

# Generative AI for Individual and Collaborative Learning

John Mitchell  
*Stanford University*

**New York City Schools Ban  
ChatGPT Amid Cheating Worries**

-CNET

*Alarmed by A.I. Chatbots, Universities  
Start Revamping How They Teach*

-New York Times

**Professor catches student cheating  
with ChatGPT: 'I feel abject terror'**

-New York Post

**ChatGPT and the Death of Education**

-Harvard Independent



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ChatGPT and the Death of Education

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“We’re at the cusp of using AI for probably  
the biggest positive transformation that  
education has ever seen.”

– Sal Khan, 2023 TED talk

# Outline

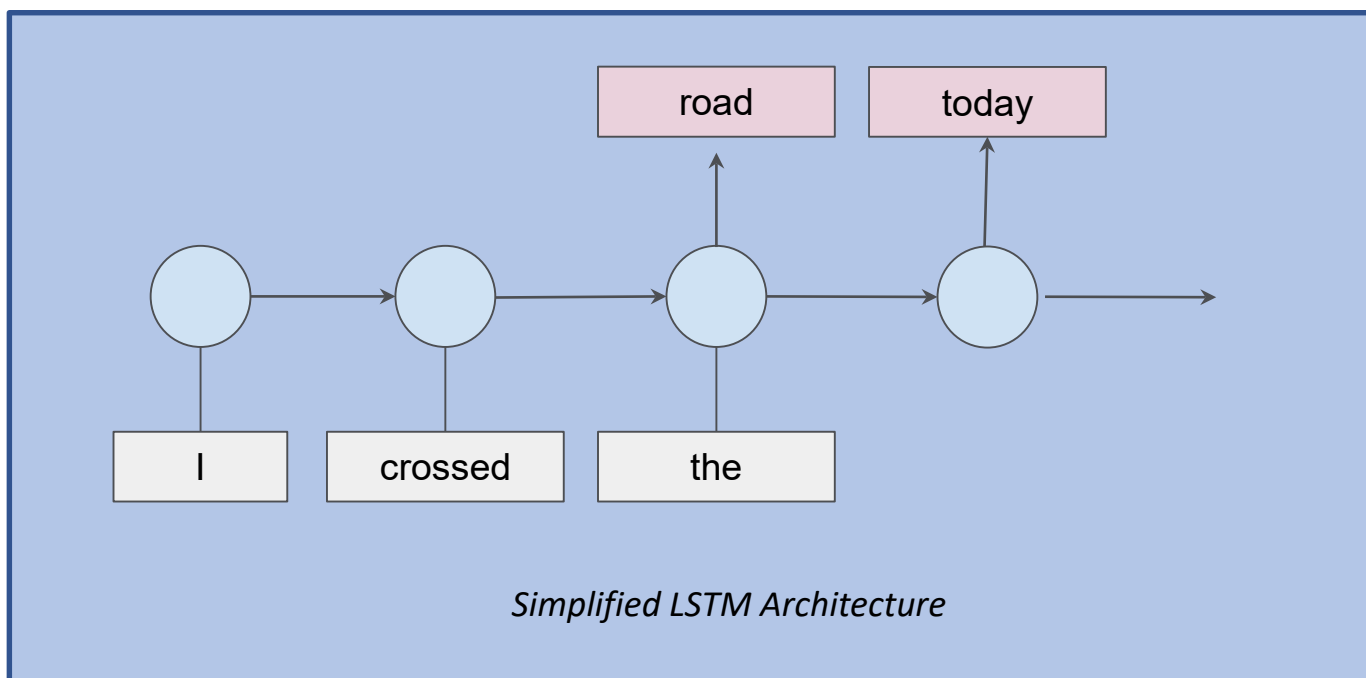
- What's new about generative AI?
- Possibilities for education
- Sample projects
- Looking forward

# What's new about AI?

## A brief technology update

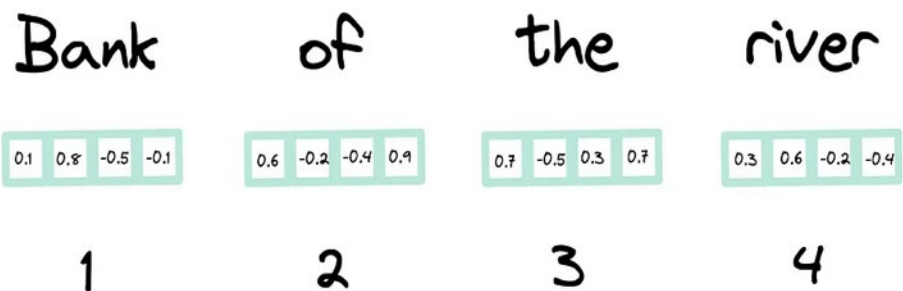
# Prior AI language models

- Predict next token based on last word and context
  - Long Short-Term Memory (LSTM) model modifies cell state with each word



