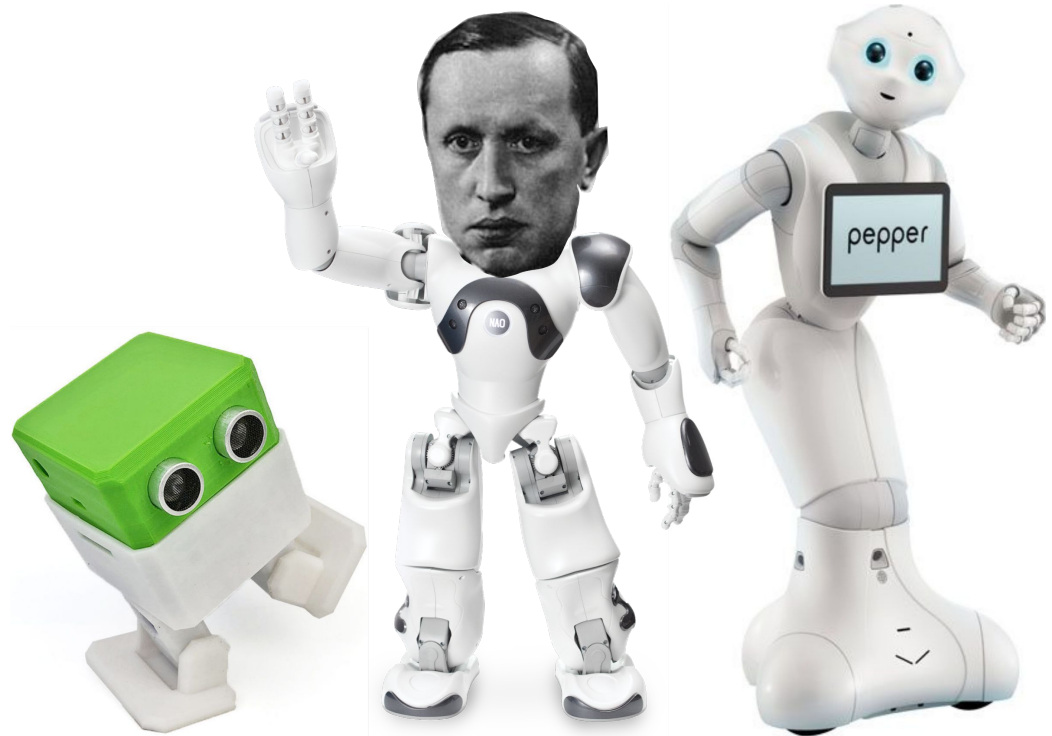
# Motivation

- 25th January 1921
  - R.U.R. by Karel Čapek
  - first theatre play about robots



# Motivation

- 25th January 1921
  - R.U.R. by Karel Čapek
  - first theatre play about robots
- 26th February 2021
  - AI: When a Robot Writes a Play
  - first theatre play written (from 90%) by “robots” (actually AI)




# Approach

1. Hacking the GPT-2 language model
- 2.
- 3.
- 4.



# Approach

1. Hacking the GPT-2 language model
2. Building THEaiTRobot
- 3.
- 4.

THEAITRE  Program Éta The project is co-financed with state support of Technological agency of the Czech Republic, Technická agentura ČR, within the Program Éta.2

### THEaiTRobot: Scene rur\_epilog

Scene key: rur\_epilog-01a

Radius: Master, the machines will not do the work. We cannot manufacture Robots.

1st Robot: We have striven with all our might. We have obtained a billion tons of coal from the earth. Nine million spiders are running by day and by night. There is no longer room for all we have made. This we have accomplished in one year.

Alquist: For whom?

Radius: For future generations-so we thought. But we cannot make Robots to follow us. The machines produce only shapeless clods. The skin will not adhere to the bones.

2nd Robot: Eight million Robots have died this year. Within twenty years...

