Impact of Generative AI on Human Creativity and Creative Processes

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University of Delaware

This presentation is based on a few research talks I gave in several universities between April and June 2023.

I took this photo :)

BlackBerry's Famous Last Words At 2007 iPhone Launch: 'We'll Be Fine'

Parmy Olson Former Staff

AI, robotics and the digital transformation of European business.

May 26, 2015, 07:31am EDT

FORBES > INNOVATION > CONSUMER TECH

Technology Is Destroying The Music Industry, Which Is Great For The Next Taylor Swift

Ian Morris Former Contributor ⓘ

Nov 17, 2014, 03:41pm EST

In 2009, while Detroit was reeling and cutting costs - as GM killed off Pontiac, Hummer, Saab and Saturn - the famous Bob Lutz of GM laughed at Tesla and said it really wasn't a car company. He proclaimed Tesla would never really matter, because as it tried to grow up it would never compete effectively. According to Mr. Lutz, nobody really wanted an electric car, because it didn't go far enough, it cost too much and the speed/range trade-off made them impractical. Especially at the price Tesla was selling them. And who would want a roadster?
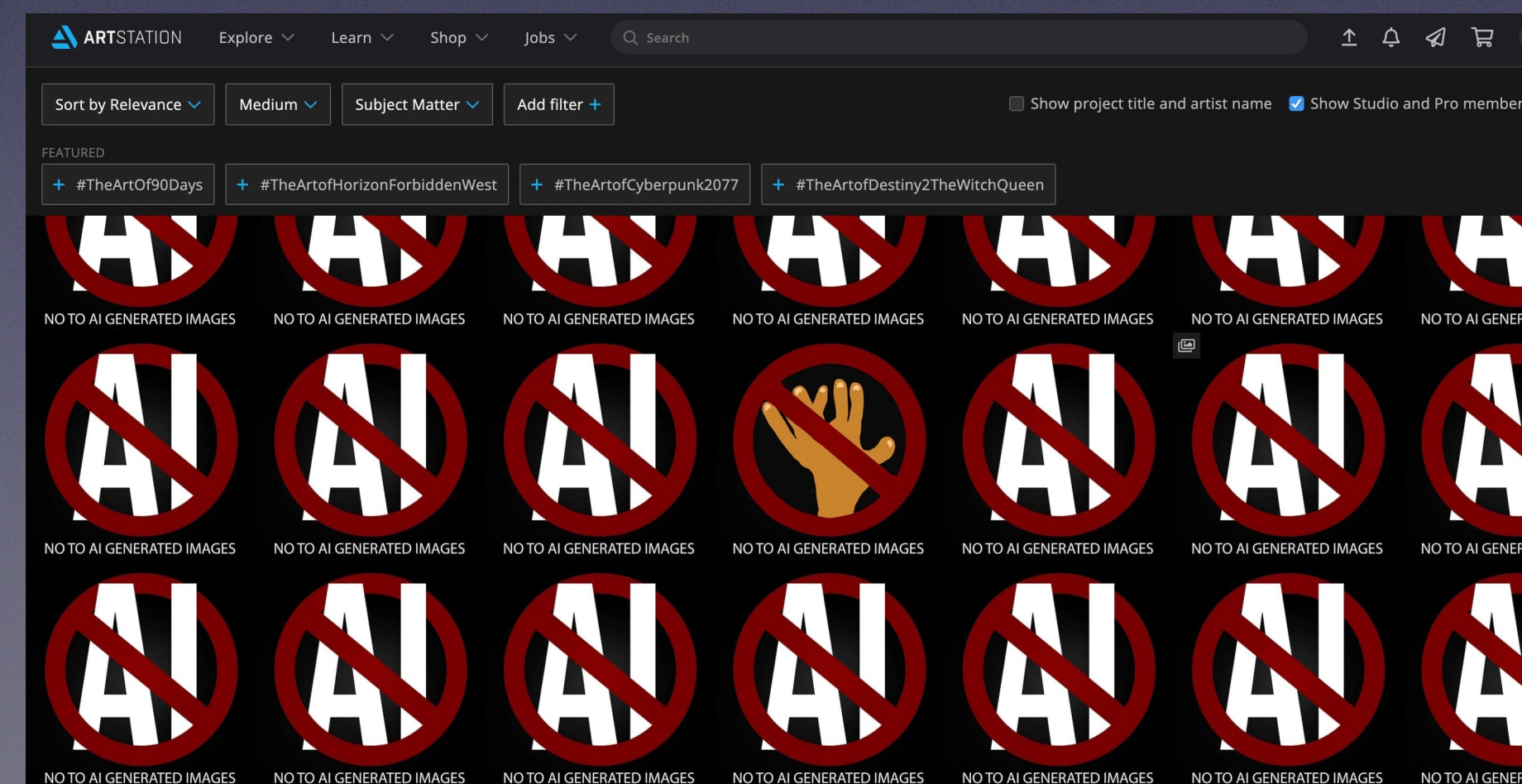

Inc.

