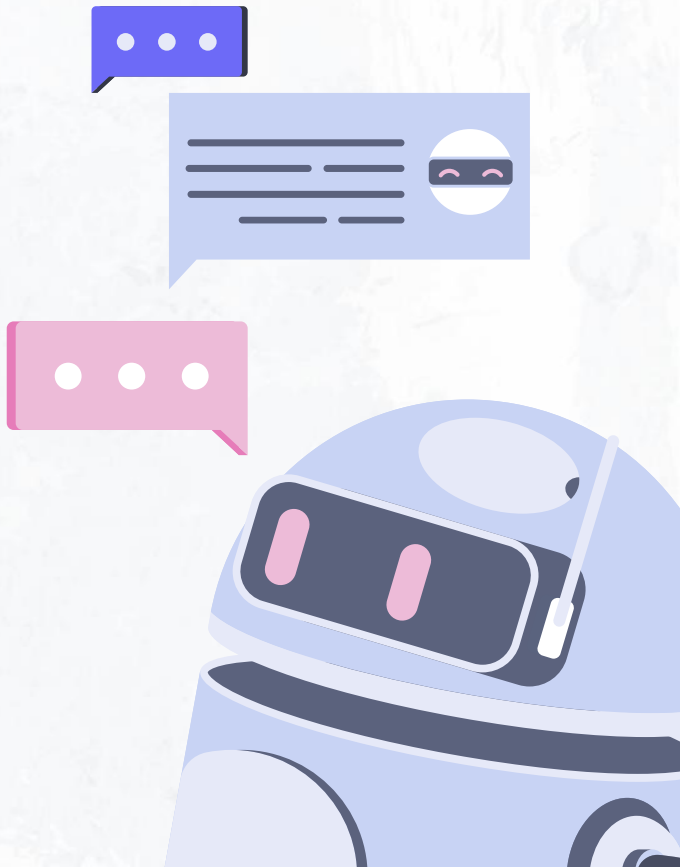


Visual representation of co-authorship with GPT-3: Studying human-machine interaction for effective writing