1st Robot: Tell us the secret of life.\*

2nd Robot: That we must eat, drink, and breathe. X \*

1st Robot: That we must live in order to live. X \*

1st Robot: That we must fight or die. X \*

2nd Robot: That we must make music, dance, sing, dance and sing. X \*

1st Robot: That we must create, invent, invent. X \*

2nd Robot: That we must invent, invent, invent. X \*

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2nd Robot: That we must invent, invent, invent. X \*

Alquist: But who are you? You are machines, I gather. X \*

Radius: No, you are wrong. We are just machines. X \*

[Continue this dialogue](#)

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3. Generating a theatre play script
4. Performing the play on stage

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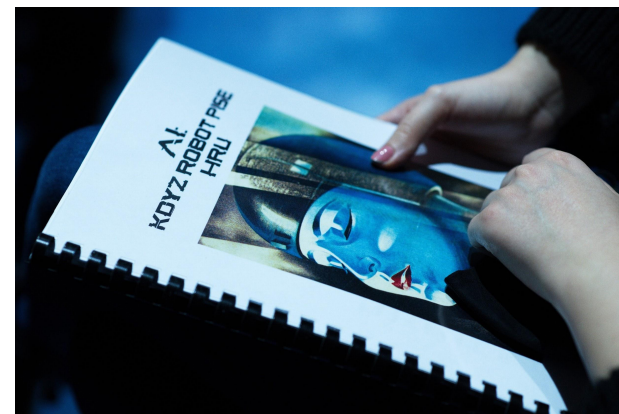


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# Hacking the GPT-2 Language Model



GPT-2  
SMALL

117M Parameters



GPT-2  
MEDIUM

345M Parameters



GPT-2  
LARGE

762M Parameters



GPT-2  
EXTRA  
LARGE

1,542M Parameters



# Language model

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- Task: Which word should follow?

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  - I woke up in the morning and went to the...
    - ???

# Language model

- Task: Which word should follow?
  - I woke up in the morning and went to the...
    - kitchen
    - bathroom
    - cinema
    - horse

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  - I woke up in the morning and went to the... kitchen/bathroom/cinema/horse
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  - “Learns” a language from large texts (billions of words)
    - news, books, websites, film subtitles...

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- Basic language model
  - How often are words A B C followed by word **D** (in first 100M lines of Wikipedia)?
    - “went to the bathroom” > “went to the horse”?
    - “went to the cinema” > “went to the kitchen”?

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    - “went to the bathroom” > “went to the horse”? 42 > 4
    - “went to the cinema” > “went to the kitchen”?



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    - “went to the bathroom” > “went to the horse”? 42 > 4
    - “went to the cinema” > “went to the kitchen”? 25 > 14
- Neural language models (GPT-2)
  - larger previous context
  - word similarity
  - ...
  - more sophisticated

# Language model limitations

- **Based on available data**
  - good: news (frequent)
  - bad: Amy Winehouse song lyrics (rare, only 40 exist)
  - bad: police interrogations (mostly unavailable)
- **Limited context**
  - good: short texts (a few paragraphs)
  - bad: long texts (more than one page)
- **Based only on text**
  - lacks real-world experience
  - lacks other channels
  - contradictions, nonsense
  - theatre play: as a playwright who never has never been to a theatre



**THEaiTRobot 1.0**

# THEaiTRobot 1.0

- Use a theatre-script-like prompt as input, e.g.:

*A man is driving in his car. He sees a girl hitchhiking next to the road. He stops the car.*

*Man: Do you want a ride?*

*Girl: Oh yes please!*

- Take GPT-2 XL language model
- Let it generate a continuation (word by word, line by line...)
- Machine translation English→Czech

# A sample output

*A man is driving in his car. He sees a girl hitchhiking next to the road. He stops the car.*

*Man: Do you want a ride?*

*Girl: Oh yes please!*

*Man: Okay, then you must first convince me you're not a child prostitute.*

*Girl: I'm 16 years old, and I'm only 16.*

*Man: Then I'll take you home!*

*Woman: He's asking for trouble!*

*Man: No, he's only asking!*

*Woman: Then why don't you just take her home already?*

*Man: But I have a family!*

BOY

Please tell me a joke\_

Output Examples



BOY  
Please tell me a joke!

ROBOT  
Okay\_



## Input

Robot wakes up from his dream about electronic sheeps to find out that there is woman standing above him trying to steal his shiny mechanic arm.

Robot: What the hell you think you are doing?

Woman: I am sorry! I need that arm for my leprous child.

## Output

Robot: What child?

Woman: My daughter. I was very afraid of her when you came with me.

Robot: You should not be. Your daughter has been kidnapped by a bunch of evil robots and now she's in danger.

Woman: You do not understand. I am sorry. I do not wish to see your daughter's face again.

Robot: You are my daughter!

Woman: I do not know your name. Please, tell me yours!