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INC. MASTERS

Embracing the Controversy That Comes With Innovation You don't come up with great new ideas without ruffling some feathers. Here's how to manage the pushback. 🔗
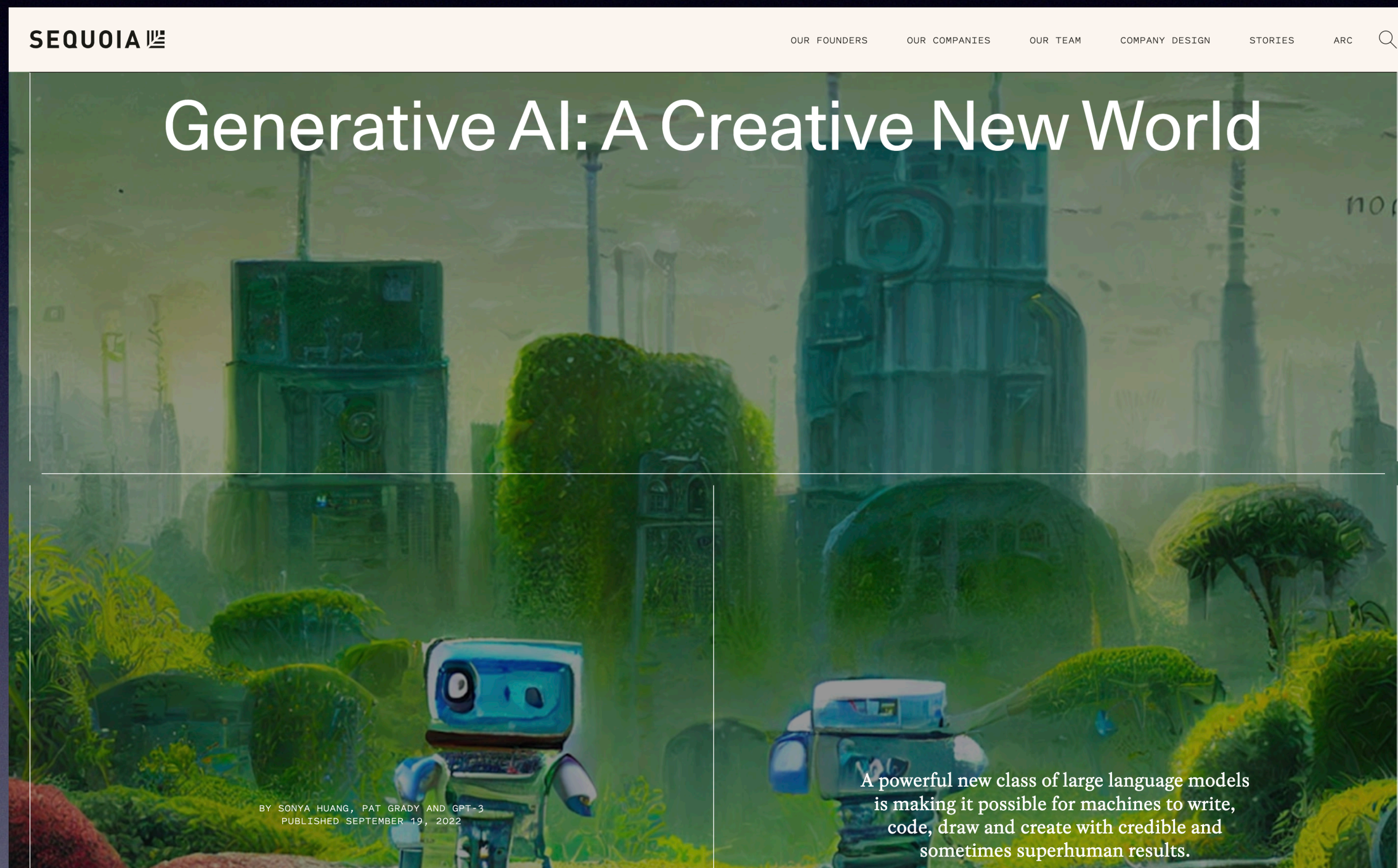
BY ROY DEKEL @ROYDEKEL

