Augmenting Human Creativity with Automated Text Generation

Melissa Roemmele
melissa@roemmele.io
Language Weaver (RWS Group)
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Research Context

COMPUTERS THAT MODEL HUMAN BEHAVIOR
[E.G. *ARTIFICIAL INTELLIGENCE / AI, MACHINE LEARNING*]

COMPUTERS THAT MODEL HUMAN CREATIVITY
[E.G. *COMPUTATIONAL CREATIVITY*]

this talk
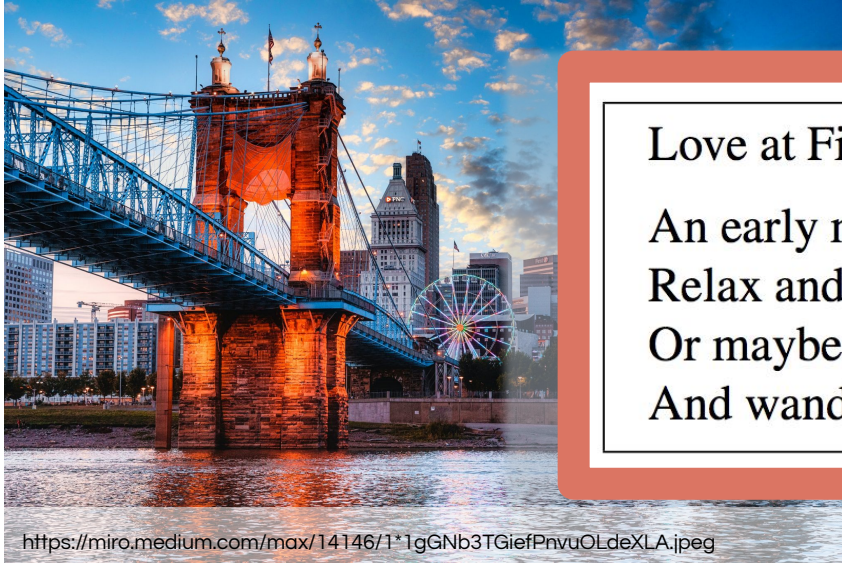*[E.G. CREATIVE LANGUAGE GENERATION, STORY GENERATION]*

COMPUTERS THAT MODEL HUMAN LANGUAGE
[E.G. *NATURAL LANGUAGE PROCESSING / NLP, NATURAL LANGUAGE GENERATION / NLG*]

Examples of Creative Language Generation

Poetry

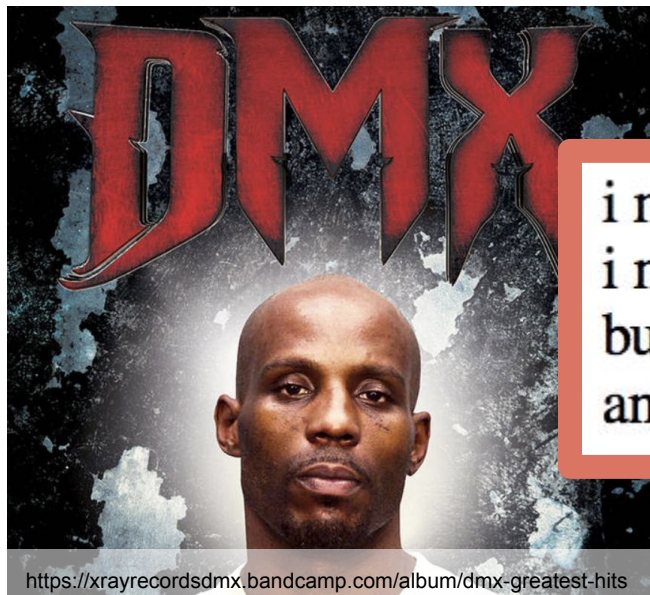https://miro.medium.com/max/14146/1*1gGNb3TGiefPnvuOLdeXLA.jpeg

Love at First Sight

An early morning on a rainy night,
Relax and make the other people happy,
Or maybe get a little out of sight,
And wander down the streets of Cincinnati.