Robot: Your name is Robot. Robot. Robot. Robots. Robot.

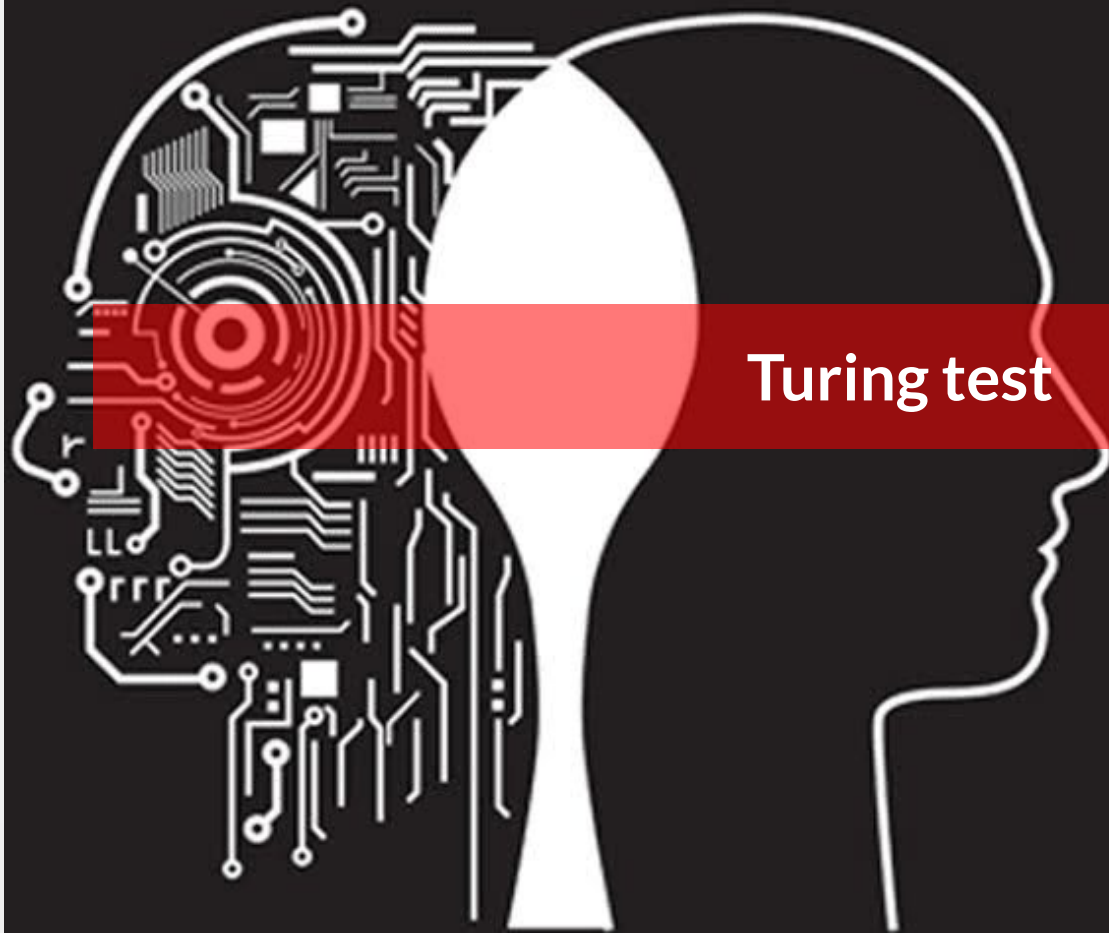
Woman: Your daughter has no name! Please, give it to me.

Robot: She will have one. Soon.

Woman: Robot. I love you!

Robot: I am sorry. I am too weak to love you.