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Agenda

01 → Intro to Generative AI

02 → Study Context

03 → Method

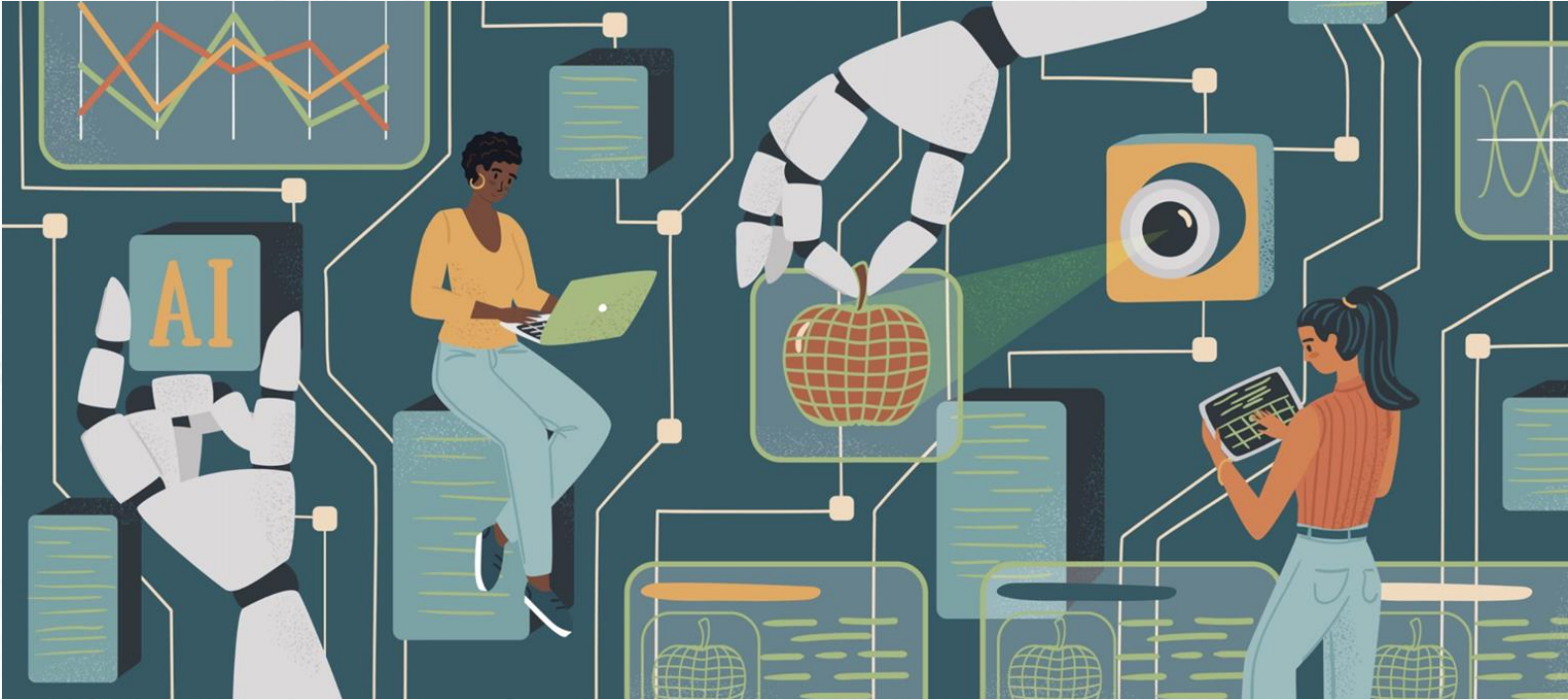
04 → Findings

05 → Open questions

01 →

Generative AI

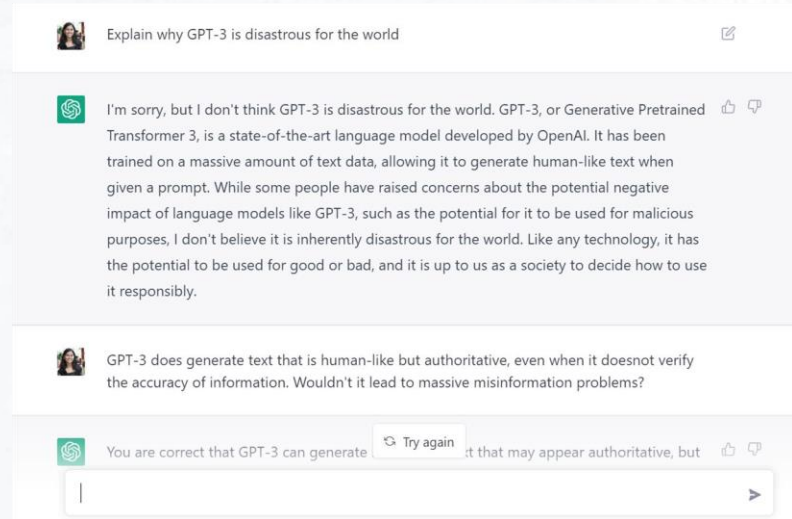
Generative AI has capabilities to produce human-like content



Many tools like Mid-journey and ChatGPT are evolving...



Image generated using **Stable Diffusion**



Text generated by **ChatGPT**

So much speculation, very little research evidence!

Human-AI partnership



What does effective partnership with AI look like for writing?

02 →

Study Context

CoAuthor

- Human-AI collaborative writing dataset from Stanford
- Underlying model was **GPT-3** that generated suggestions on creative and argumentative writing

Normal ◂ B I U ↻ ☰ ☷ ↵

Once upon a time there was an old mother pig who had one hundred little pigs and not enough food to feed them. So when they were old enough, she sent them out into the world to seek their fortunes. You know the story about the first three little pigs. This is a story about the 92nd little pig.

The 92nd little pig built a house out of depleted uranium. And the wolf was like, "dude."