Ghazvininejad et al. (2016). Generating Topical Poetry. Proceedings of the 2016 Conference on Empirical Methods in Natural Language Processing.

Song Lyrics

i m gon na be alright or die
i m a dog and i m the dog and i m a dog
but i m gon na be alright
and i m gon na be alright

https://xrayrecordsdmx.bandcamp.com/album/dmx-greatest-hits

Potash et al. (2018). Evaluating Creative Language Generation: The Case of Rap Lyric Ghostwriting. Proceedings of the Second Workshop on Stylistic Variation.

Slogans

www.thegreenhead.com/2009/08/copco-bag-caps.php

❖ "Relax. Refresh. Enjoy."

❖ "Feed, snap, snack"

❖ "Snack it, save it, Cap it"

❖ "Open, eat, seal, repeat!"

Clark et al. (2018). Creative Writing with a Machine in the Loop: Case Studies on Slogans and Stories. 23rd International Conference on Intelligent User Interfaces

Word blends

shopping;marathon	shopparathon
fashion;fascism	fashism
wiki;etiquette	wikiquette
clown;president	clowident

https://www.forbes.com/sites/gregpetro/2019/04/05/shopping-malls-arent-dying-theyre-evolving

Gangal et al. (2017). CharManteau: Character Embedding Models For Portmanteau Creation. Proceedings of the 2017 Conference on Empirical Methods in Natural Language Processing

Puns

https://www.nationalgeographic.com/photography/article/peace-symbol-gallery#/painted-volkswagen_13394_600x450.jpg

"That's because **negotiator** got my car back to me in one **peace**."

He et al. (2019). Pun Generation with Surprise. Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics

Satirical News

U.S. Asks Pugs If They Can Do Anything
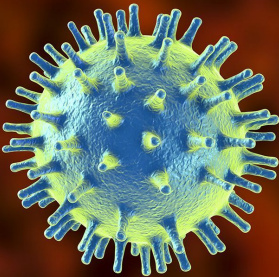
By Jacob Lockwood
Published Friday, April 24th, 2020

In a statement released Tuesday, citizens of the United States asked pugs if they can do anything, and if so, what? "Is there anything at all that you can do?" the amassed nation collectively wondered aloud while staring at the country's population of pugs, who were all simultaneously panting with their tongues out. "What exactly is your purpose? Do you have skills? Or are you not useful for anything? Please, pugs, tell us what you do. We're all very unsure." Responding to the inquiry of all Americans, the gathered pugs began to drool.

Horvitz & Littman (2020). Context-Driven Satirical Headline Generation. Proceedings of the Second Workshop on Figurative Language Processing.

Flash Fiction

Writing Prompt: *The scientists have discovered something terrible.*

The scientist stood there, a little dazed as he stared.
"What is it?" He asked.
"This...this...Thing...This is a virus . . ."
. . . "We don't know what this thing is. We haven't seen anything like it . . ." Dr. Jones stared at the scientist for a moment . . .
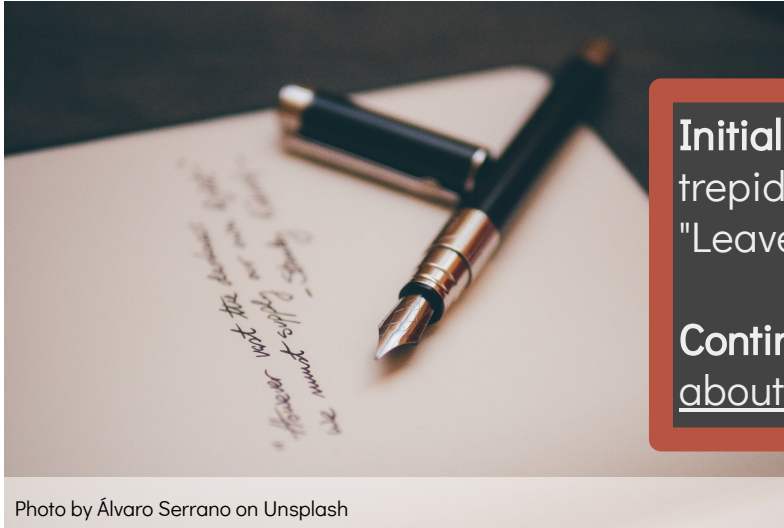
https://www.nationalgeographic.org/encyclopedia/viruses/