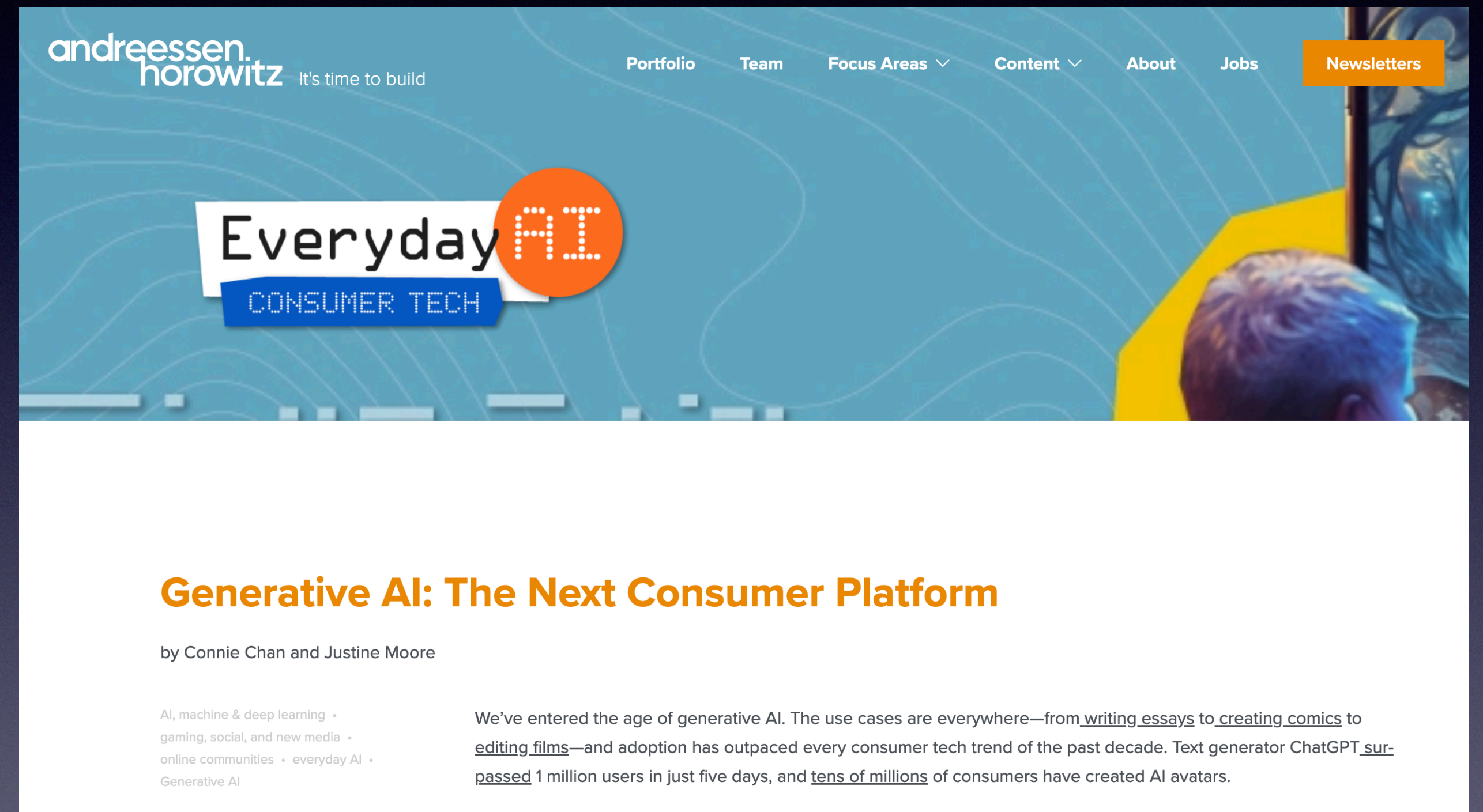More controversial >> more disruptive?