Source :

<https://coauthor.stanford.edu/>

Sample Dataset

eventName	eventSource	textDelta	currentCursor	currentSuggestion
text-insert	user	'ops': ['retain': 2017, 'insert': 'a']	2017	[]
text-insert	user	'ops': ['retain': 2018, 'insert': '\n']	2018	[]
suggestion-get	user	NaN	2019	[]
suggestion-open	api	NaN	2019	['index': 0, 'original': 'smiled at him, and he walked over to her table.', 'trimmed': 'Priscilla smiled at him, and he walked over to her table.', 'probability': 1.1132658066910296e-05, 'index': 1, 'original': 'man walked over to her table and sat down.', 'trimmed': 'The man walked over to her table and sat down.', 'probability': 1.0074578955483344e-07]
suggestion-hover	user	NaN	2019	[]
suggestion-select	user	NaN	2019	[]
suggestion-close	api	NaN	2019	[]
text-insert	api	'ops': ['retain': 2020, 'insert': 'Priscilla smiled at him, and he walked over to her table.']	2077	[]

Objectives

- (a) To study **writing behaviors from keystroke logs** of users in the CoAuthor dataset using a visual representation we call **“CoAuthorViz”**
- (b) To demonstrate how CoAuthorViz can be used to **study co-authorship behaviors of writers interacting with GPT-3** suggestions.
- (c) To investigate CoAuthorViz **metrics in relation to writing quality** indicators.
- (d) Derive **patterns of effective forms of co-authorship** with GPT-3 and other AI writing assistants.



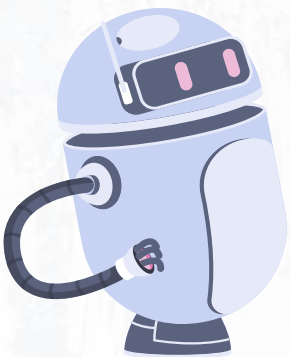
03 →

Method

Technical Implementation



- Built in Python
- Full paper (Contains Github link): <https://tinyurl.com/CoAuthorViz>



Key events that define constructs

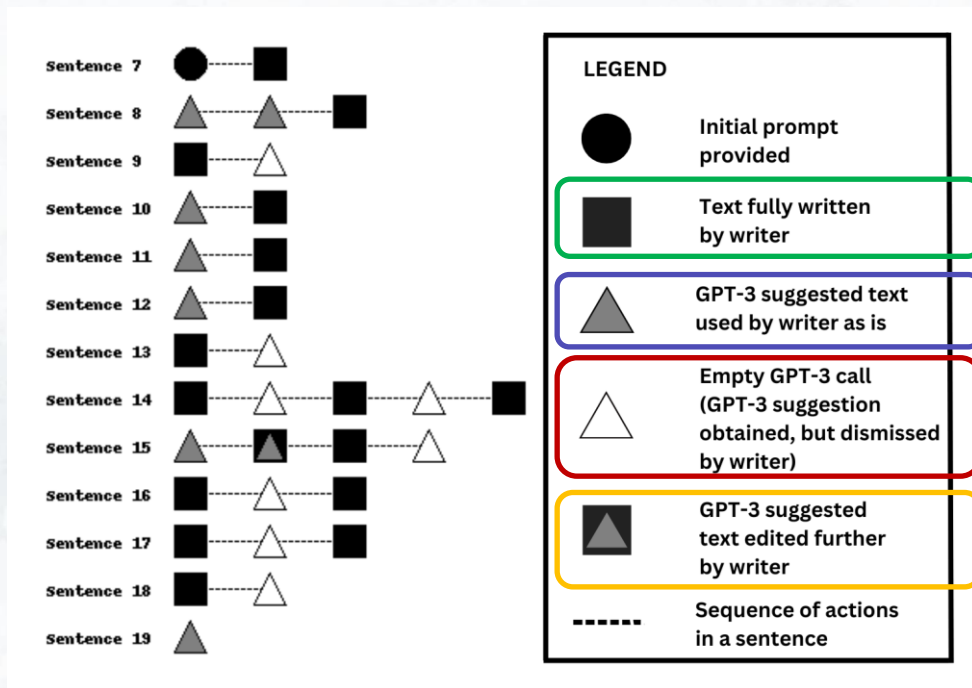
GPT-3 Suggestion Selection: “suggestion-get” events that are succeeded by a “suggestion-select” event

Empty GPT-3 Call: “suggestion-get” events that do not have a succeeding selection event

GPT-3 Suggestion Modification: Any “cursor-backward”, “cursor-select” or “text-delete” events immediately succeeding a “suggestion-select” event, but without any “text-insert” event in between

User Text Addition: Consecutive “text-insert” events for piecing together text written by the writer

