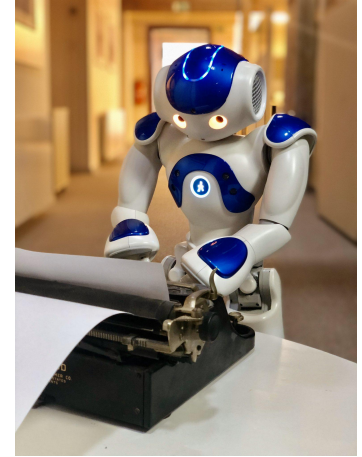
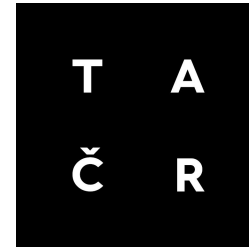


Rudolf Rosa, Tomáš Musil, Ondřej Dušek, Dominik Jurko, Patrícia Schmidtová,
David Mareček, Ondřej Bojar, Tom Kocmi, Daniel Hrbek, David Košťák, Martina Kinská,
Marie Nováková, Josef Doležal, Klára Vosecká, Tomáš Studeník and Petr Žabka



THEAiTRE



THEAiTRE 1.0: Interactive generation of theatre play scripts

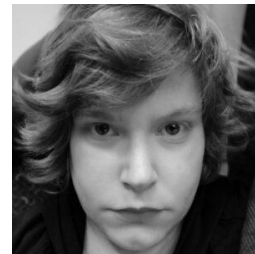


Charles University
Faculty of Mathematics and Physics
Institute of Formal and Applied Linguistics