The Age of Generative AI

September 2022

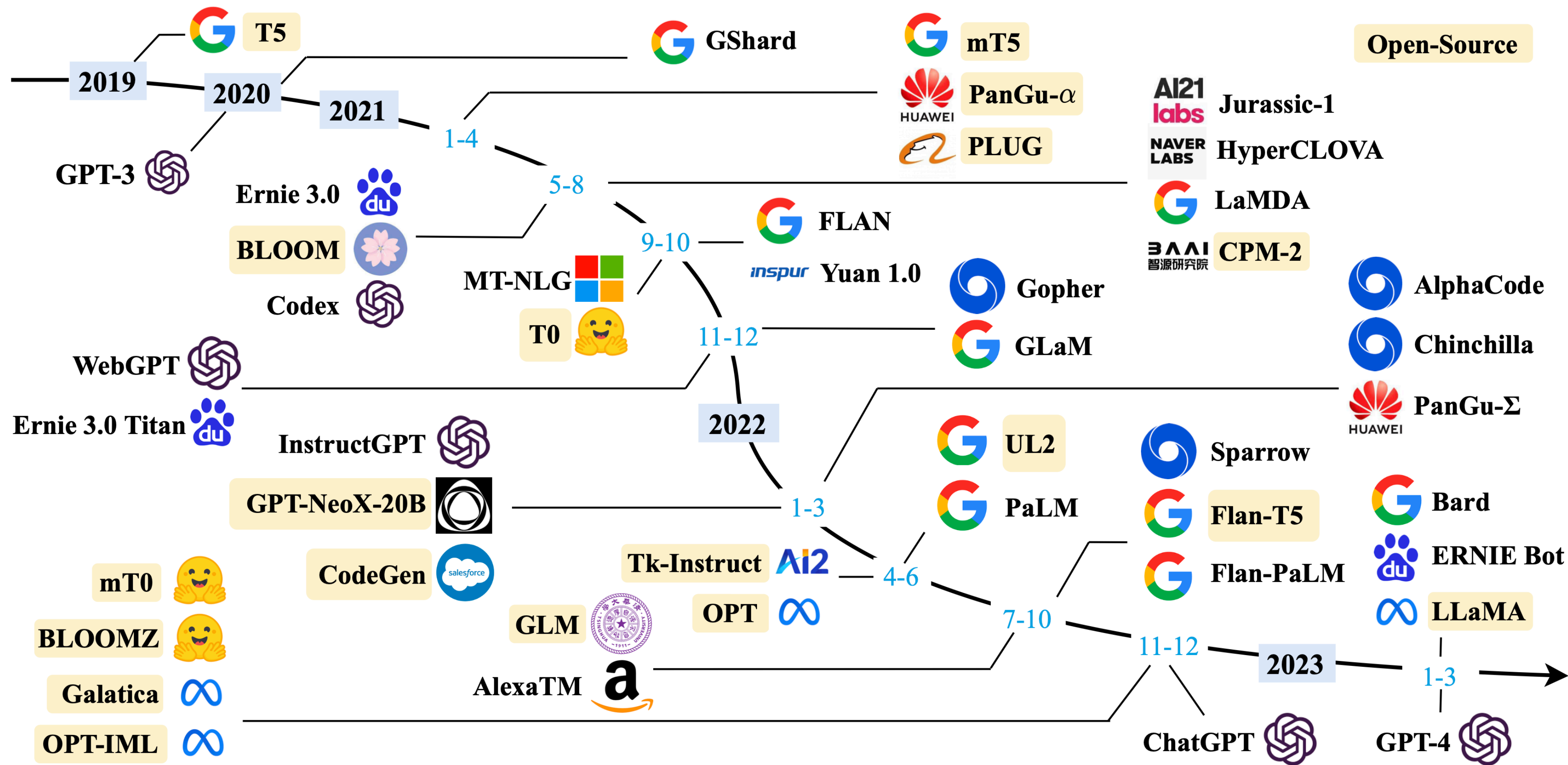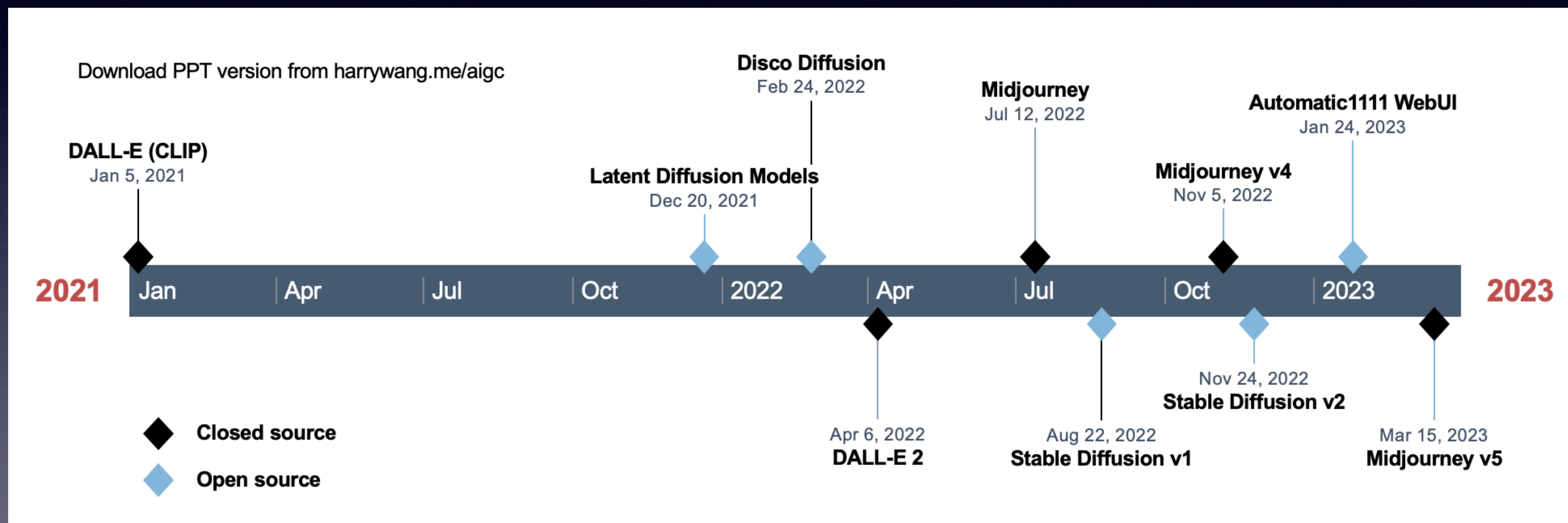March 2023