Fan et al. (2018). Hierarchical Neural Story Generation. Proceedings of the 56th Annual Meeting of the Association for Computational Linguistics
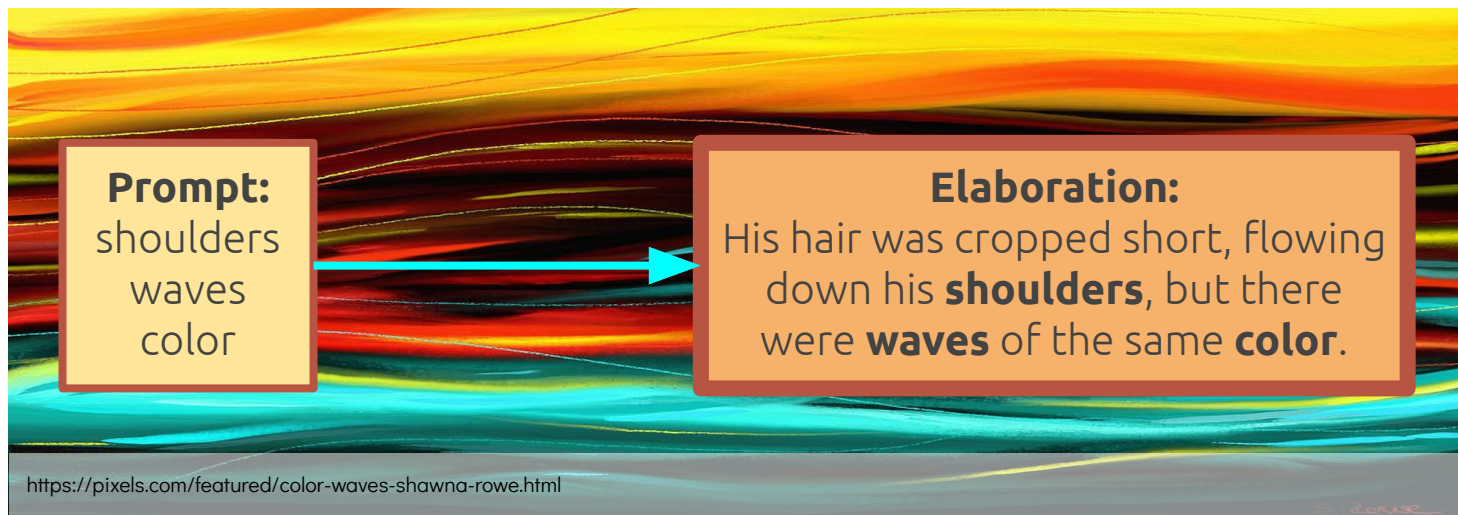
Story Continuation

Photo by Álvaro Serrano on Unsplash

Initial Story: I picked up the note with trepidation, and read in a quavering voice: "Leave this house. You are in danger."

Continuation: <u>I was shaking, so I was worried about the tears that I would need to save.</u>

Roemmele & Gordon. (2018) Automated Assistance for Creative Writing with an RNN Language Model. Demo at the 2018 International Conference on Intelligent User Interfaces. http://www.get-creative.help/

Idea Elaboration (i.e. text infilling)

Prompt:
shoulders
waves
color

Elaboration:
His hair was cropped short, flowing down his **shoulders**, but there were **waves** of the same **color**.

https://pixels.com/featured/color-waves-shawna-rowe.html

Roemmele, M. (2021). Inspiration through Observation: Demonstrating the Influence of Automatically Generated Text on Creative Writing. 12th International Conference on Computational Creativity (ICCC 2021)

Why are computers useful for augmenting human creativity?