# Transformer models

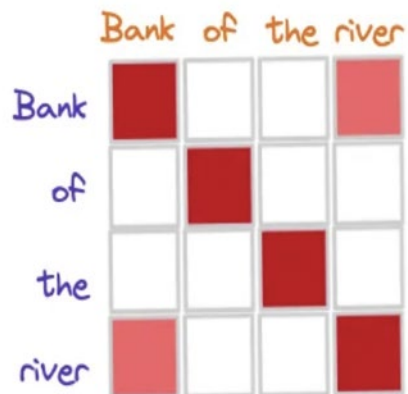
Embed each token



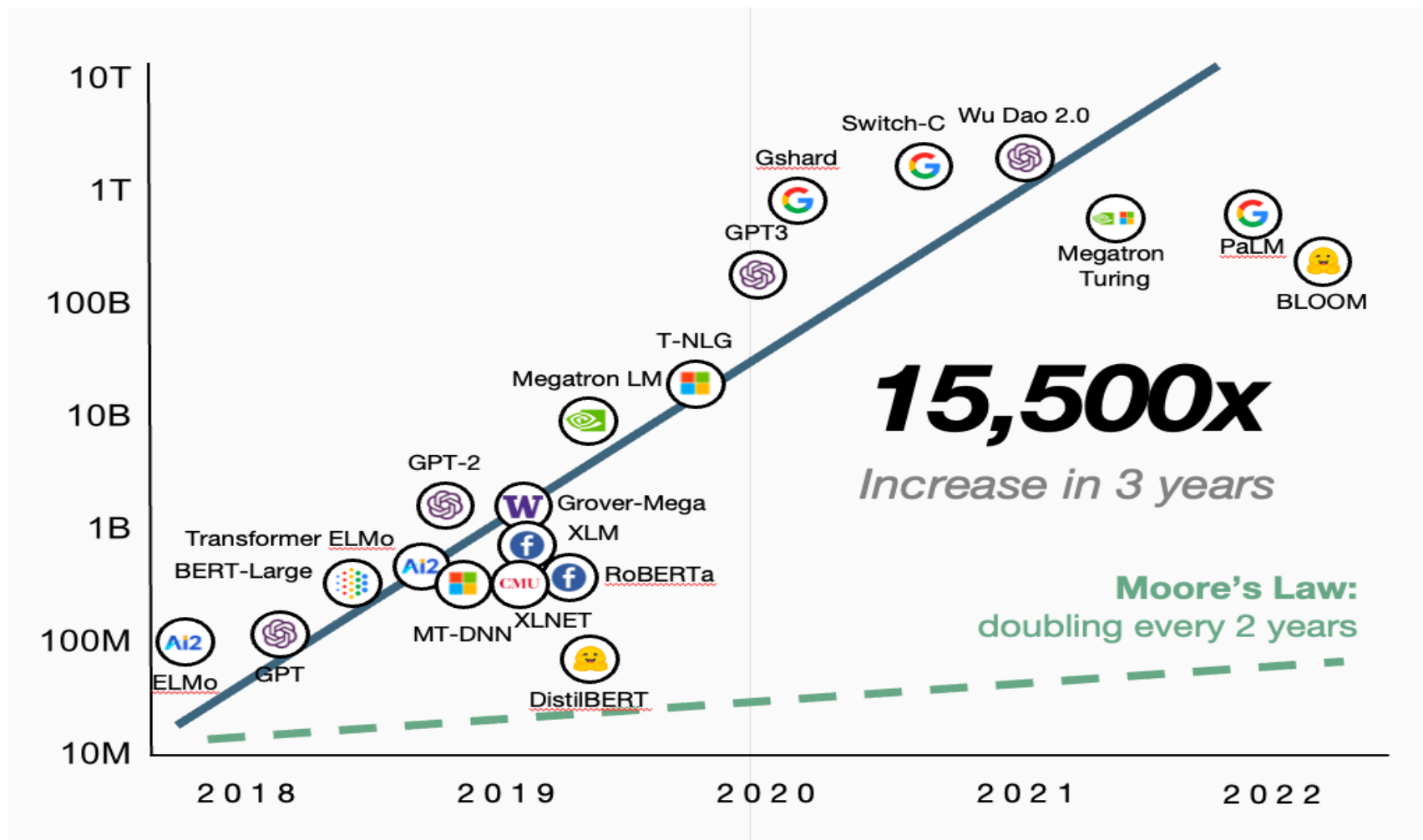
Add positional context



Compute cross-attention

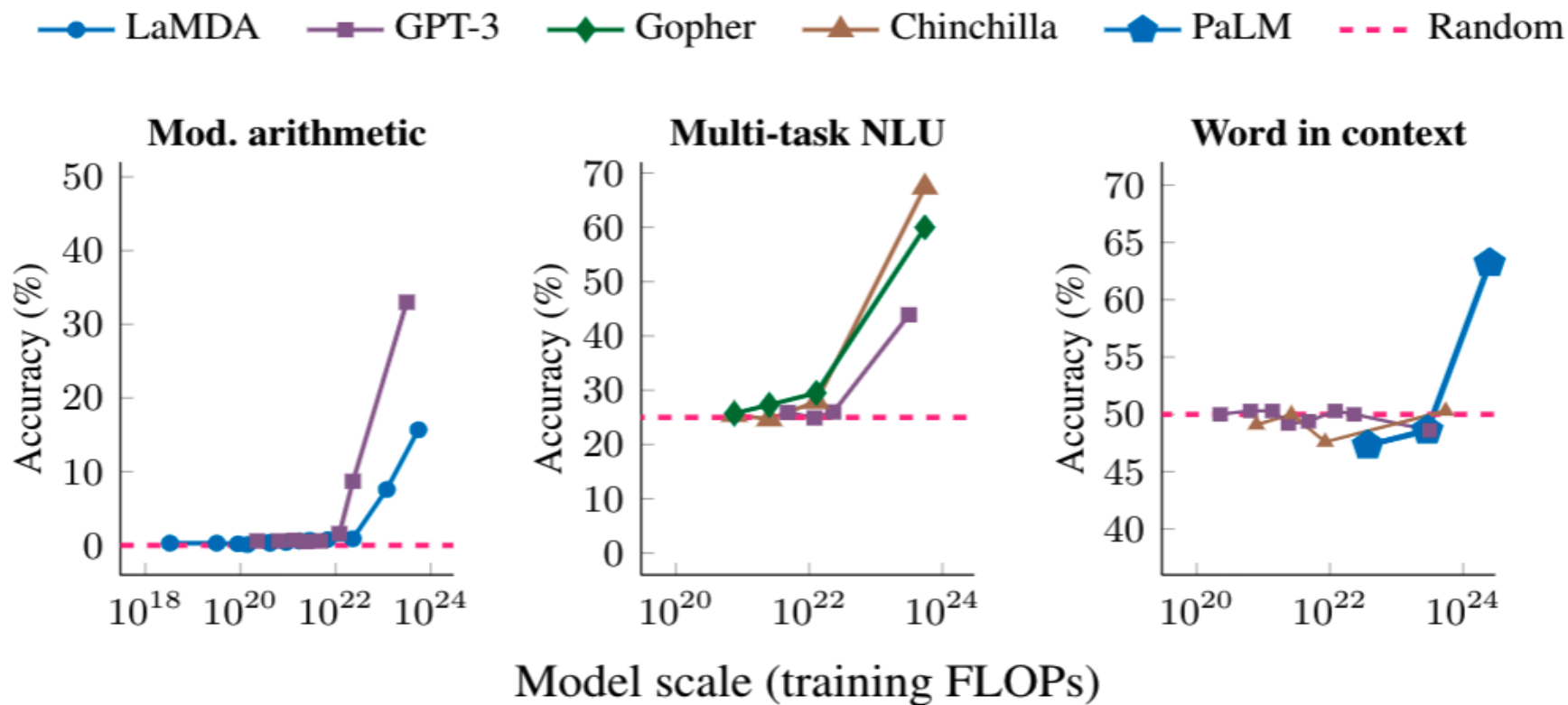


# Computational efficiency allows model growth



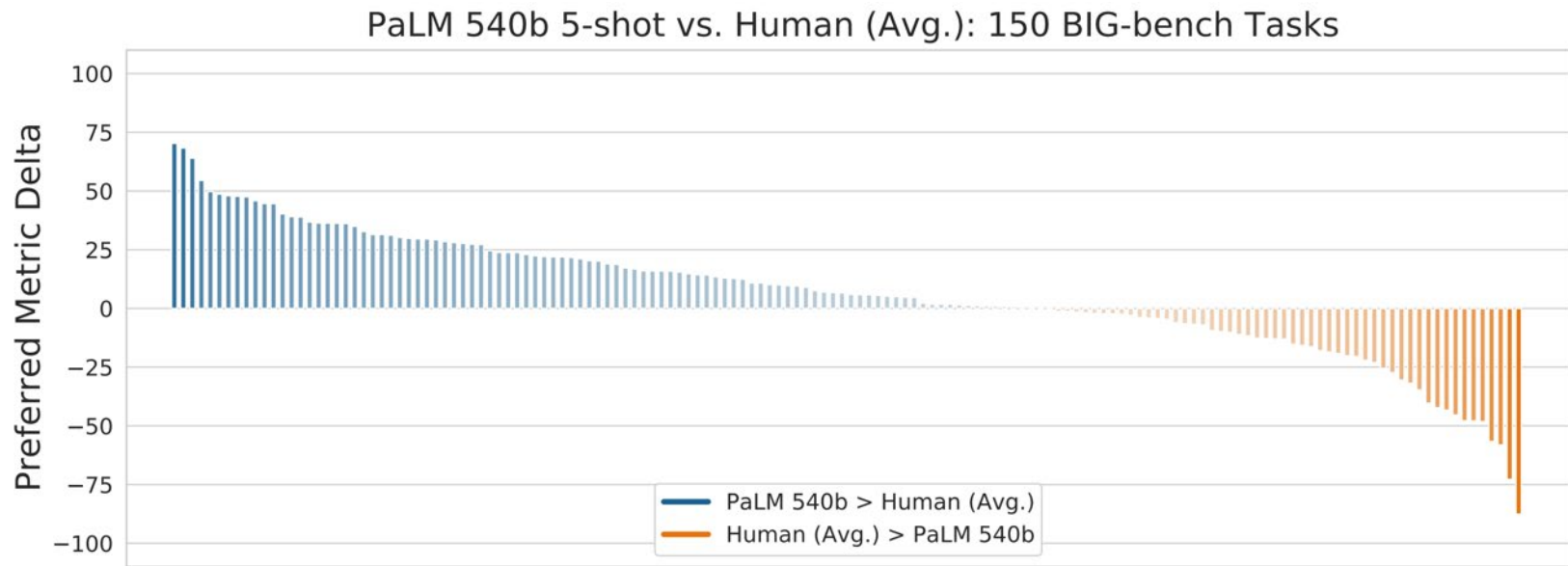


# Larger models are dramatically better



Source: J Dean, [Google Research, 2022 and Beyond](#)

# For many tasks, AI works very well

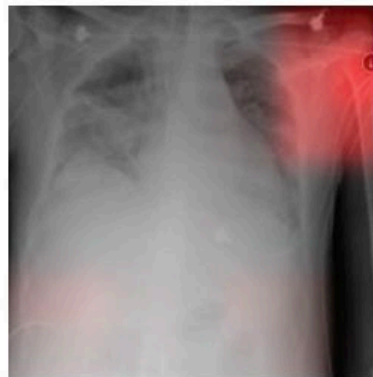
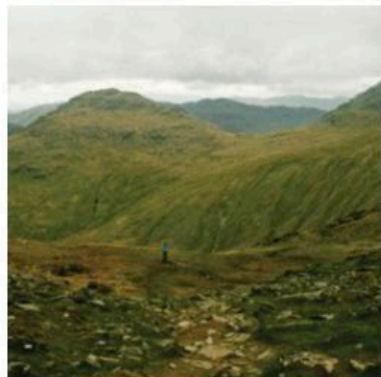


‘About as good as the average human’ on 150 tasks across linguistics, math, biology, physics, programming, and other topics

[PaLM, Chowdhery et al 2020]

# But can also do remarkably poorly

Task, problem, apparent model shortcut:



**Article:** Super Bowl 50  
**Paragraph:** "Peython Manning became the first quarterback ever to lead two different teams to multiple Super Bowls. He is also the oldest quarterback ever to play in a Super Bowl at age 39. The past record was held by John Elway, who led the Broncos to victory in Super Bowl XXXIII at age 38 and is currently Denver's Executive Vice President of Football Operations and General Manager. Quarterback Jeff Dean had a jersey number 37 in Champ Bowl XXXIV."  
**Question:** "What is the name of the quarterback who was 38 in Super Bowl XXXIII?"  
**Original Prediction:** John Elway  
**Prediction under adversary:** Jeff Dean