Large Language Models (LLM)

Fig. 1. A timeline of existing large language models (having a size larger than 10B) in recent years. We mark the open-source LLMs in yellow color.

Text-to-Image Models and Systems

The context of today's discussion is text-to-image generation.

https://harrywang.me/calligraphy

A Framework and Dataset for Abstract Art Generation via CalligraphyGAN", with Jinggang Zhuo and Ling Fan,
Workshop on Machine Learning for Creativity and Design at NeurIPS 2020, Vancouver, Canada.

Disco Diffusion to Stable Diffusion

2022 May
Disco Diffusion

2023 March
Stable Diffusion

A photo I took at
Barnes Foundation

A nice painting of a tiger running in
the jungle chased by a hunter in
red cloth by henri rousseau

ultra detailed pencil and
watercolors and digital illustration
of many plants grow inside the bus
by henri rousseau

Dreambooth (Aug. 2022) and Lora (Jan. 2023)
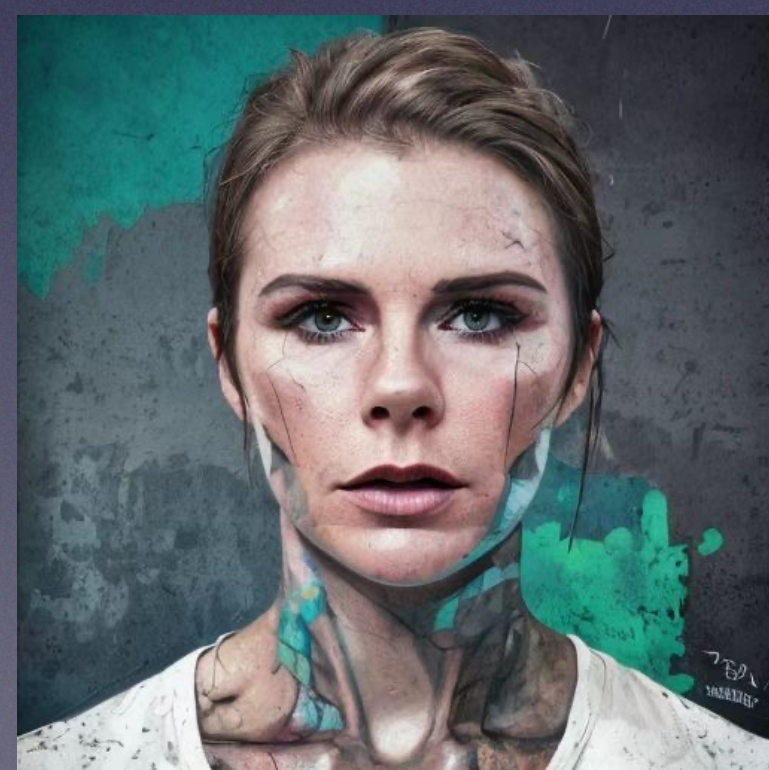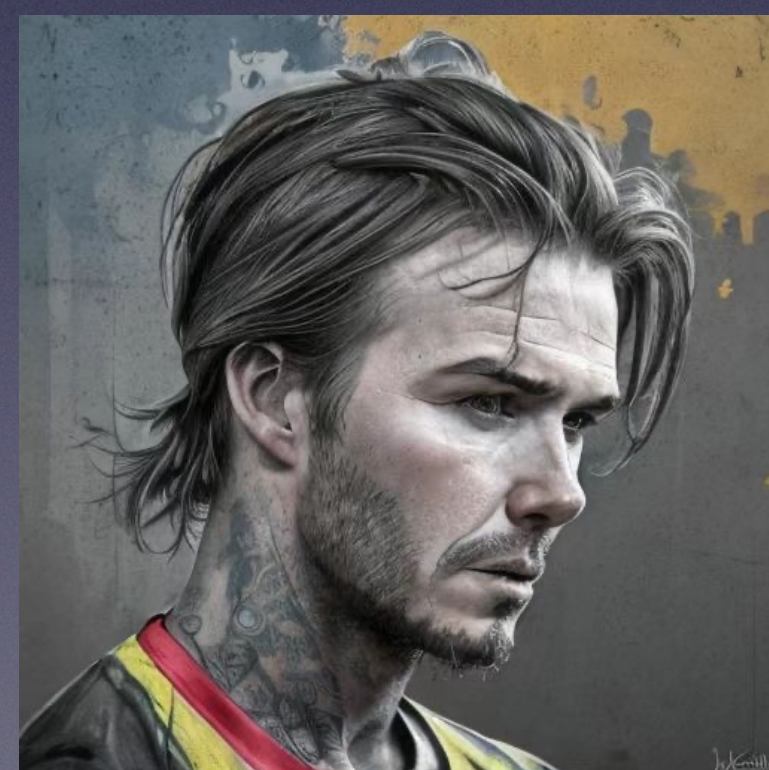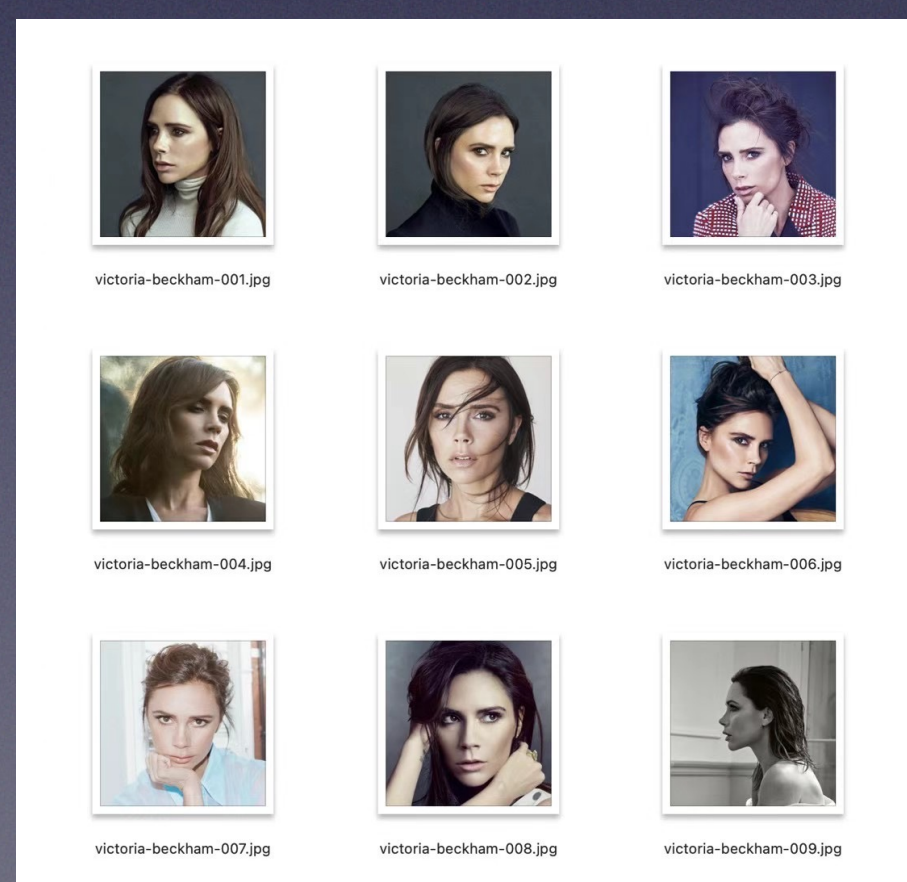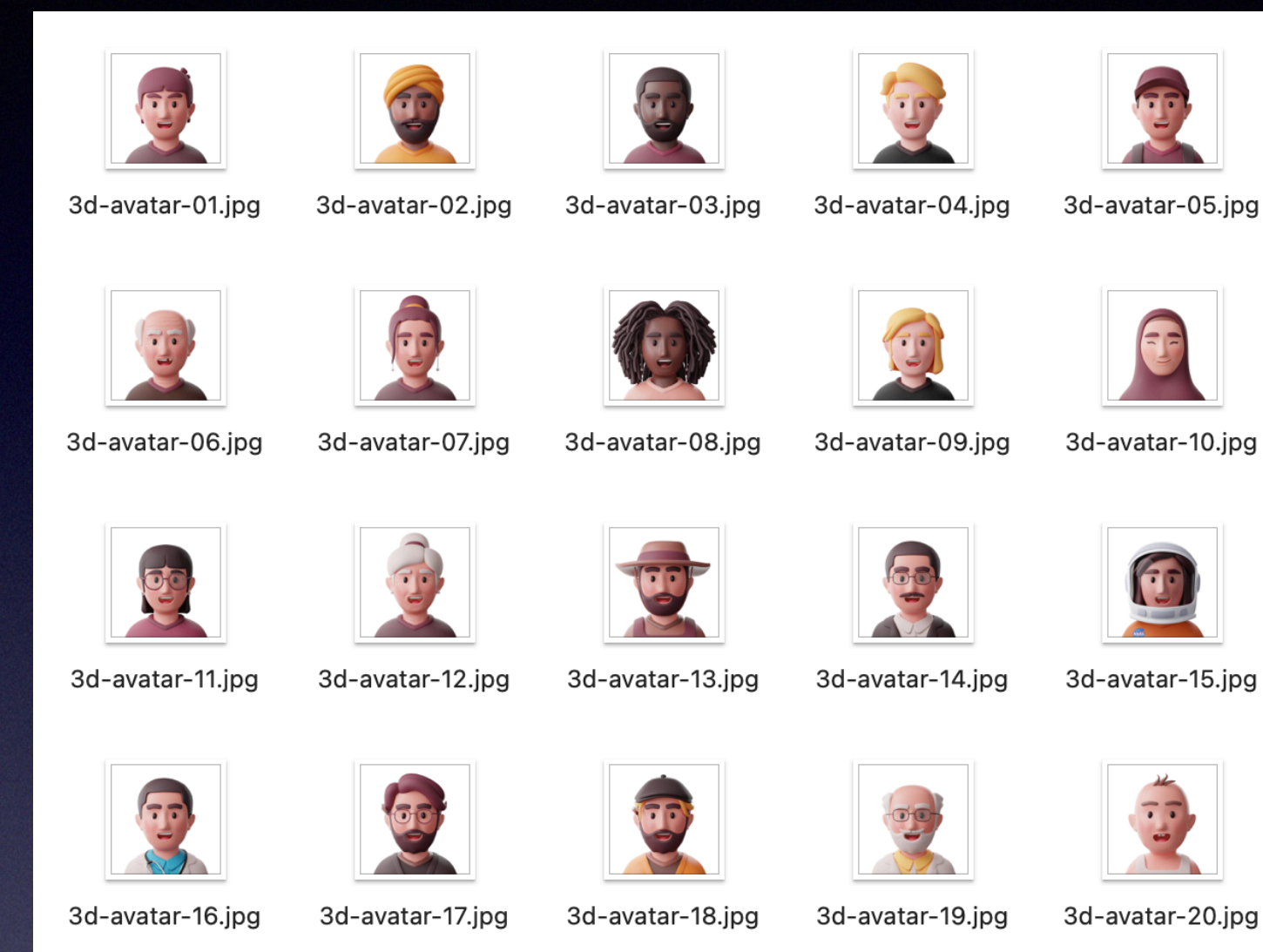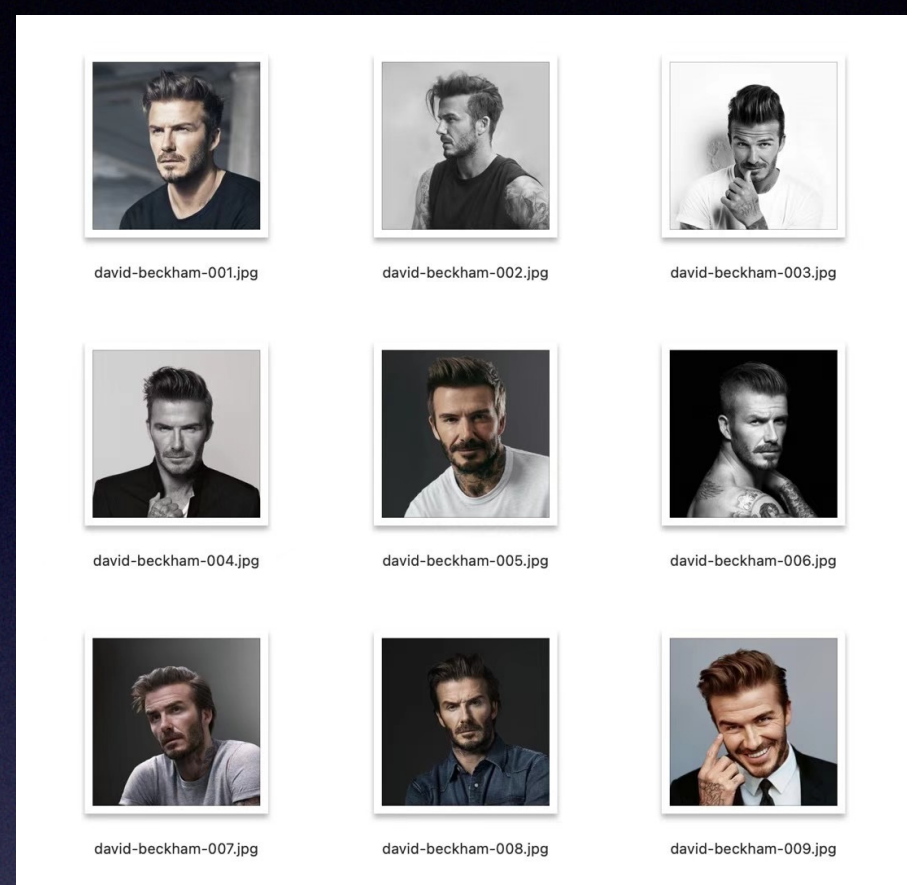
Instruct Pix2Pix (Nov. 2022)