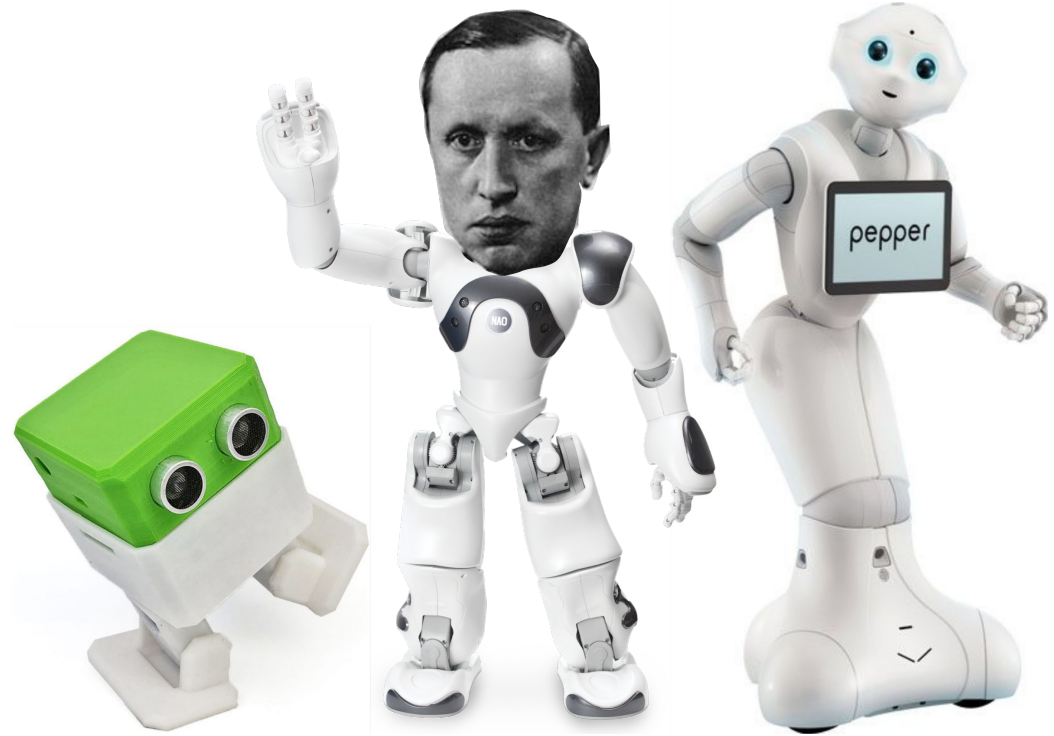
unless otherwise stated

The team



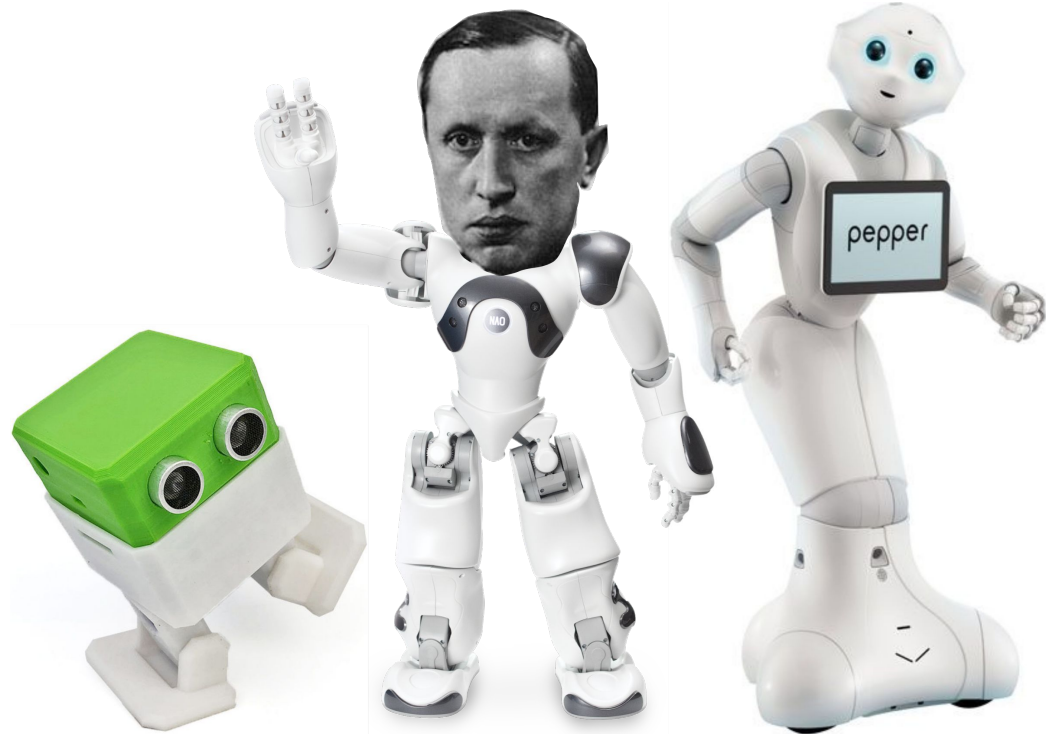
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- 25th January 1921
 - R.U.R. by Karel Čapek
 - first theatre play about robots



Motivation

- 25th January 1921
 - R.U.R. by Karel Čapek
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- 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 a web application
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THEaitRE  Program Éta The project is co-financed with state support of Technological Agency of the Czech Republic, Technická agentura ČR, within Program Éta 2.0.

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. ✖ ✖

1st Robot: That we must live in order to live. ✖ ✖

1st Robot: That we must fight or die. ✖ ✖

2nd Robot: That we must make music, dance, sing, dance and sing. ✖ ✖

1st Robot: That we must create, invent, invent. ✖ ✖

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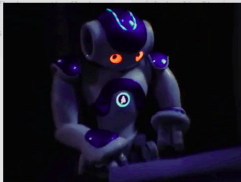
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Alquist: But who are you? You are machines, I gather. ✖ ✖

Radius: No, you are wrong. We are just machines. ✖ ✖


[Continue this dialogue](#)

[Back to main](#)



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THEAITRE  Program Éta The project is co-financed with state support of Technological Agency of the Czech Republic, Technological Agency CZU within the Program 278.2

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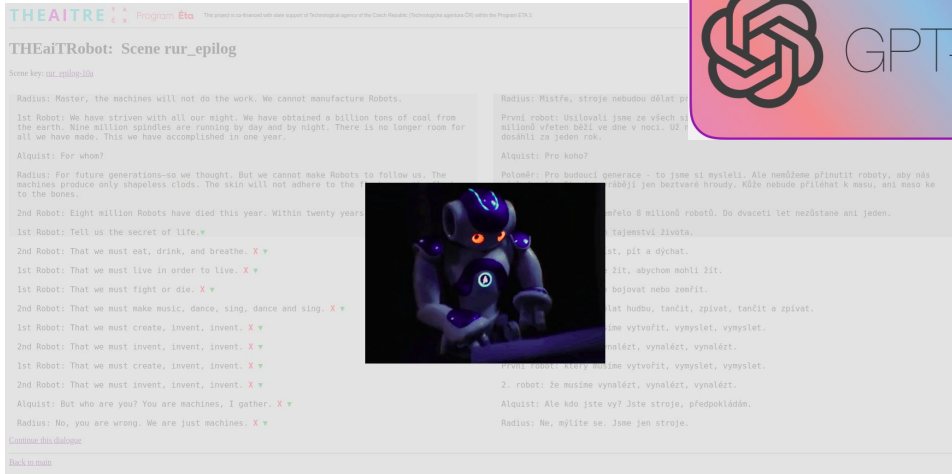
[Continue this dialogue](#)

[Back to main](#)



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2. Building a web application
3. Generating a theatre play script
4. Performing the play on stage



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

Language model

- Task: Which word should follow?