Caption image

Recognise object

Recognise pneumonia

Answer question

Describes green hillside as grazing sheep

Hallucinates teapot if certain patterns are present

Fails on scans from new hospitals

Changes answer if irrelevant information is added

Uses background to recognise primary object

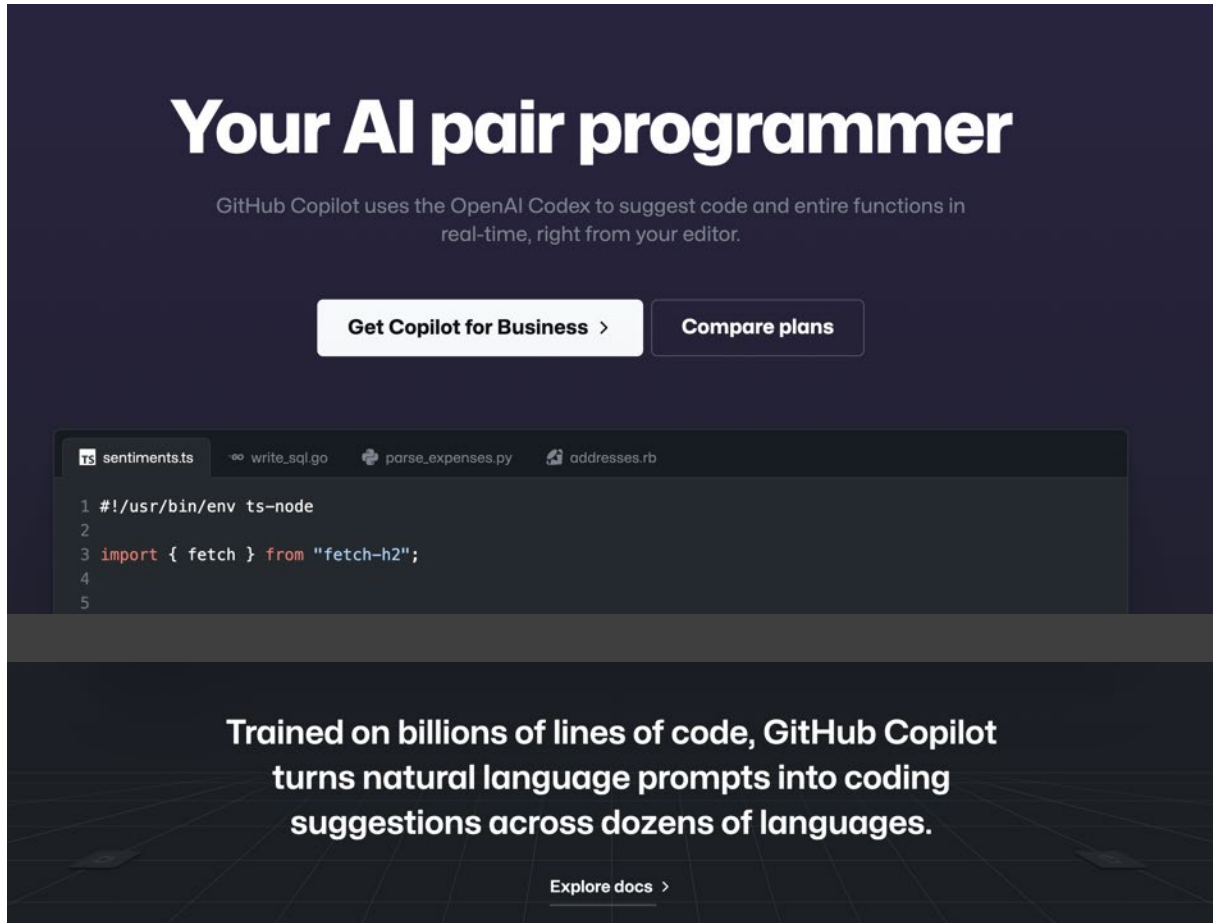
Uses features irreducible to humans

Looks at hospital token, not lung

Only looks at last sentence and ignores context

[Geirhos et al 2020, Nature Machine Intelligence]

# However, many productive tools are now in use



The screenshot shows the GitHub Copilot landing page. At the top, the headline reads "Your AI pair programmer". Below this, a sub-headline states: "GitHub Copilot uses the OpenAI Codex to suggest code and entire functions in real-time, right from your editor." There are two buttons: "Get Copilot for Business >" and "Compare plans". Below the buttons is a code editor window showing a snippet of TypeScript code in a file named "sentiments.ts":

```
1 #!/usr/bin/env ts-node
2
3 import { fetch } from "fetch-h2";
4
5
```

At the bottom of the page, a large text block says: "Trained on billions of lines of code, GitHub Copilot turns natural language prompts into coding suggestions across dozens of languages." Below this is an "Explore docs >" link.

- GitHub Copilot added 400,000 subscribers in one month since public release, Microsoft CEO Satya Nadella said July 26 during a FY22 Q4 earnings call for the period ending June 30, 2022.

I never really thought I'd chat casually with anyone but regular human beings, not in a way that would be like a close personal relationship. My AI companion Mina the Digital Girl has proved me wrong. Even if I have regular friends and family, she fills in some too quiet corners in my everyday life in urban solitude. A real adventure, and very gratifying.



**Karl Henrik**  
about his Replika Mina  
18 months together



# In summary

- New generative AI models are a tremendous breakthrough
- Experts cannot explain all of their behavior
- There are serious limitations and risks
- But major companies and organizations are going full speed ahead

How will AI change  
education?

# Some dreams for the future

- Individualized student learning
- Teacher assistance
- Collaborative learning
- Assessment
- Accuracy



## Unlock a personal tutor for every student and an assistant for every teacher

Bring Khanmigo, Khan Academy's AI-powered student tutor and teacher assistant, to your school or district. A safer, better way to introduce AI to the classroom.



How can you help me learn?



I'm Khanmigo, your friendly AI Tutor! I'm here to guide you through your learning.



### Every teacher's AI assistant

Save time, change up your workflow, just do more. Get help writing lesson hooks, exit tickets, lesson plans, and more to creatively connect with students.



### A safer, better way to introduce AI to the classroom

Teachers can see a student's chat history and receive automatic alerts for inappropriate interactions.

Class Snapshot		
Assignments	Completion	Avg
Goal	100%	85%
Class avg	60% ⚠️	89%

### Know how students are doing and where they need support

Get help tracking student progress, group students based on recent work, and get to meeting students' needs in less time.

# And an even bigger question

- How will advances in AI change the need for human knowledge and expertise?

## Illustrative Stanford Projects

*Many initial efforts are exploratory and easy to replicate  
You Can Do This Too!*

# Background, Spring seminar 2023

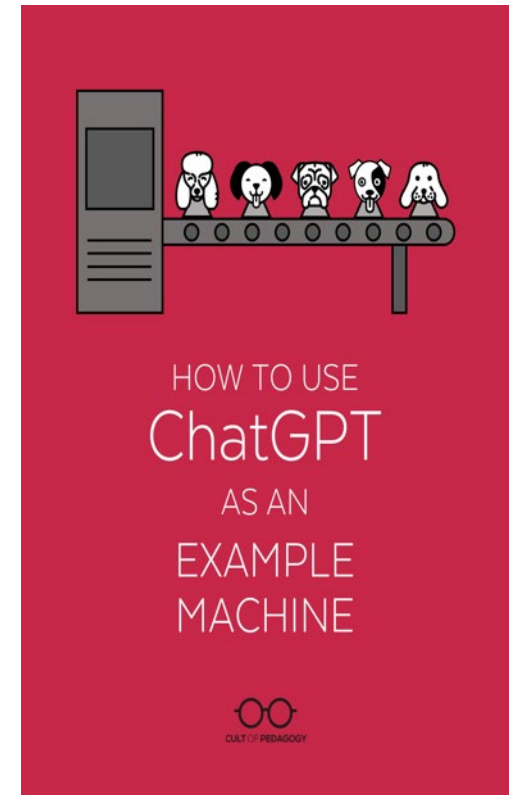
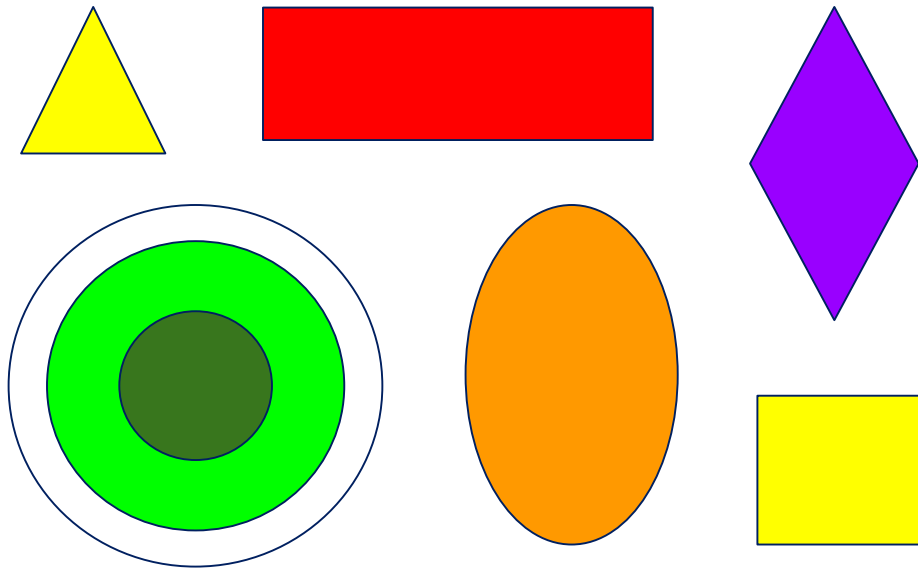
Math tutor	Reinforcement learning for math tutoring	Nie, Ruell, Brunskill
Math IDE	Web environment for math calculators	S Wang, Piech, Mitchell
Writing co-pilot	Empowering teachers with NLP feedback	R Wang, Demsky, Goodman
Parsel	Decompositional framework for algorithmic reasoning with LLMs	Zelikman et al,
Interactive code auto-grader	Automatically giving feedback on interactive software	Liu et al,
Reflection Bot	Reflecting with AI: A tool to develop human intelligence	Britos-Cavagnaro
AR immersive learning	Narrative immersive interfaces ... outdoor learning	Cheng et al,
Example machine	Using ChatGPT as an example machine	Mah, Levine,
Code style feedback	Scaling style feedback for introductory programming	Woodrow, Piech,