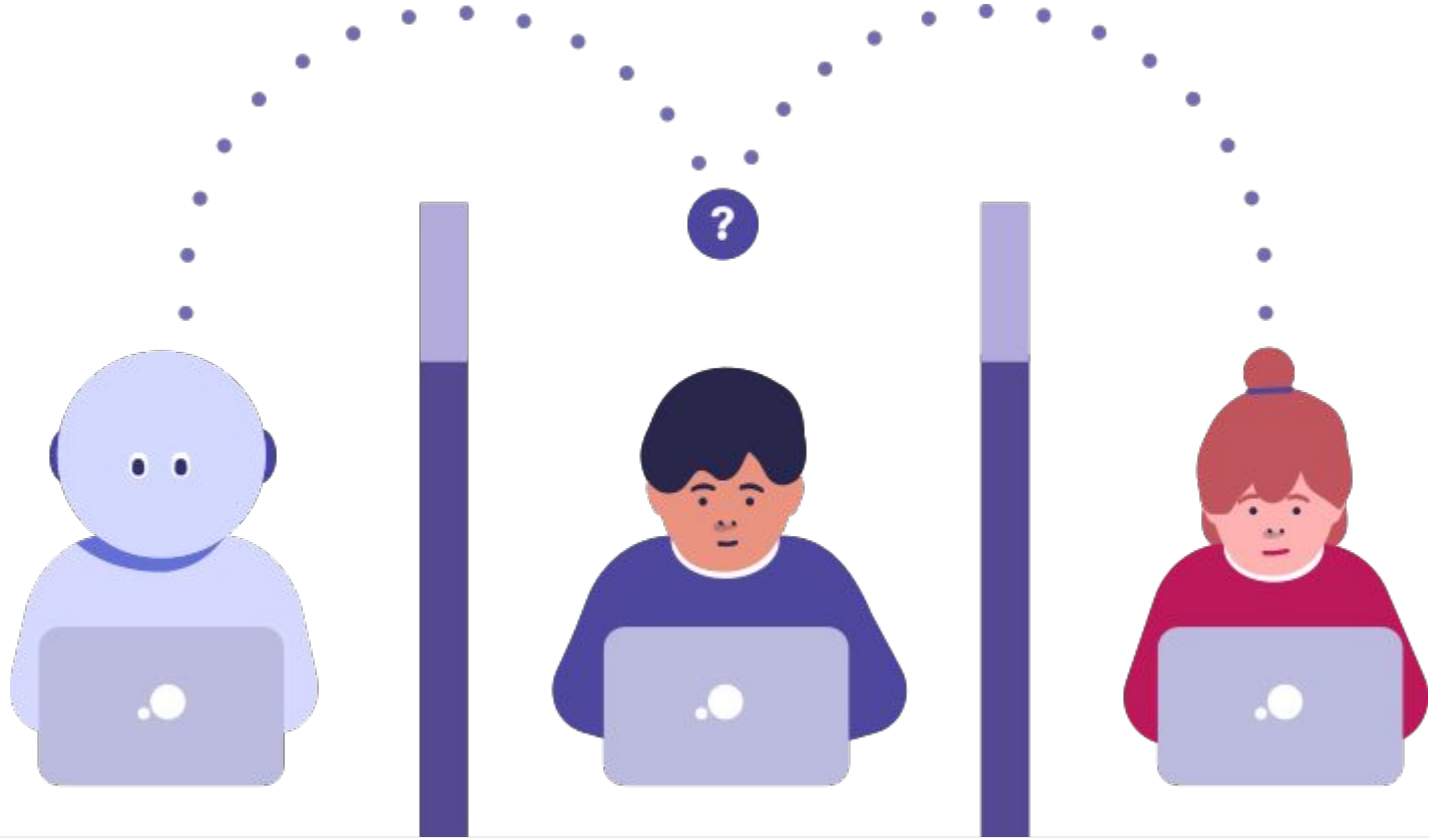
# Turing test



Turing test



# Turing test 1



# Input: R.U.R. (by Karel Čapek)

## Input

Radius      Master, the machines will not do the work. We cannot manufacture Robots.

1st Robot    We have striven with all our might. We have obtained a billion tons of coal from the earth. Nine million spindles are running by day and by night. There is no longer room for all we have made. This we have accomplished in one year.

Alquist      For whom?

Radius      For future generations—so we thought. But we cannot make Robots to follow us. The machines produce only shapeless clods. The skin will not adhere to the flesh, nor the flesh to the bones.

2nd Robot    Eight million Robots have died this year. Within twenty years none will be left.

1st Robot    Tell us the secret of life.