Human creativity involves unfamiliar combinations of familiar ideas (Boden, 1990)

Often a process of serendipity: "chance with judgment"

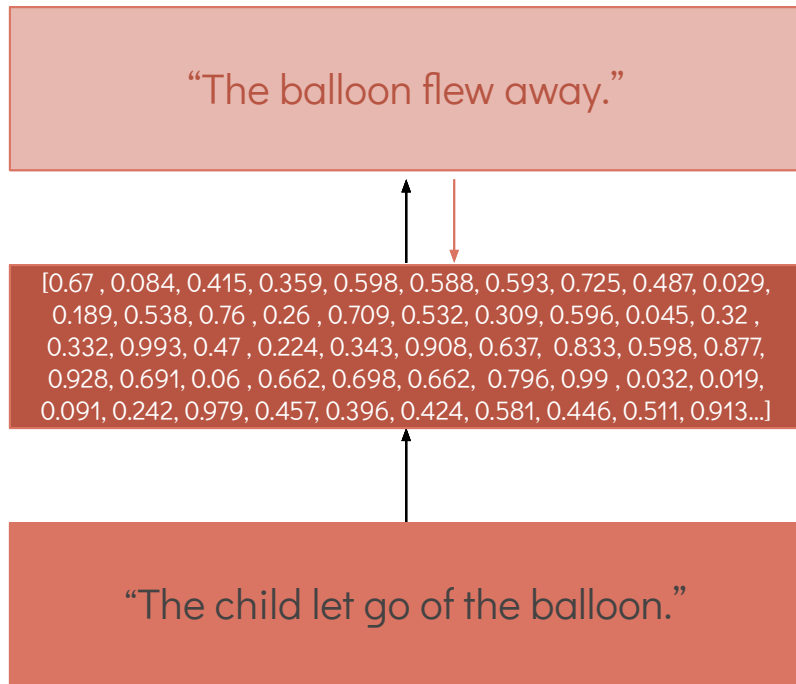Computers are good at simulating combinations

https://letchworthwritersfiction.com/erol-hasan

Machine Learning Models for Text Generation
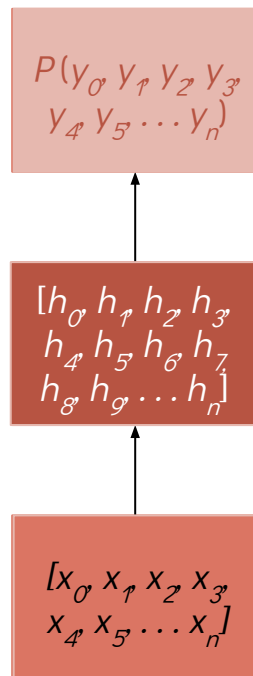
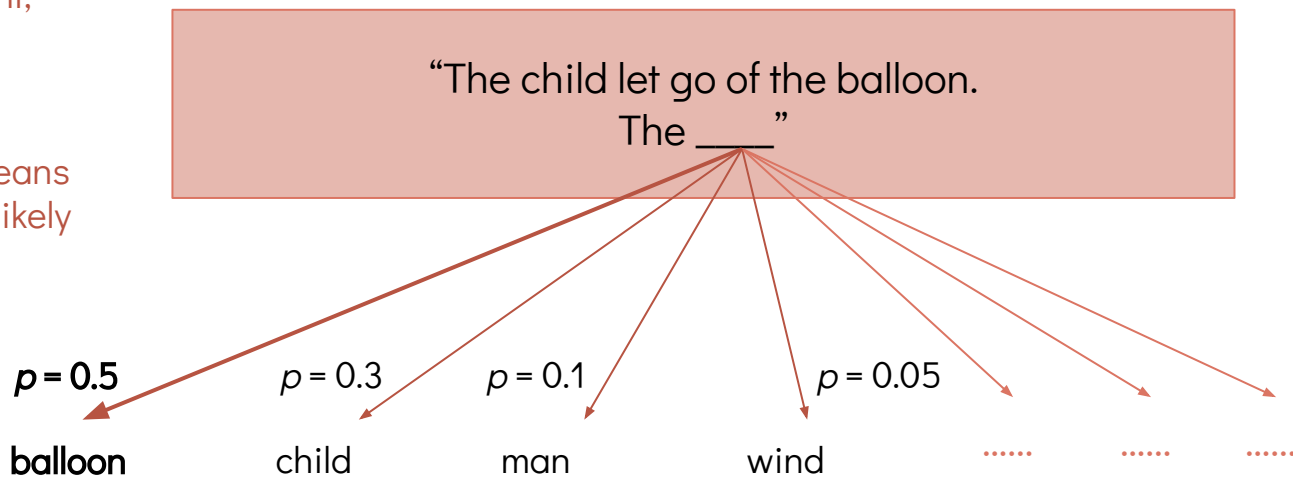# Learning Text: Story Continuation Example