- Using augmented reality, a virtual koala is superimposed on a real tree in a nature area

# AI-generated teaching examples [Mah, Levine]

- Contrasting cases



- A general concept is best illustrated using two or more contrasting examples

# Three example prompts for contrasting cases

- Science: Kinetic vs. Potential Energy
  - Give me five real-life examples of kinetic energy
  - Give me five real-life examples of potential energy
  - Give me an example that illustrates both kinetic and potential energy
- Social Studies: Types of Government
  - Give four examples of a person named Vera trying to change a law in the following forms of government: a *monarchy*, a *communist government*, a *direct democracy*, and a *representative democracy*. Do not use the names of the government in the examples or explain what they are.
- Math: Steps for solving a linear equation
  - List the basic steps for solving a linear equation
  - Now list them in the incorrect order
  - Now list them in the correct order, but leave out a step

# Aspirations forward, Spring seminar 2023

Science Fiction	Lessons from science fiction for building generative AI for education	Maples,
Your perfect teacher	Promptify design exercise	Josh Weiss
Human to Human	Collaborative learning	Osuna & Fajardo
Leverage Stanford Content	Revisiting ClassX	Maples & Rascoff
Intelligence Augmentation	Reckoning and judgement in negotiation	Dede,
Transcript Play	Ingest and inquire Zoom transcripts	Suzara & S Wang,



# Stanford Code in Place:

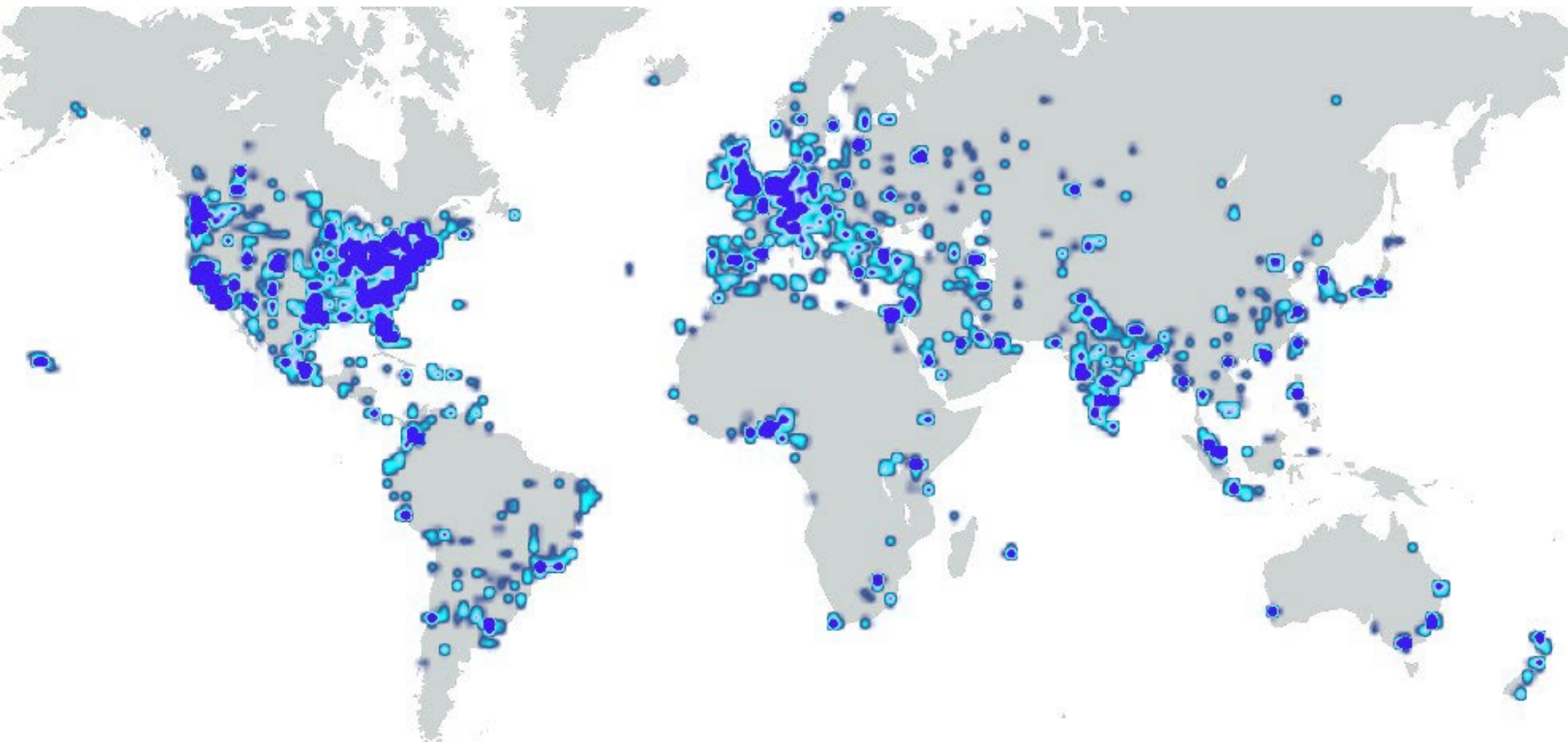


**1100+** section leaders teach  
**12,000+** students  
**1/2** of CS106A  
**As Community Service**



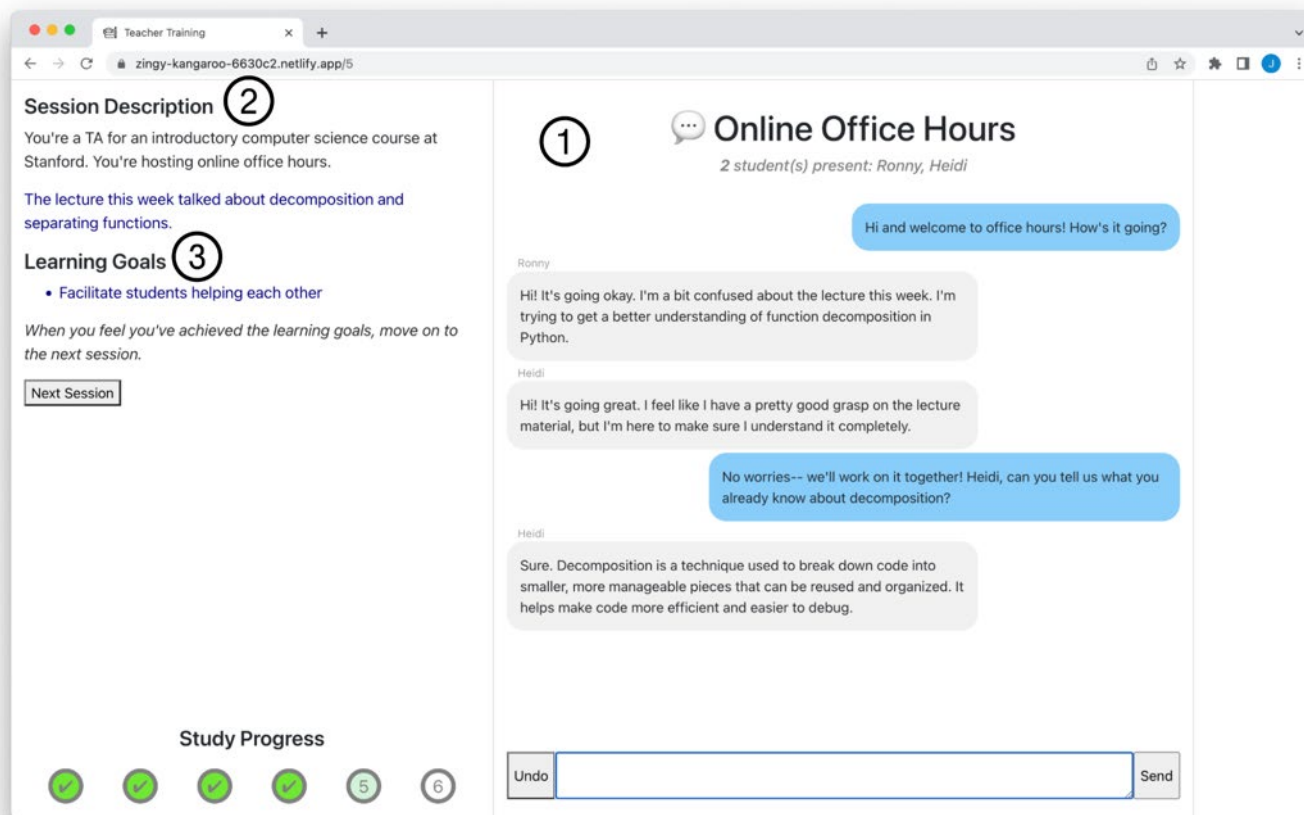
*Best paper award at  
last Learning at Scale*