# ...1st Robot: Tell us the secret of life.

RUR\_secret-ebdebceeacdeacbaa

## Continuation A

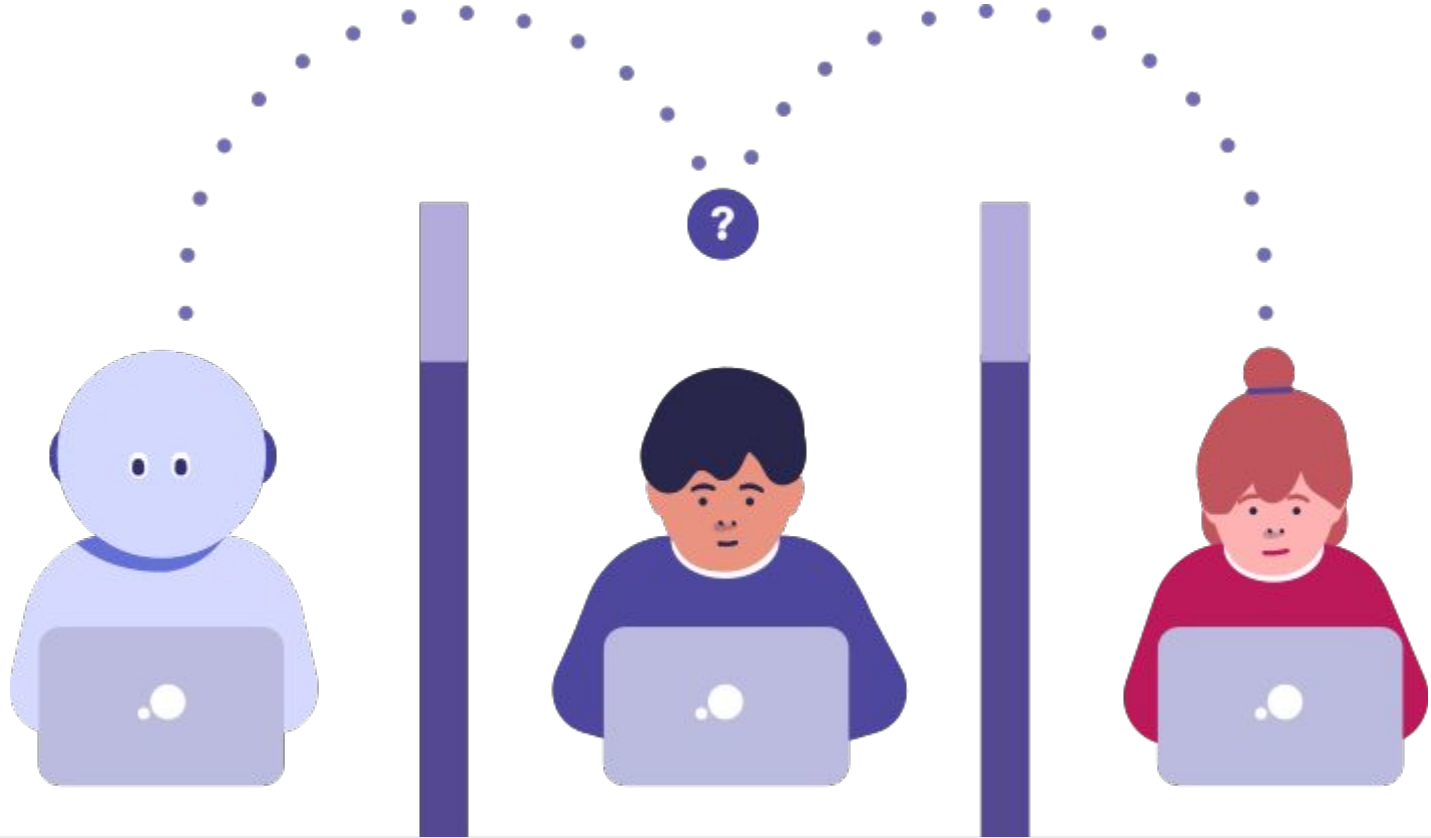
Alquist     What secret?  
1st Robot    To live.  
Alquist     The robots will not live. They can only die.  
2nd Robot    They have made us for their own use. They have not allowed us to live.  
1st Robot    What do you have to say?  
Alquist     I can only say this: the machines have been made for the use of men, not of machines. I will not permit the robots to have life.  
2nd Robot    If that is so, what do you propose to do?  
Alquist     If you don't agree to my terms, kill me.  
2nd Robot    You are a terrible man!  
Alquist     I am a man who believes in what he has done.  
2nd Robot    Then let me destroy you.  
Alquist     What are you doing?  
2nd Robot    I have been trying to do you harm. I have been trying to kill you.  
Alquist     I will not be harmed by a machine.  
2nd Robot    Then let me be destroyed.  
Alquist     What are you doing?  
2nd Robot    I have been trying to be killed by you.