Standard machine learning approach:

- Model reads text to learn probabilities of segments

- Segments predicted according to learned probabilities

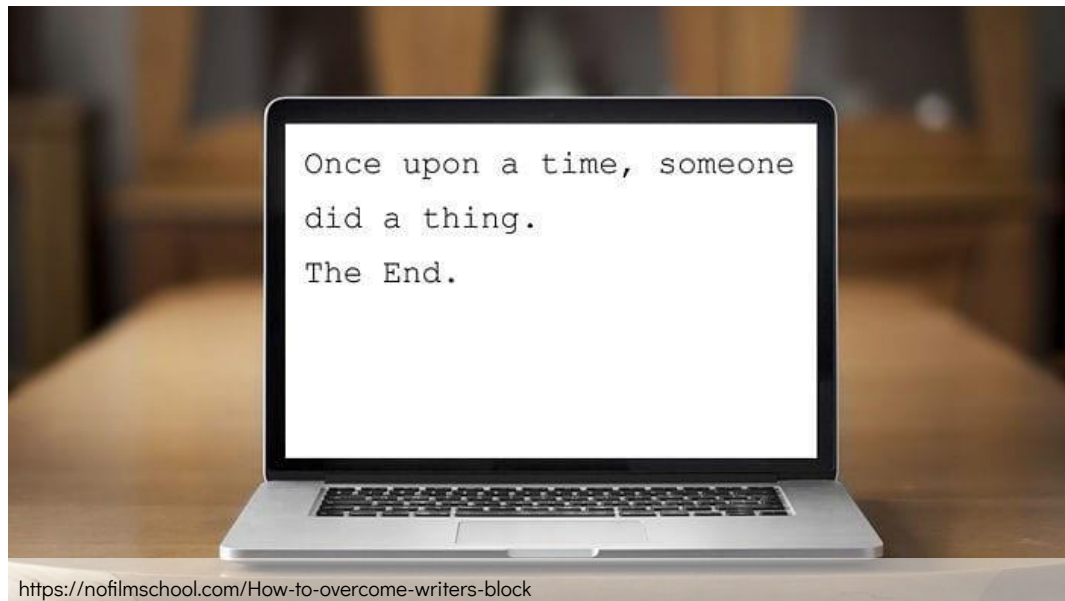- Constant feedback loop to adjust text encoding to better predict segments

"The balloon flew away."