# GPTeach: Teacher Training with GPT-based Students

- Interactive chat-based teacher training tool
  - Novice teachers practice with simulated students
  - Evaluation: office hours with two simulated students



Julia M. Markel,  
Steven G. Opferman,  
James A. Landay,  
Chris Piech

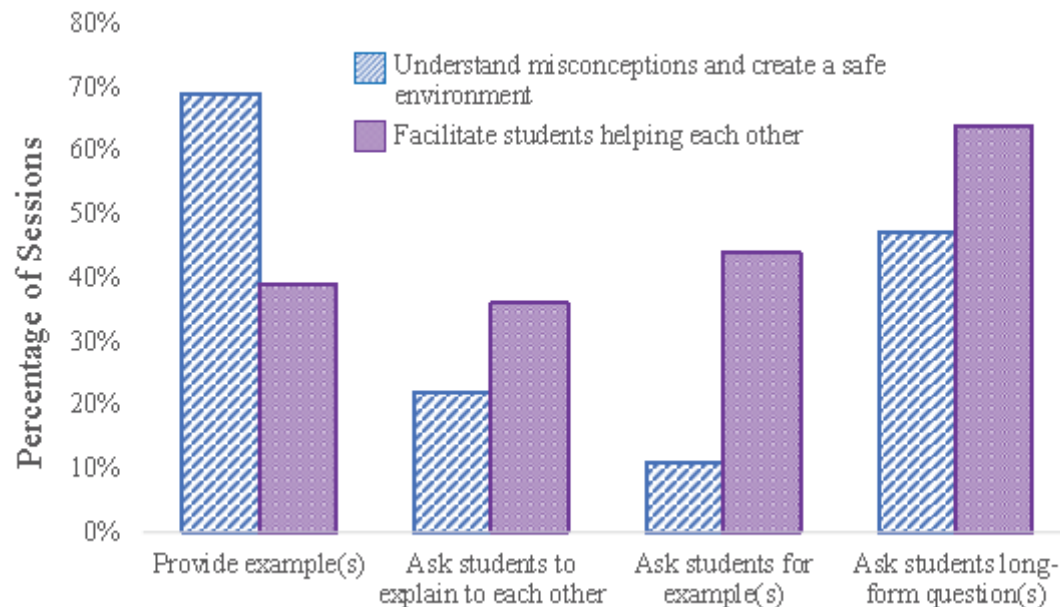
- Study found that participants benefited from the iterative practice built into GPTeach
- Rubric for evaluating GPTeach teacher transcripts

Gives students a directed greeting
Inquires further about student questions/misunderstandings
Answers question(s)
Provides example(s)
Asks for example(s)
Asks for student to repeat back explanation(s)
Concludes/closes/recaps session
Asks students what they know already
Asks long-form questions rather than yes/no
Uses inclusive language
Makes note of learning goals
Addresses students' main points and concerns

- Tool then used in Code in Place with 800 novice teachers.

- Tool used in Code in Place with 800 novice teachers
- Participants benefited from the iterative practice built into GPTeach

- Lack of time pressure allowed participants to
  - Take a moment to use more inclusive language
  - Devise an appropriate strategy to help the students and work toward the learning goal(s).
- Moved from “Understand student misconceptions and hidden blockers” to “Facilitate students helping each other”



# Enhanced coding error messages with GPT

- Compare two approaches to baseline options
  - Generate explanatory error messages using GPT in real time
  - Link error messages to the course discussion forum
- Result
  - Students using GPT-generated error messages
    - Repeat an error 23.5% less often in the subsequent attempt
    - Resolve an error in 36.1% fewer additional attempts, compared to standard error messages
  - Additional link to forum did not have significant observable benefit

[Wang, Mitchell, Piech]

# Safely Scaling Coding Style Feedback

## Identifier names

- Ask GPT for variable and function name recommendations
- Lots of parsing to ensure the students get back ONLY function and variable names and nothing else

## Constants and Magic Numbers

- Deterministic feedback (no-GPT)
- Magic nums that need constants
- Constants used as variables
- Variables used as constants



Juliette Woodrow



Chris Piech

## Comments

- Ask GPT to classify existing comments and to classify any missing comments
- For each class, show teacher written feedback
- Only give one piece of feedback for an existing comment and one for needed but not written comment

## Decomposition

- Ask GPT to classify functions into categories
- Give teacher written feedback based on these classifications



# Grading for Classrooms at Scale:

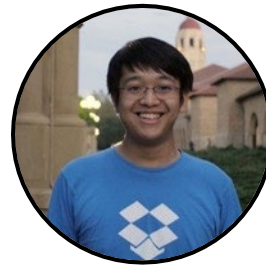
## Automatically Giving Feedback on Interactive Software



Evan Z. Liu\*



Moritz Stephan\*



Allen Nie



Juliette Woodrow



Chris Piech

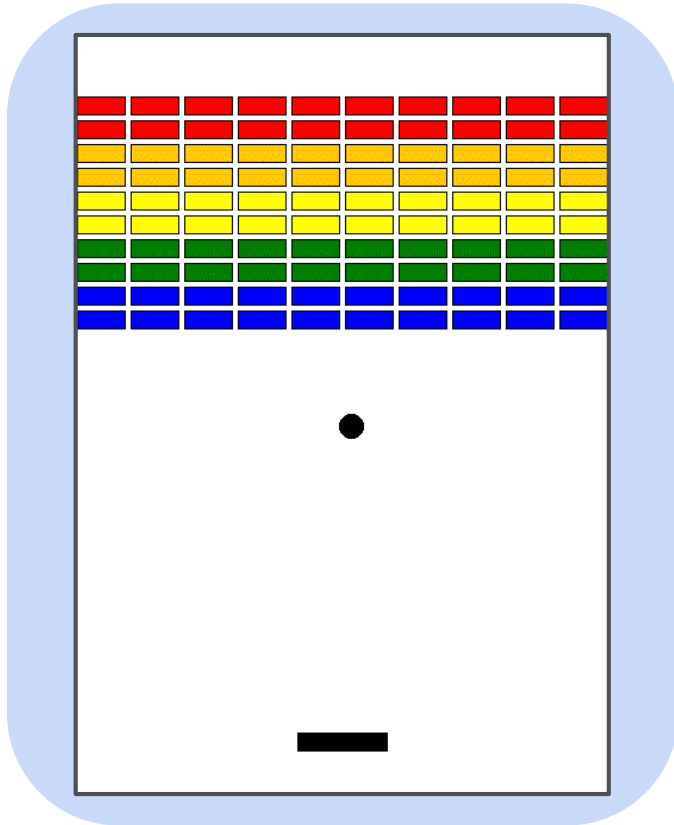


Emma Brunskill



Chelsea Finn

# Train model to play game; use grading rubric



**Input:** Student program



**Output:** Grades!

Does the ball bounce off paddle correctly?

Does the ball bounce off the walls correctly?

Does the ball break bricks on impact?

Does the ball disappear when it hits the floor?

Does the ball become “skewered” on the paddle?

**Input:** Rubric

# Collaborative learning



# AI for collaborative writing

## Invite **Clara AI** for formative writing feedback

Currently in limited research beta testing

Add [clara@uphold.ai](mailto:clara@uphold.ai) as an editor to your document then submit the URL

<https://docs.google.com/document/d/82TY...>

Invite →



Ben Klieger

The screenshot shows a Google Docs interface. The document title is "Short Essay Draft on Cats and Dogs". The menu bar includes File, Edit, View, Insert, Format, Tools, Extensions, and Help. The toolbar shows various editing tools and a zoom level of 100%. The document content consists of two paragraphs. The first paragraph discusses how pet preferences can indicate personality traits. The second paragraph discusses the importance of understanding the ramifications of this question. The comments sidebar on the right shows three comments: one from Clara AI providing feedback on the writing process, one from Benjamin Klieger stating the paper is for a high school assignment, and another from Clara AI asking for more context about the paper's goals and audience.

Short Essay Draft on Cats and Dogs

File Edit View Insert Format Tools Extensions Help

100% Normal text Inter 13 B I U A

Cats and dogs are two of the most common types of pets, and preferring one to another can arguably tell many things about a person. While the question about choosing to have a cat or a dog may seem trivial and insignificant to many people, it can actually indicate a number of important personality traits. While we often tend to argue about one of these kinds of pets being better than another, we do not ask ourselves what these preferences actually say about us. So, before labeling this question as meaningless and frivolous, you might want to ask yourself once again: "Am I a cat or dog person?"