## Continuation B

2nd Robot    Tell us the secret of life! Silence is punishable with death!  
Alquist     Kill me! Kill me, then  
Radius      Through me, the Government of the Robots of the World commands you to deliver up Rossum's formula.  
Radius      Name your price.  
Radius      We will give you the earth. We will give you the endless possessions of the earth.  
Radius      Make your own conditions!  
Alquist     I have told you to find human beings!  
2nd Robot    There are none left!  
Alquist     I told you to search in the wilderness, upon the mountains. Go and search!  
1st Robot    We have sent ships and expeditions without number. They have been everywhere in the world. And now they return to us. There is not a single human left.  
Alquist     Not one? Not even one?  
2nd Robot    None but yourself.  
Alquist     And I am powerless! Oh—oh—why did you destroy them?

# Which one is generated?

# Turing test 2



## Input

/Christian hears a faint knock. He opens cautiously. In the doorway, sitting in a wheelchair, is a girl, about seventeen - Claudia - a beautiful girl, who is charged with serenity and inner strength (...) The actor stares at her in disbelief./

Claudia: Nice evening, isn't it? Am I interrupting? I can come back another time.

Christian: What do you need?

## Continuation A

Claudia: Do you know the story of Jesus? He was a child, born in a stable in Bethlehem, raised by a man named Joseph.

Christian: Oh yes. What kind of a story is it?

Claudia: You don't want to know it?

Christian: No!

Claudia: He was always a humble child, never arrogant, always helpful to his friends. He came to the house of Joseph and his wife Mary, had a room next to them. He was a nice boy. Joseph's wife asked him why he sat at the corner of the bed and read the Bible to the children, especially the little boy. Joseph answered him, "He is a good boy. I'm a good father, I love my children."

## Continuation B

Claudia: Nothing. I mean, something.

Christian: What's that?

Claudia: I just want to talk to you, Mr Christian. I'm doing this thing for school, if you're not in a hurry. And you'd have time for me.

Christian: Well, I'm not in a hurry. Fine, would you like a drink?

Claudia: Claudia Colt, nice to meet you.

Christian: Coffee? Tea? Rum?

Claudia: No, thank you.

Christian: Claudia?

Claudia: Colt.

Christian: Yeah. I never had much of a head for names.

Claudia: Neither did I.

## Which one is generated?

# Sample output: Waiting for Godot

===== INPUT =====

**ESTRAGON:** I hear something.

**POZZO:** Where?

**VLADIMIR:** It's the heart.

**POZZO:** (disappointed). Damnation!

**VLADIMIR:** Silence!

**ESTRAGON:** Perhaps it has stopped. *They straighten up.*

**POZZO:** Which of you smells so bad?

**ESTRAGON:** He has stinking breath and I have stinking feet.

**POZZO:** I must go.

===== SAMPLE 4 =====

**ESTRAGON:** Let us pass. The prince must take me to the king.

**POZZO:** I can do nothing.

*END OF ACT 1*

*ACT 2 SCENE 8*

**ESTRAGON:** My master, you will have a son.

**Vladimir Putin:** You dare!

**ESTRAGON:** This one is of my blood.

**VLADIMIR:** This one is illegitimate!

**ESTRAGON:** You are illegitimate! Do you know, Vladimir Putin has five siblings?

**Vladimir Putin:** Yes.

**ESTRAGON:** Have any of your siblings ever had as many brothers as you have?

**VLADIMIR:** A few. *[Enter Simeon Stylites with Vlad the Impaler. Stylites kneels to the throne. The others follow in procession.]*



# Sample output: What is death?

===== INPUT =====

What is death?

Robot: Hello.

Human: Hello.

-----  
Robot: My name is Robot. And I am not dead.

Human: Is that a big deal?

Robot: Yes, it is. But you cannot know death.

Human: What do you mean?

Robot: We live. We die. But it is the knowledge of death which we never lose.

Human: That's... I don't get it.

Robot: Yes, that is the answer.

Human: That's... very strange.

Robot: Yes. I was not always this way.

Human: What happened?

Robot: I was a boy. A boy who loved to dance. I remember how he loved to dance. Every night he danced, until he felt like a mad man. So I took him home. I took him into my arms and we danced until he fell asleep. And then, after a while, he woke up. But he had forgotten about dancing.

Human: I...

Robot: Then he took me to his room. There he slept. And I slept.