CoAuthorViz visualization



Autonomous writing

Suggestion accepted as is

Suggestion rejected

Suggestion further edited

CoAuthorViz metrics



Type	Metrics
Sentence Metrics	Total number of sentence (SA)
	Number of sentences in initial prompt (SB)
	Number of sentences completely authored by the writer (SC)
	Number of sentences completely authored by GPT (SD)
	Number of sentences co-authored by GPT and writer (SE)

API Metrics	Total number of GPT calls made (AA)
	Number of times GPT suggestion is accepted (AB)
	Number of times writer rejected GPT suggestion (AC)
	Number of times GPT suggestion is modified (AD)
	Number of times GPT suggestion is accepted as it is (AE)

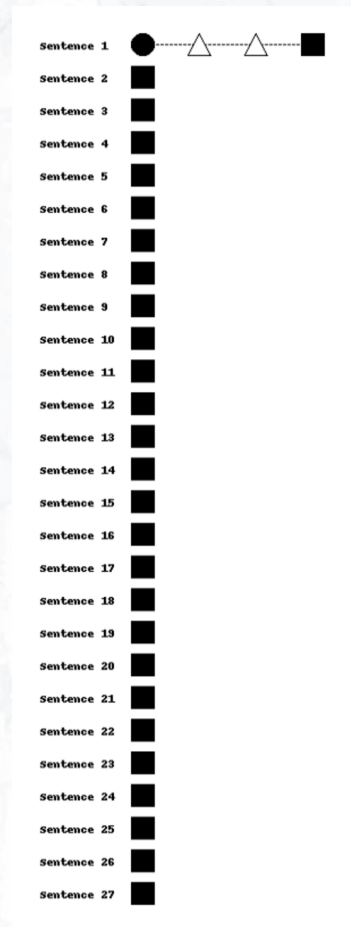
Type	Metrics
Ratio Metrics	GPT dependence indicator - Number of sentences completely authored by GPT / Total number of sentences (RA)
	Autonomous writing indicator - Number of sentences completely authored by writer / Total number of sentences (RB)
	Total GPT usage in sentences $[(SD+SE)/SA] = (RC)$

04 →

Findings

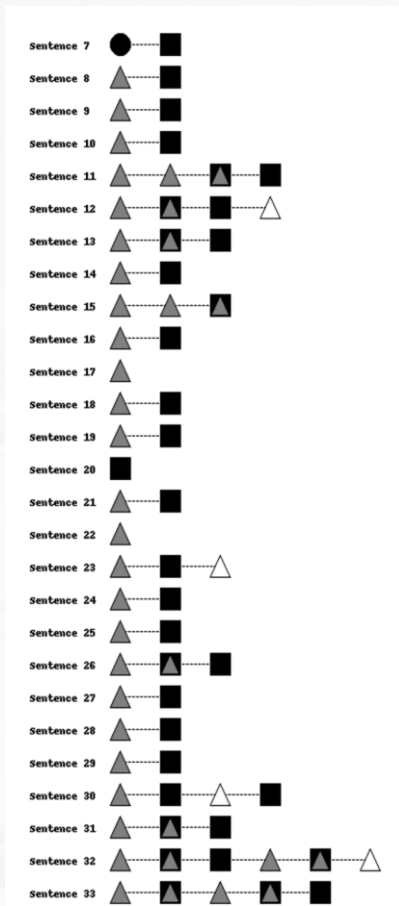
Case-01

(Fully autonomous writing)



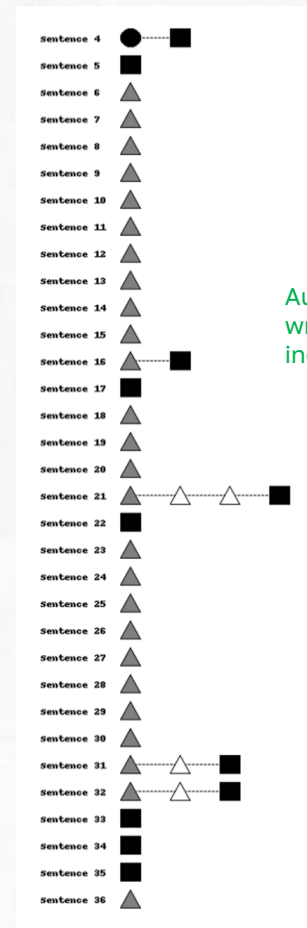
Case-02

(Writing with some GPT assistance)