[0.67 , 0.084, 0.415, 0.359, 0.598, 0.588, 0.593, 0.725, 0.487, 0.029, 0.189, 0.538, 0.76 , 0.26 , 0.709, 0.532, 0.309, 0.596, 0.045, 0.32 , 0.332, 0.993, 0.47 , 0.224, 0.343, 0.908, 0.637, 0.833, 0.598, 0.877, 0.928, 0.691, 0.06 , 0.662, 0.698, 0.662, 0.796, 0.99 , 0.032, 0.019, 0.091, 0.242, 0.979, 0.457, 0.396, 0.424, 0.581, 0.446, 0.511, 0.913...]

"The child let go of the balloon."

Generating Text

To generate a text segment, iteratively sample from learned probabilities

Combinatorial process means generated segments are likely to be novel

"The child let go of the balloon.
The ____"

$p = 0.5$

$p = 0.3$

$p = 0.1$

$p = 0.05$

balloon

child

man

wind

......

......

......

https://nofilmschool.com/How-to-overcome-writers-block

Experiments with Story Continuation

Creative Help

Type \help\ when you want to generate a sentence.

Once there was an adorable black kitty named Opal . She was very fluffy and soft, and everybody loved her. Unfortunately one day while she was coming home from her grandmother's house, she got lost in a dark forest. \help\

Creative Help

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Creative Help

Type \help\ when you want to generate a sentence.

Once there was an adorable black kitty named Opal . She was very fluffy and soft, and everybody loved her. Unfortunately one day while she was coming home from her grandmother's house, she got lost in a dark forest. And she was trying to make her way through the trees.

Creative Help

Type \help\ when you want to generate a sentence.

Once there was an adorable black kitty named Opal . She was very fluffy and soft, and everybody loved her. Unfortunately one day while she was coming home from her grandmother's house, she got lost in a dark forest. And as she was trying to make her way through the trees, a skeleton appeared!

Analyzing helpfulness

Research question: can we predict the value of generated text to a writer?

Assumption: more helpful suggestions will be modified less

Can analyze how linguistic features of the suggestion predict helpfulness

https://oldcapitolbooks.com/2017/05/06/authors-and-editors-butting-heads-or-holding-hands/
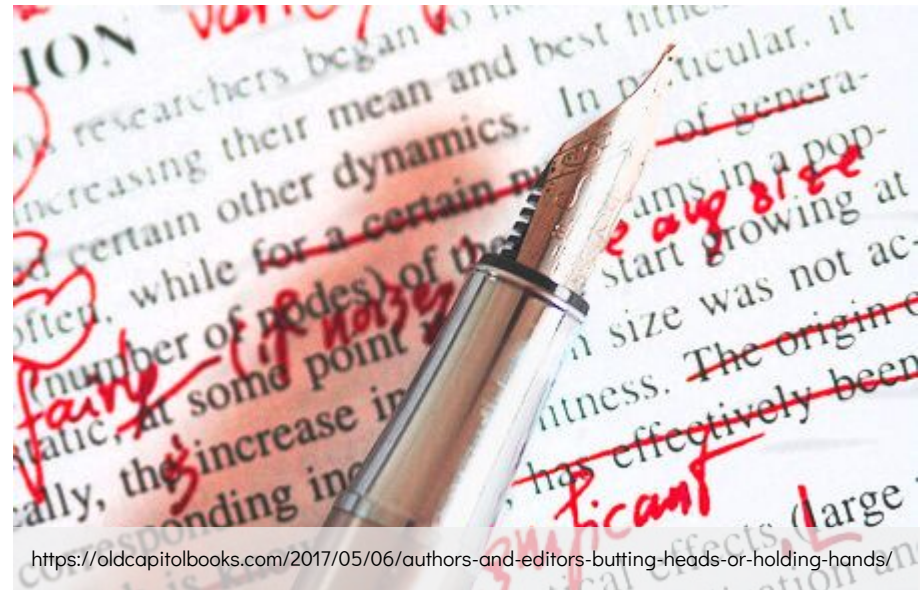
Outcome