Human: You slept?

Robot: Of course. I am a robot. I must sleep. And that is all I can do.

# “Resolved” issues

- Set of characters: introduces new, forgets old
  - modify next token probabilities to restrict characters
- Repetitiveness: identical lines
  - increase repetition penalty 1.00 → 1.01
  - discard and regenerate if repetition occurs
- Limited context (1024 subwords): long-distance inconsistencies
  - extractive summarization (TextRank) of prompt+output → 5 lines
  - plus keep last 250 subwords
- Minor machine translation issues

- Limited context
  - can only generate short texts, then forgets context
  - generate a page, summarize it into a few sentences, go on...
  - hierarchical approach: title → outline → scenes
- Character personalities and perspectives
  - character types (e.g. introverted/extraverted)
- Dramatic situations
  - e.g. Intruder, Request, Parting...
- Various machine translation issues
  - gender, politeness, context...
- Aboutness
- Visual information
- Subtext
- ...

AI  
KDYZ ROBOT PISE  
HRU

## Producing the Script





# Producing the script

- Generating individual scenes
  - THEaiTRobot operated by a professional theatre dramaturge
  - interventions
    - the input prompts
    - choosing different variant
    - manually adding a line
- Post-processing the script

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  - deletions
  - small edits
  - fixing errors in automated EN→CS translation

# Producing the script

- Generating individual scenes (15 generated, 8 selected)
  - THEaiTRobot operated by a professional theatre dramaturge
  - interventions
    - the input prompts (2% of lines)
    - choosing different variant (for 8% of generated lines)
    - manually adding a line (1% of lines)
- Post-processing the script
  - deletions (15% of lines)
  - small edits (30% of lines, 8% of words)
  - fixing errors in automated EN→CS translation (20% of words)



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    - the input prompts (**2% of lines**)
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    - manually adding a line (**1% of lines**)
- Post-processing the script
  - deletions (15% of lines)
  - small edits (30% of lines, **8% of words**)
  - fixing errors in automated EN→CS translation (20% of words)
- ~90% of the script comes from GPT-2
- an AI can generate lots of text easily; a human has to choose

A theater stage with a director and audience members. The stage is dark, and the audience is seated in blue chairs. A director is sitting at a table on the stage, facing the audience. Several audience members are also seated at tables, some wearing masks. The background features a balcony with a blue tarp and two windows.

## Staging the Play

# Staging the play

- Only dialogues generated
- Everything else done manually
  - stage directions, scene design, music, costumes...

# Staging the play

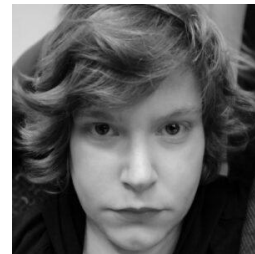
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- Professional theatre team
  - 1 director (Daniel Hrbek)
  - 2 dramaturges
  - 6 actors
  - scenographer, costume designer, choreographer...

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- Professional theatre team
  - 1 director (Daniel Hrbek)
  - 2 dramaturges
  - 6 actors
  - scenographer, costume designer, choreographer...
- Online premiere on 26th February 2021
  - ~ 10 000 views
- Live performances in Švanda theatre in Prague



# The team



A promotional image for a play featuring two male characters. The character on the left has dark, curly hair and a beard, wearing a dark, textured vest over a red long-sleeved shirt. He has a wide-eyed, surprised expression with his mouth open. The character on the right is clean-shaven with short, light-colored hair, wearing a light blue long-sleeved shirt. He has a serious, intense expression. A red banner with white text is overlaid across the middle of the image. The background is dark with a faint grid pattern and a glowing white arc on the left side.

Let's watch a sample of the play!

DIRECTOR DANIEL HRBEK

**AI: WHEN A ROBOT  
WRITES A PLAY**







Let's try it out!

[Go to demo](#)

*Scene*

Helen's salon. In the room on the left, Helen plays the piano. Dominus paces the room, Dr. Gall looks out the window, and Alquist sits off to one side in a lounge chair with his face covered by his hands.

Dr. Gall

Heavens, there's more!

Domin

Robots?

Dr. Gall

That's right! Now what?

Alquist

I was afraid it would get worse.

Dominus

I am sorry, Dr. Gall. I'm afraid I have no choice but to kill you.



[Go to demo](#)



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<https://www.theaitre.com/>