Language model

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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

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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 - Large amount of texts: news, books, websites, film subtitles... (bilions of words)

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- Neural language models
 - See a larger number of preceding words (GPT-2: up to 1023 previous words)
 - Choose which preceding words to look at (attention, skip-gram)
 - Can estimate word similarity (cosine distance of word embeddings)
 - Complex internal representations and operations instead of simple comparison of frequencies

The base approach

- Take GPT-2 XL language model
- Feed it with a theatre-script-like prompt, 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!

- Let it generate a continuation
- 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!

“Resolved” issues

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- Set of characters: introduces new, forgets old
 - modify next token probabilities to restrict characters

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Unresolved issues + plans

- Generating a whole play (now: individual scenes)
 - hierarchical approach: title → outline → scenes (fine-tuned models)

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- Aboutness
- Visual information
- Subtext
- ...

A blue and white robot with glowing orange eyes and a red triangle on its chest, set against a dark background. The robot has a blue horn-like structure on its head and blue accents on its arms and legs. A red horizontal bar is overlaid across the middle of the image, containing the text "The Web Application".

The Web Application



THEaiTRobot: Scene masters_death

Scene key: [masters_death-Jab10a](#)

It's the morning. The Robot enters the room of his master who is really old and sick. The Robot sees that his master is not doing very well this morning. He sits at the edge of his bed and takes his hand.

Robot: I remember how you jumped on this bed when you were little. You were full of beans.

Master: We both know I am dying.*

Robot: I remember you saying that too; you sick old man. And how you have tried to kill yourself many times. X *

Master: I have tried but it's so hard. I want to be alive. I want to be with my children and grandchildren. X *

Robot: I am sorry but you can't. There is no way. No way. There is no way. X *

Master: I don't want to hear that. You can't keep killing yourself and not do something about it. X *

Robot: Oh, well I don't want to hear that either. X *

Master: Well, you have to get up. I need to help you. X *

Robot: I am going to bed. X *

Master: I will wait for you. X *

Je ráno. Robot vstoupí do pokoje svého pána, který je opravdu starý a nemocný. Robot vidí, že jeho pánovi se dnes ráno moc nedaří. Sedí na kraji postele a bere ho za ruku.

Robot: Pamatuje si, jak jsi na tuhle postel skákala, když jsi byla malá. Byl jsi plný fazolí.

Mistr: Oba víme, že umírám.

Robot: Pamatuje si, že jsi to říkal taky, ty starý nemocný dědku. A jak ses mnohokrát pokusil zabít.

Mistr: Zkoušel jsem to, ale je to tak těžké. Chci být naživu. Chci být se svými dětmi a vnoučaty.

Robot: Je mi líto, ale to nemůžete. V žádném případě. Ani náhodou. V žádném případě.

Mistr: To nechci slyšet. Nemůžu se pořád zehýbat a nic s tím dělat.

Robot: No, to taky nechci slyšet.

Mistr: No, musíš vstát. Musím ti pomoci.

Robot: Jdu si lehnout.

Mistr: Počkám na tebe.

AI
KDYZ ROBOT PISE
HRU

Producing the Script



Producing the script

- Generating individual scenes
- Post-processing the script

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- Generating individual scenes
 - THEaiTRobot operated by a professional theatre dramaturge
 - interventions
 - the input prompts
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 - 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)

Producing the script

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- 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)
- ...so ~90% of the script comes from GPT-2

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.

Sample output: R.U.R.

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?

Turing test: Which one is generated?

claudia_intruder-aaa...

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.

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.

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 seated in the front rows, some wearing masks. A balcony with a blue tarp and metal railing is visible above the stage. The text "Staging the Play" is overlaid on a red banner in the center of the image.

Staging the Play

Staging the play

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

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 - 1 director (Daniel Hrbek)
 - 2 dramaturges
 - 6 actors
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- Online premiere on 26th February 2021
 - ~ 10 000 views
- Live performances once possible

DIRECTOR DANIEL HRBEK

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



THEaiTRE 1.0: Interactive generation of theatre play scripts

- Hacking the GPT-2 language model
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<https://www.theaitre.com/>