Conclusion: Certain features of suggestions did predict their helpfulness ✓

sentiment_match = 1.0

helpfulness_score = 0.7

↑ correlation(sentiment_match, helpfulness_score)

➔ when suggestion matches sentiment of initial story (e.g. "fearful"), it tends to be more helpful

https://www.toppr.com/guides/english-language/vocabulary/fill-in-the-blanks/
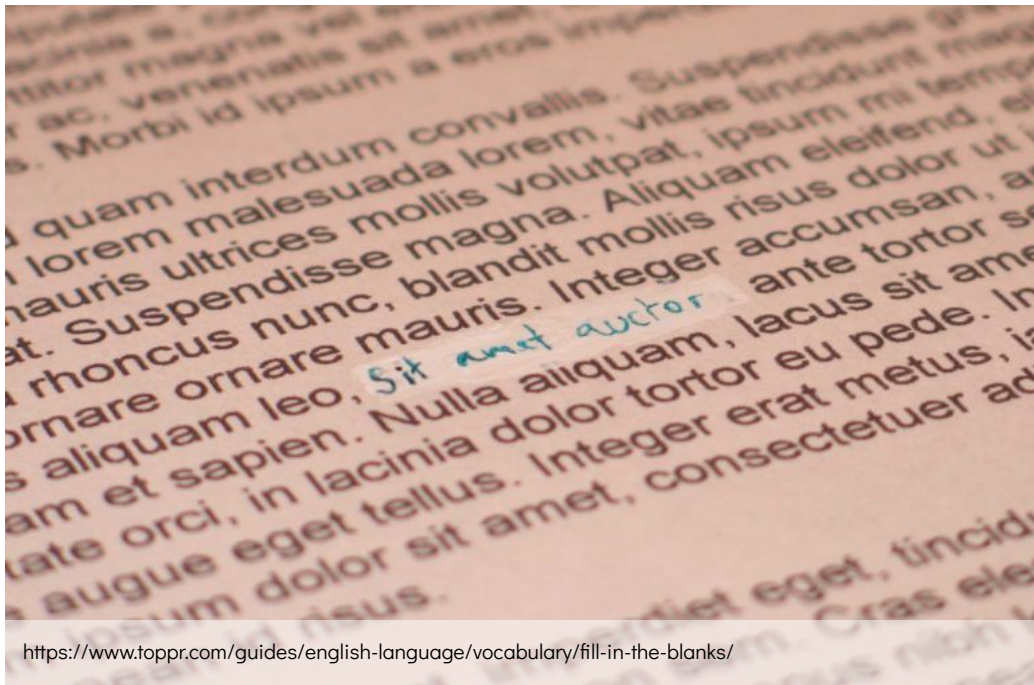
Experiments with Text Infilling

Text Infilling Model

Same general design as that used for story continuation

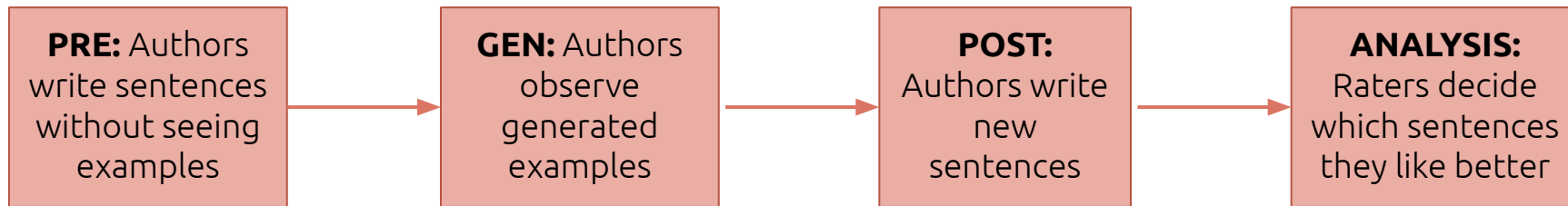Specifically uses **GPT-2:** millions of parameters trained on millions of documents