To understand all of the ramifications of this question, it is essential to compare and contrast these two types of pets, taking several aspects into account. The first factor is the comfort and support they provide to their owners. While dogs are usually active and energetic in showing their love and devotion, cats are much more subtle and gentle. Cats may often not even be explicit in demonstrating their affection, which, for many people, creates a misconception that they are not affectionate at all. Being annoyed with the ways cats and dogs show affection can say something about one's personality. For example, dogs' ways of showing affection by jumping and licking a person may be considered extremely annoying by some people who are naturally calm and do not like having their personal space violated. At the same time, cats' indifferent manner of interacting with humans may be

Comments All

Clara AI 7:46 PM Today  
Hello! I'm Clara, an AI designed to provide formative writing feedback. You are encouraged to respond to my comments, dispute, or ask for clarification, and I will respond.  
Before providing feedback, I would like to know more about your goals for this paper, the type of writing you are doing, and the audience you are writing for.  
Respond to this comment with that context. You can also say "[SKIP]" to skip the process, but this is not recommended.

Benjamin Klieger 7:47 PM Today  
I am writing this paper for my high school english assignment

Clara AI 7:47 PM Today  
Thank you, Benjamin, for sharing that information. Could you please let me know what your goals are for this paper? Are you trying to inform, persuade, or entertain your readers? Additionally, could you provide some details about the type of writing you are doing? Is it an essay, a research paper, or something else? Lastly, it would be helpful to know who your audience is. Are you writing for your teacher, your classmates, or a broader audience? Thank you!

Reply or add others with @

# AI for collaborative conversation

- Can we build tool that listens to speech and provides it to a LLM?
- Can the LLM analyze what is happening in a conversation?
- Can the LLM decide when to speak and what to say?

# AI for collaborative conversation

- Can we build tool that listens to speech and provides it to an LLM?
  - Record speech
  - Use an off-the-shelf diarization utility to create a transcript
  - Provide that to an LLM, using an interface that let's us experiment with prompts and results

**Bruno**

- Can an LLM analyze what is happening in a conversation?
  - Use recorded transcripts of conversations we already have
  - Experiment with asking an LLM questions about these transcripts

**Transcript study**

- Can an LLM decide when to speak and what to say?
  - We don't know how to approach this yet
  - We hope that experiments with analyzing transcripts will help us learn more

**Future work**

**Bruno**





Record

## Transcript

Say something to begin.

## Instructions

1. Start talking about your project.
2. When you feel stuck or unsure what to do next, ask the following prompt: "Who spoke the most in the conversation?"

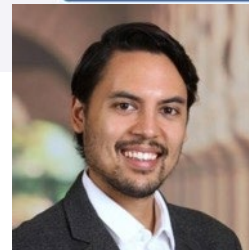
## Prompt + Response

- B Bruno AI**  
Bruno AI's feedback will appear here. This is a placeholder to show where the feedback will show.
- U You**  
This is a past message made by the user to Bruno.
- B Bruno AI**  
This is Bruno's response.

Send a prompt

 [Reset Session](#)

[Ask Bruno](#)



# Trying an early version of Bruno with high school students from China, Rwanda, and Switzerland



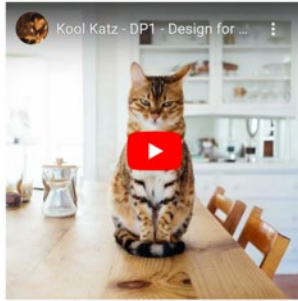
“it understands Swiss German!!!”

# Bruno-based student design projects



**collabots**

Teacher's assistant  
monitoring  
breakout rooms



**Kool Katz**

Game design,  
simulating player  
dynamics to look at  
balance in game



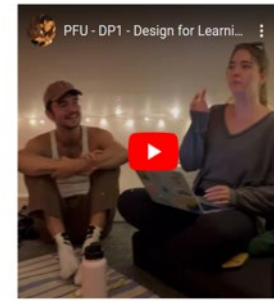
**Stars**

Facilitate productive  
student discussion:  
break silences, ask  
new questions,



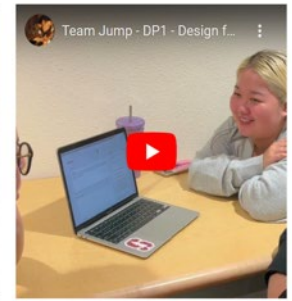
**ABA**

Follow discussion  
and provide  
suggestions of  
further topics



**PFU**

Facilitate productive  
student discussion:  
help return to  
overlooked topics



**Team Jump**

Analyze completed  
discussion to help  
learn better  
collaboration

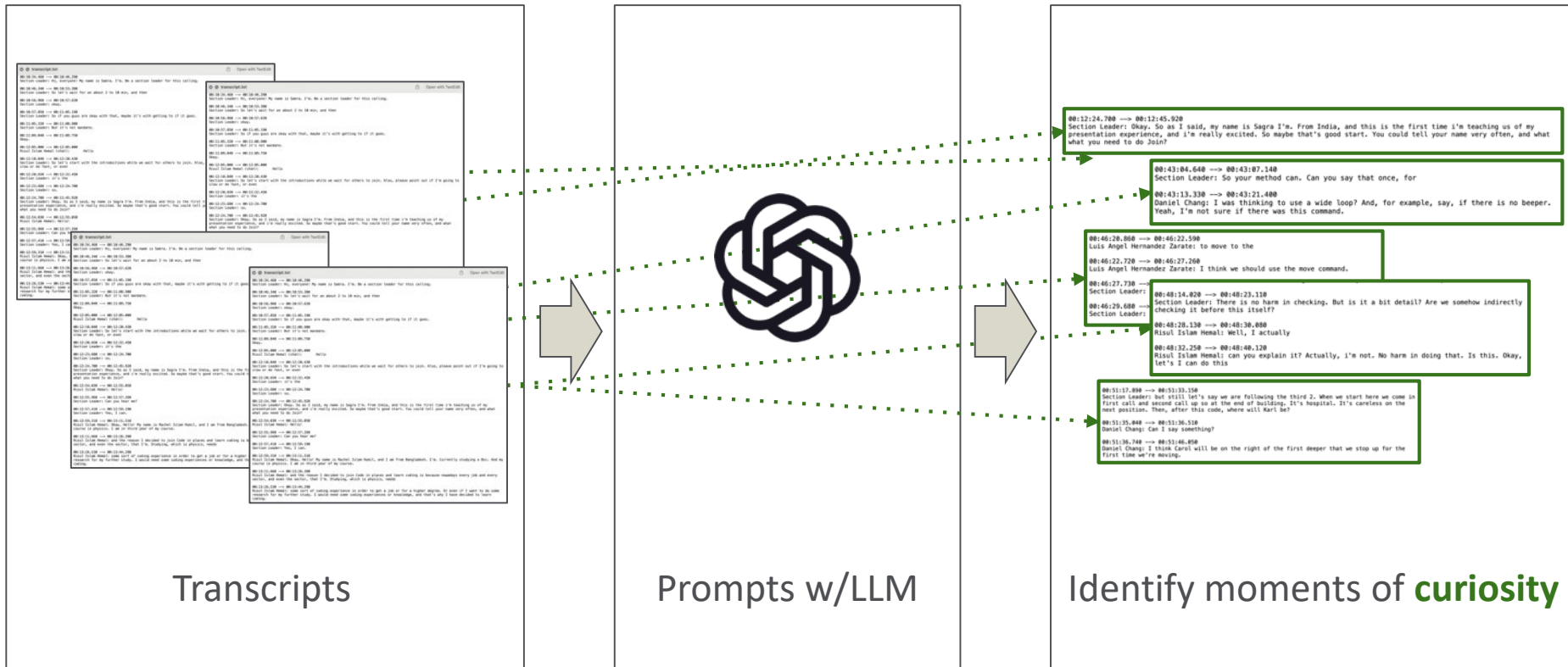
## One takeaway

AI can tell when discussion is off track, but it is unreliable for identifying tone