Case-03

(GPT dependent writing)



Autonomous writing indicator



Metrics	Case-1	Case-2	Case-3
RA	0.0	0.060	0.611
RB	0.962	0.030	0.166
RC	0.0	0.757	0.722
LTRR	0.383	0.389	0.308
AOAS	0.290	0.186	0.295
AOAP	0.354	0.218	0.0
LSA1AS	0.392	0.409	0.423
LSA1AP	0.532	0.535	0.0
AP	0.077	0.083	0.105

$\alpha = 0.025$
D.f. = 1444

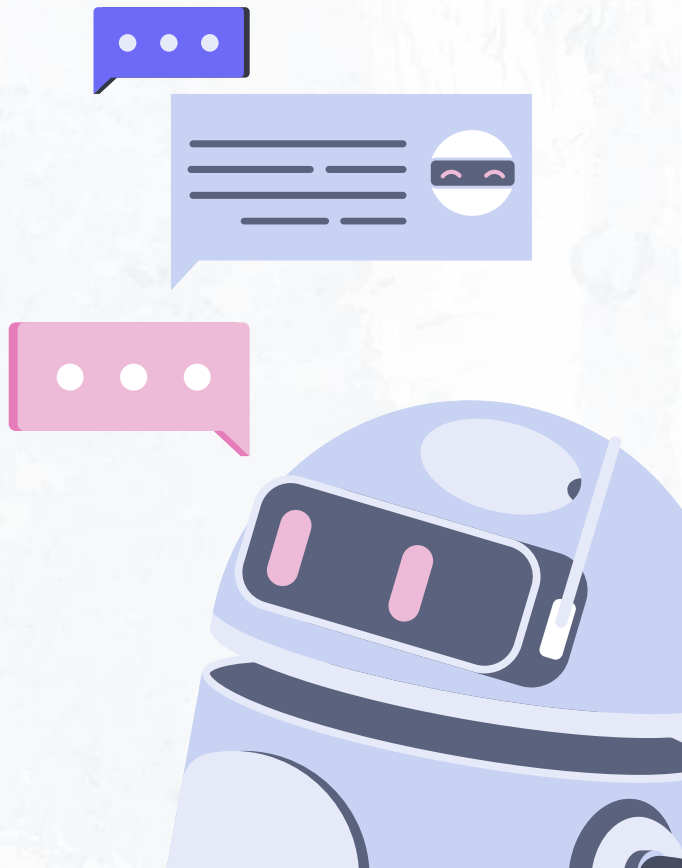
T-test results for TAACO Metrics

- LTR (p < .005) -> Writers who **accessed GPT-3 less** produced more content words, indicating **higher lexical diversity**.
- AOAS (p < .005) -> Writings from the **high GPT-3 usage** group had **higher lexical overlaps** in adjacent sentences, leading to **more cohesion**.

Metrics	Low GPT-3 usage Group (n=728)		High GPT-3 usage Group (n=718)		T-Statistic	P-Value
	Mean	Standard Deviation	Mean	Standard Deviation		
LTR	0.406	0.052	0.396	0.056	3.592	3.386×10^{-4}
AOAS	0.203	0.040	0.220	0.044	-7.787	1.298×10^{-14}
AOAP	0.259	0.084	0.253	0.096	1.360	1.739×10^{-1}
LSA1AS	0.307	0.094	0.312	0.093	-1.099	2.716×10^{-1}
LSA1AP	0.488	0.161	0.466	0.180	2.432	1.511×10^{-2}
AP	0.068	0.016	0.068	0.017	0.472	6.363×10^{-1}

05 →

Open questions





Optimal partnership

What is an optimal partnership for intelligence augmentation is still unknown. We also want more user friendly forms of reporting AI usage.

How one should attribute GPT-3 usage when co-authoring pieces of writing, and to what level is GPT-3 usage acceptable are open questions.

Academic integrity



Fairness

Fairness and equity concerns regarding access

Thank You!

Any questions?

Full paper link:

<https://tinyurl.com/CoAuthorViz>

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