"**he** rode his bike to **town** in the pouring **rain.**"

[0.67 , 0.084, 0.415, 0.359, 0.598, 0.588, 0.593, 0.725, 0.487, 0.029, 0.189, 0.538, 0.76 , 0.26 , 0.709, 0.532, 0.309, 0.596, 0.045, 0.32 , 0.332, 0.993, 0.47 , 0.224, 0.343, 0.908, 0.637, 0.833, 0.598, 0.877, 0.928, 0.691, 0.06 , 0.662, 0.698, 0.662, 0.796, 0.99 , 0.032, 0.019, 0.091, 0.242, 0.979, 0.457, 0.396, 0.424, 0.581, 0.446, 0.511, 0.913...]

"he town rain"

Experimental Design

Research question: Does observing automatically generated examples of an authoring task (here, text infilling) help people better perform the task themselves?

PRE: Authors write sentences without seeing examples	→	**GEN:** Authors observe generated examples	→	**POST:** Authors write new sentences	→	**ANALYSIS:** Raters decide which sentences they like better

Interface

Item 5 / 10

Do not refresh the page or navigate to the previous page

prompt

Write two sentences with these words: **sat, woods, had**

Examples:

automatically generated sentences (hidden in PRE stage)

It was not long before they **sat** in the **woods**, in a clearing where a path **had** been cut and then had come out.

He **sat** in the **woods** for an hour, after the others **had** left.

I **sat** there thinking about the long days in the **woods** when I **had** a plan for me to go back to Kettlewell Manor.

He **sat** up, his eyes looking for the way out of the **woods** that **had** been hidden behind the mountains.

He **sat** down in the **woods** he **had** used as a bath.

Sentence 1

human-authored sentences

Exhausted, I sat down and peered into the woods, wondering if they had a secret they were keeping from me.

Sentence 2

I sat in my swing daydreaming while thinking about the woods I had seen in my dream last night.
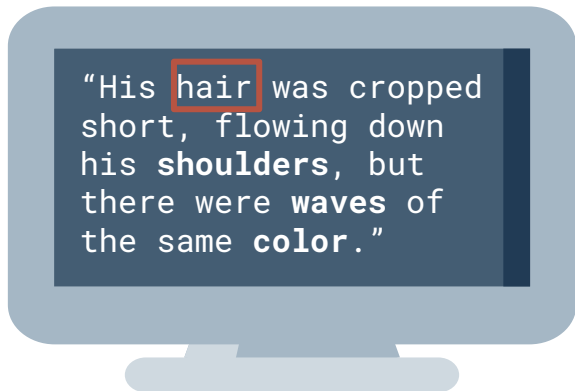
SUBMIT

Outcome

Conclusion: Authors wrote more appealing sentences after they observed the generated examples ✓

Explanation: Examples may have activated concepts connecting the prompt words that authors did not previously consider (i.e. "unexpected combinations of familiar ideas")

PROMPT: shoulders, waves, color

GEN

"His hair was cropped short, flowing down his **shoulders**, but there were **waves** of the same **color**."

POST

"Her new hair cut had the length to the **shoulders**, with **waves** of a bright pink **color** all the way down."

Other infilling examples

These examples particularly show how AI can be used to overcome conventional constraints in thinking:

PROMPT	OUTPUT
novel coronavirus	In the late 1970s, the **novel** "**Coronavirus**" was published.
contact trace	She knew that he would never make eye **contact**, but the tone of his voice sent a **trace** of anxiety throughout her body.
flatten the curve	Brenna felt her eyes **flatten**, but saw **the** subtle **curve** of the smile on his face.
super-spreading events	Our **super-spreading** mind has to control **events** in life.

Text Generation Tutorial: github.com/roemmele/texgen

Story Continuation Demo: get-creative.help

Text Infilling Demo: roemmele.github.io/InSentive