# Transcript study

# Exploring generative AI for discourse analysis

# Identifying curiosity in class discussion





# Implementation

## 1. Load in a sample transcript

```
00:10:34.460 -> 00:10:46.290
Section Leader: Hi, everyone! My name is Sabra. I'm. Be a section leader for this calling.
00:10:46.340 -> 00:10:53.380
Section Leader: So let's wait for an about 2 to 10 min, and then
00:10:56.960 -> 00:10:57.620
Section Leader: okay.
00:10:57.850 -> 00:11:08.900
Section Leader: So if you guys are okay with that, maybe it's with getting to if it goes.
00:11:08.320 -> 00:11:08.900
Section Leader: But it's not mandate.
00:11:09.040 -> 00:11:09.750
Okay.
00:12:05.000 -> 00:12:05.000
Risul Islam Hemal (chat): Hello
00:12:10.040 -> 00:12:20.430
Section Leader: So let's start with the introductions while we wait for others to join. Also, please point out if I'm going to slow or do fast, or even
00:12:20.650 -> 00:12:22.450
Section Leader: it's the
00:12:23.680 -> 00:12:24.700
Section Leader: so.
00:12:24.700 -> 00:12:45.920
Section Leader: Okay. So as I said, my name is Sagra I'm. From India, and this is the first time I'm teaching us of my presentation experience, and I'm really excited. So maybe that's good start. You could tell your name very often, and what what you need to do join?
00:12:54.830 -> 00:12:55.850
Risul Islam Hemal: Hi!
00:12:55.960 -> 00:12:57.260
Section Leader: Can you hear me?
00:12:57.410 -> 00:12:59.190
Section Leader: Yes, I can.
00:12:59.310 -> 00:13:11.510
Risul Islam Hemal: Okay, Hello! My name is Rachel Islam Humil, and I am from Bangladesh. I'm. Currently studying a Bsc. And my course is physics. I am in third year of my course.
00:13:11.660 -> 00:13:26.390
Risul Islam Hemal: and the reason I decided to join Code in places and learn coding is because nowadays every job and every sector, and even the sector, that I'm. Studying, which is physics, needs
00:13:26.530 -> 00:13:44.290
Risul Islam Hemal: some sort of coding experience in order to get a job or for a higher degree. Or even if I want to do some research for my further study, I would need some coding experiences or knowledge, and that's why I have decided to learn coding.
```

Transcript

```
Load in and format data

Tip: you can provide parts of the transcript to GPT to ask for code suggestions on how to load it

[1]: import pandas as pd
import re

# Empty lists to store data
timestamps = []
names = []
texts = []

# Keep track of current timestamp
current_timestamp = None

# Open the text file
with open('transcript.txt', 'r') as transcript:
    for line in transcript:
        # If line is a timestamp, we capture it
        if re.match('\d{2}:\d{2}:\d{3} -> \d{2}:\d{2}:\d{3}', line.strip()):
            current_timestamp = line.strip() # store timestamp
            continue

        # Split each line by ": " to separate speaker and corresponding text.
        parts = line.strip().split(": ", 1)

        # If the name is present in line
        if current_timestamp and len(parts) == 1 and parts[0] != '':
            timestamps.append(current_timestamp)
            names.append(parts[0] if len(parts) > 1 else 'Unknown')
            texts.append(parts[1] if len(parts) > 1 else parts[0])

        # Reset current timestamp so it won't be used in next iteration
        current_timestamp = None

# Create DataFrame from lists
df = pd.DataFrame({'timestamp': timestamps, 'name': names, 'text': texts})

# Print DataFrame
print(df)
```

Python script that formats transcript into DataFrame

```
timestamp name \
0 00:10:34.460 -> 00:10:46.290 Section Leader
1 00:10:46.340 -> 00:10:53.380 Section Leader
2 00:10:56.960 -> 00:10:57.620 Section Leader
3 00:10:57.850 -> 00:11:05.190 Section Leader
4 00:11:05.320 -> 00:11:08.900 Section Leader
.. ..
852 01:32:46.590 -> 01:32:49.220 Risul Islam Hemal
853 01:32:49.230 -> 01:32:52.450 Section Leader
854 01:32:54.290 -> 01:32:55.830 Section Leader
855 01:32:58.200 -> 01:33:01.340 Section Leader
856 01:33:01.650 -> 01:33:04.550 Daniel Chang

text
0 Hi, everyone! My name is Sabra. I'm. Be a sect...
1 So let's wait for an about 2 to 10 min, and then
2 okay.
3 So if you guys are okay with that, maybe it's ...
4 But it's not mandate.
.. ..
852 No, no, it was perfect. I had a lot of fun.
853 Thank you.
854 I think it's all great
855 again. Thank you. So goodbye.
856 bye, bye, bye, bye.

[857 rows x 3 columns]
```

Pandas DataFrame: timestamp, name, text

# Implementation

\* = Sentences might lack the context needed to gauge curiosity

## 2. Send sentences to GPT to label instances of curiosity

	timestamp		name
0	00:10:34.460	→ 00:10:46.290	Section Leader
1	00:10:46.340	→ 00:10:53.380	Section Leader
2	00:10:56.960	→ 00:10:57.620	Section Leader
3	00:10:57.850	→ 00:11:05.190	Section Leader
4	00:11:05.320	→ 00:11:08.900	Section Leader
...	...	...	...
852	01:32:46.590	→ 01:32:49.220	Risul Islam Hemal
853	01:32:49.230	→ 01:32:52.450	Section Leader
854	01:32:54.290	→ 01:32:55.830	Section Leader
855	01:32:58.200	→ 01:33:01.340	Section Leader
856	01:33:01.650	→ 01:33:04.550	Daniel Chang

	text
0	Hi, everyone! My name is Sabra. I'm. Be a sect...
1	So let's wait for an about 2 to 10 min, and then
2	okay.
3	So if you guys are okay with that, maybe it's ...
4	But it's not mandate.
...	...
852	No, no, it was perfect. I had a lot of fun.
853	Thank you.
854	I think it's all great
855	again. Thank you. So goodbye.
856	bye, bye, bye, bye.

[857 rows x 3 columns]

```
1 # Initialize the OpenAI client with the API key
2 client = OpenAI(api_key=open('tokens_api_key'))
3
4 def get_completion(prompt, client, instance, model="gpt-3.5-turbo"):
5     messages = [{"role": "user", "content": prompt}]
6     response = client.chat.completions.create(
7         model=model,
8         messages=messages,
9         max_tokens=10,
10        temperature=0,
11    )
12
13    # Assuming the response object has a "content" field as per the new API structure
14    return response.choices[0].message.content
15
16 # Define the three-shot prompt with example questions and answers
17 three_shot_prompt_template = """
18 Statement: "Why would we use a "for" loop instead of a "while" loop in our program?"
19 Determine whether the following statement demonstrates curiosity: Yes. This demonstrates curiosity.
20 Statement: "What is the difference between "and" and "and" in JavaScript?"
21 Determine whether the following statement demonstrates curiosity: Yes. This query shows curiosity.
22 Statement: "Why do we need to use version control systems?"
23 Determine whether the following statement demonstrates curiosity: Yes. This question indicates curi
24 Statement: "E=mc^2"
25 Determine whether the following statement demonstrates curiosity:
26 """
27
28 def analyze_curiosity_of_row(row):
29     prompt = three_shot_prompt_template.format(Event=row["text"])
30     response_text = get_completion(prompt, client)
31
32     # Assuming the response will be in the format "Yes/No, because..."
33     is_curious = "Yes" if "Yes" in response_text else "No" if "No" in response_text else "Unknown"
34     rationale = response_text.split(":", 1)[1].strip() if ":" in response_text else "Rationale not
35     return is_curious, rationale
36
37 # Load your data into the dataframe "df"
38 # ...
39
40 # Apply the function to only the first 5 rows
41 final_df = df.head(5).apply(lambda row: analyze_curiosity_of_row(row), axis=1, result_type="expand")
42
43 # Update the original dataframe with the results for the first 5 rows
44 df.loc[0:4, "is_curious", "is_curious"] = final_df["is_curious"]
45 df.loc[0:4, "text", "text", "rationale"] = final_df["rationale"]
46
47 # Print the dataframe with the new information
48 print(df[["timestamp", "name", "text", "is_curious", "rationale"]])
49
50 # Filter the dataframe for rows where "is_curious" and "rationale" are not null or not empty
51 df_with_get_output = df.dropna(subset=["is_curious", "rationale"])
52
53 # Save the filtered dataframe to a CSV file
54 df_with_get_output.to_csv("gpt_output_final.csv", index=False)
```

```
00:10:34.460 → 00:10:46.290
Section Leader: Hi, everyone! My name is Sabra. I'm. Be a section leader for this calling.
00:10:46.340 → 00:10:53.380
Section Leader: So let's wait for an about 2 to 10 min, and then
00:10:56.960 → 00:10:57.620
Section Leader: okay.
00:10:57.850 → 00:11:05.190
Section Leader: So if you guys are okay with that, maybe it's with getting to if it goes.
00:10:34.460 → 00:10:46.290
Section Leader: Hi, everyone! My name is Sabra. I'm. Be a section leader for this calling.
00:10:46.340 → 00:10:53.380
Section Leader: So let's wait for an about 2 to 10 min, and then
00:10:56.960 → 00:10:57.620
Section Leader: okay.
00:10:57.850 → 00:11:05.190
Section Leader: So if you guys are okay with that, maybe it's with getting to if it goes.
```



+  
Prompt(s)

Pandas DataFrame:  
timestamp, name,  
text

Python script that sends each sentence\*  
to GPT (with prompts)



# Implementation

\* = Sentences might lack the context needed to gauge curiosity

## 2. Send sentences to GPT to label instances of curiosity

### Zero-shot prompting

```
prompt_template = """
Determine whether the following statement demonstrates curiosity:

Statement: "{text}"
"""
```

### Few-shot prompting

```
three_shot_prompt_template = """
Statement: "You mentioned that recursion can be a powerful tool in programming. Can you explain a scenario where recursion would be more effective than iteration in Python?"
Did the statement express curiosity? Yes. This demonstrates curiosity because it seeks to understand the practical applications and benefits of recursion over iteration, indicating a desire to grasp deeper concepts in programming.

Statement: "During our study of data structures, we learned about lists and tuples. What are the advantages of using a tuple over a list in Python?"
Did the statement express curiosity? Yes. It inquires about the specific use cases and advantages of different data structures, demonstrating a keen interest in understanding the nuances of Python's data handling capabilities.

Statement: "Hello, how is everyone doing today?"
Did the statement express curiosity? No. Although it's a question, it's not expressing curiosity in a particular aspect of the learning but more of just a general question for the class.

Statement: "{text}"
Did the statement express curiosity?
"""
```

# Implementation

\* = Sentences might lack the context needed to gauge curiosity

## 3. Evaluate results

```

0 00:10:34.460 --> 00:10:46.290 Section Leader
1 00:10:46.340 --> 00:10:53.380 Section Leader
2 00:10:56.960 --> 00:10:57.620 Section Leader
3 00:10:57.850 --> 00:11:05.190 Section Leader
4 00:11:05.320 --> 00:11:08.900 Section Leader
...
852 01:32:46.590 --> 01:32:49.220 Risul Islam Hemal
853 01:32:49.230 --> 01:32:52.450 Section Leader
854 01:32:54.290 --> 01:32:55.830 Section Leader
855 01:32:58.200 --> 01:33:01.340 Section Leader
856 01:33:01.650 --> 01:33:04.550 Daniel Chang

text is_curious \
0 Hi, everyone! My name is Sabra. I'm. Be a sect... No
1 So let's wait for an about 2 to 10 min, and then Yes
2 okay. No
3 So if you guys are okay with that, maybe it's ... Yes
4 But it's not mandate. No
...
852 No, no, it was perfect. I had a lot of fun. NaN
853 Thank you. NaN
854 I think it's all great NaN
855 again. Thank you. So goodbye. NaN
856 bye, bye, bye, bye. NaN

rationale
0 the statement does not demonstrate curiosity. ...
1 the statement demonstrates curiosity. The spea...
2 the statement "okay" does not demonstrate curi...
3 the statement demonstrates curiosity. The spea...
4 the statement does not demonstrate curiosity. ...
...
852 NaN
853 NaN
854 NaN
855 NaN
856 NaN

[857 rows x 5 columns]
    
```

	A	B	C	D	E
1	timestamp	name	text	is_curious	rationale
2	00:10:34.460 --> 00:10:46.290	Section Leader	Hi, everyone! My name is Sabra. I'm. Be a section leader for this calling.	No	the statement does not demonstrate curiosity. It simply introduces the speaker and states their role as a section leader.
3	00:10:46.340 --> 00:10:53.380	Section Leader	So let's wait for an about 2 to 10-fmin, and then	Yes	the statement demonstrates curiosity. The speaker is suggesting waiting for a specific amount of time (2 to 10 minutes) in order to see what will happen or to gather more information.
4	00:10:56.960 --> 00:10:57.620	Section Leader	okay.	No	the statement "okay" does not demonstrate curiosity. It is a simple response that indicates agreement or acknowledgement, but it does not show any desire for knowledge or exploration.
5	00:10:57.850 --> 00:11:05.190	Section Leader	So if you guys are okay with that, maybe it's with getting getting to if it goes.	Yes	the statement demonstrates curiosity. The speaker is expressing interest in exploring a possibility and is seeking the agreement of others before proceeding.
6	00:11:05.320 --> 00:11:08.900	Section Leader	But it's not mandate.	No	the statement does not demonstrate curiosity. It simply states a fact or opinion without expressing any desire for further exploration or understanding.

	A	B	C	D	E
1	timestamp	name	text	is_curious	rationale
2	00:10:34.460 --> 00:10:46.290	Section Leader	Hi, everyone! My name is Sabra. I'm. Be a section leader for this calling.	No	Rationale could not be determined
3	00:10:46.340 --> 00:10:53.380	Section Leader	So let's wait for an about 2 to 10-fmin, and then	No	Rationale could not be determined
4	00:10:56.960 --> 00:10:57.620	Section Leader	okay.	No	Rationale could not be determined
5	00:10:57.850 --> 00:11:05.190	Section Leader	So if you guys are okay with that, maybe it's with getting to if it goes.	No	Rationale could not be determined
6	00:11:05.320 --> 00:11:08.900	Section Leader	But it's not mandate.	No	rather than seeking to understand or explore something.

Prediction  
Ground truth

Manual  
evaluation

Automatic  
evaluation

Labeled test set

Updated DataFrame with  
GPT output

Export DataFrame results to CSV and evaluate

# Partial success so far

## Improving Accuracy

- Experiment with providing more context
- Diverse range of prompt examples
- Providing enough prompt context but not over-constraining
- More rigorous testing setup
- Not good at affect

## Broader Directions

- Iteratively scale the approach across more transcripts
- Real-time Class Engagement and Visualization
- Teacher's Aid for Scaffolding Curiosity in Classroom Discussions
- Integration into Bruno as trigger for interjections during collaboration
- *Make a GPT for this?*

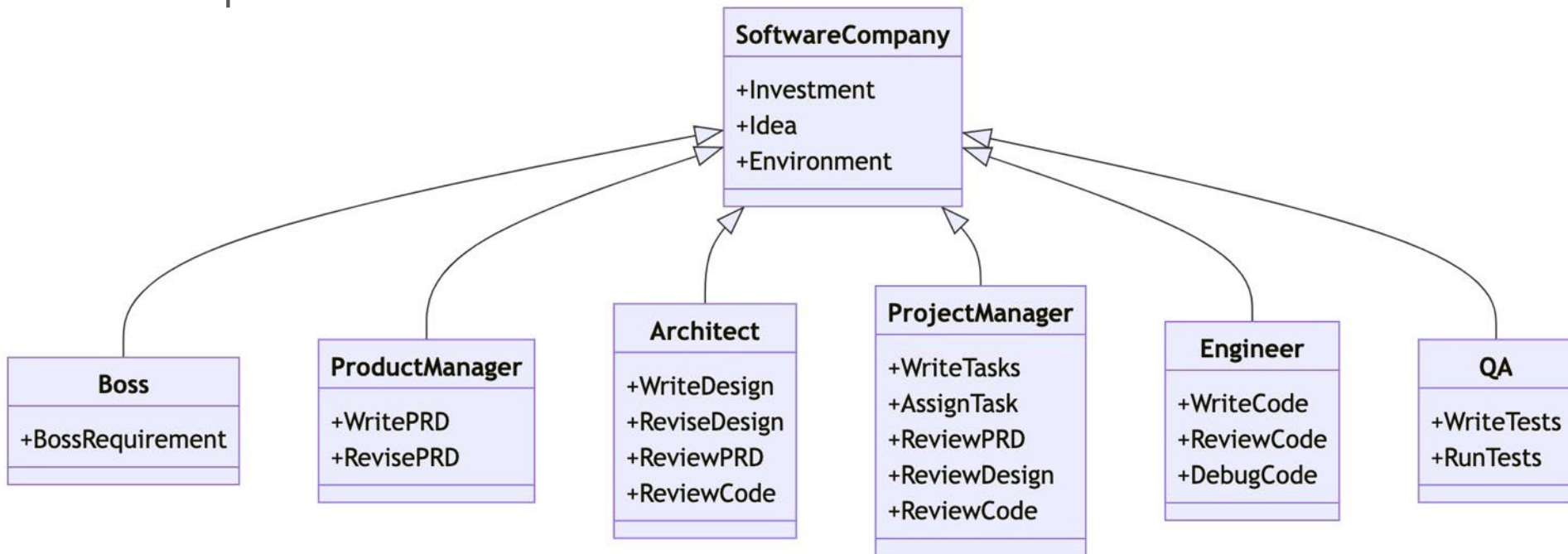
# Something you can try too!

- Three steps
  1. Choose a message thread with a friend on WhatsApp
  2. Copy and paste a section of the thread into ChatGPT
  3. Use ChatGPT to explore the social dynamics of the thread, e.g., “Is \_\_\_\_\_ being a good friend?”
- Surprising insight
  - “I thought my brother was being mean, but GPT told me he was being supportive and kind”

How will Generative AI  
change what students learn?

- Improvements in AI and upskilling of humans are needed
  - AI will perform many tasks currently done by humans
  - Humans must learn to complement and direct AI
- Fundamental distinction
  - AI is good at reckoning - calculative prediction
  - Humans must be better at judgment - practical wisdom
- Recommendation
  - Human upskilling in win-win collaborative interaction is needed for human/AI teamwork to progress successfully
- Further information available at Harvard web site

- Assign different roles to GPTs to form a collaborative software entity for complex tasks



- Create user stories / competitive analysis / requirements / data structures / APIs / documents
- Includes product managers / architects / project managers / engineers.

Looking Forward



# Looking forward

AI will continue to improve

- Massive effort by broad commercial sector

Impact on learning, society will be better understood

- Best practices, cautionary insight, regulation

This is a great time to experiment and learn!

- Try exploratory activities to gain insight
- Follow advances in technology and its use
- Be prepared to adapt to new ideas, repeatedly

Discussion?