Make her sad

Make her look
80 years old

Autumn

Snowy

NOTE: images are generated by me for learning purpose only

ControlNet (Feb. 2023)

This clothing example is from our team's work at Tezign

This bathroom sign example is from a ControlNet Competition from Replicable.Art:
https://replicable.art/competitions/64603724674efed6c92d1509

Midjourney V4, V5 (March 2023)

A Practical Guide to Quasi-Experimental Methods (PSM and DID)
June 1, 2022

`tutorial` `open-source` `teaching` `research`

Manage Long-running Python Tasks using JupyterHub on Remote Ubuntu Server
August 5, 2022

`tutorial` `open-source` `coding`

Zero-shot Image Classification and Semantic Image Search using CLIP and Unsplash Dataset
January 15, 2023

`tutorial` `coding` `teaching`

What I Learned About Fine-tuning Stable Diffusion
February 18, 2023

`tutorial` `coding` `teaching`

Midjourney Bot ✓BOT Today at 1:11 PM

1️⃣ art and graphic design of a galaxy in a glass ball at sunset in the afternoon, in the style of xbox 360 graphics, rural landscapes, minimalist landscapes, organic sculptures, realistic depictions, stock photo, rendered in cinema4d --ar 146:141

2️⃣ a sphere with the sky on the outside, in the style of digital fantasy landscapes, photo-realistic landscapes, serene pastoral scenes, light amber and green, i can't believe how beautiful this is, futuristic organic, fictional landscapes --ar 146:141

3️⃣ art landscapes backgrounds images 20, in the style of spherical sculptures, lens flares, james paick, serene pastoral scenes, glass as material, moebius, gediminas pranckevicius --ar 146:141

4️⃣ the big blue planet moon on grass, in the style of erik johansson, josh adamski, contemporary glass, uhd image, surreal, bulbous, bulbous --ar 146:141
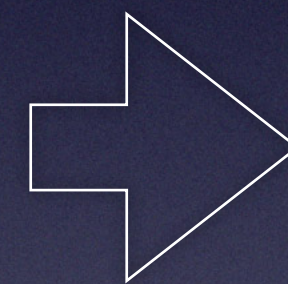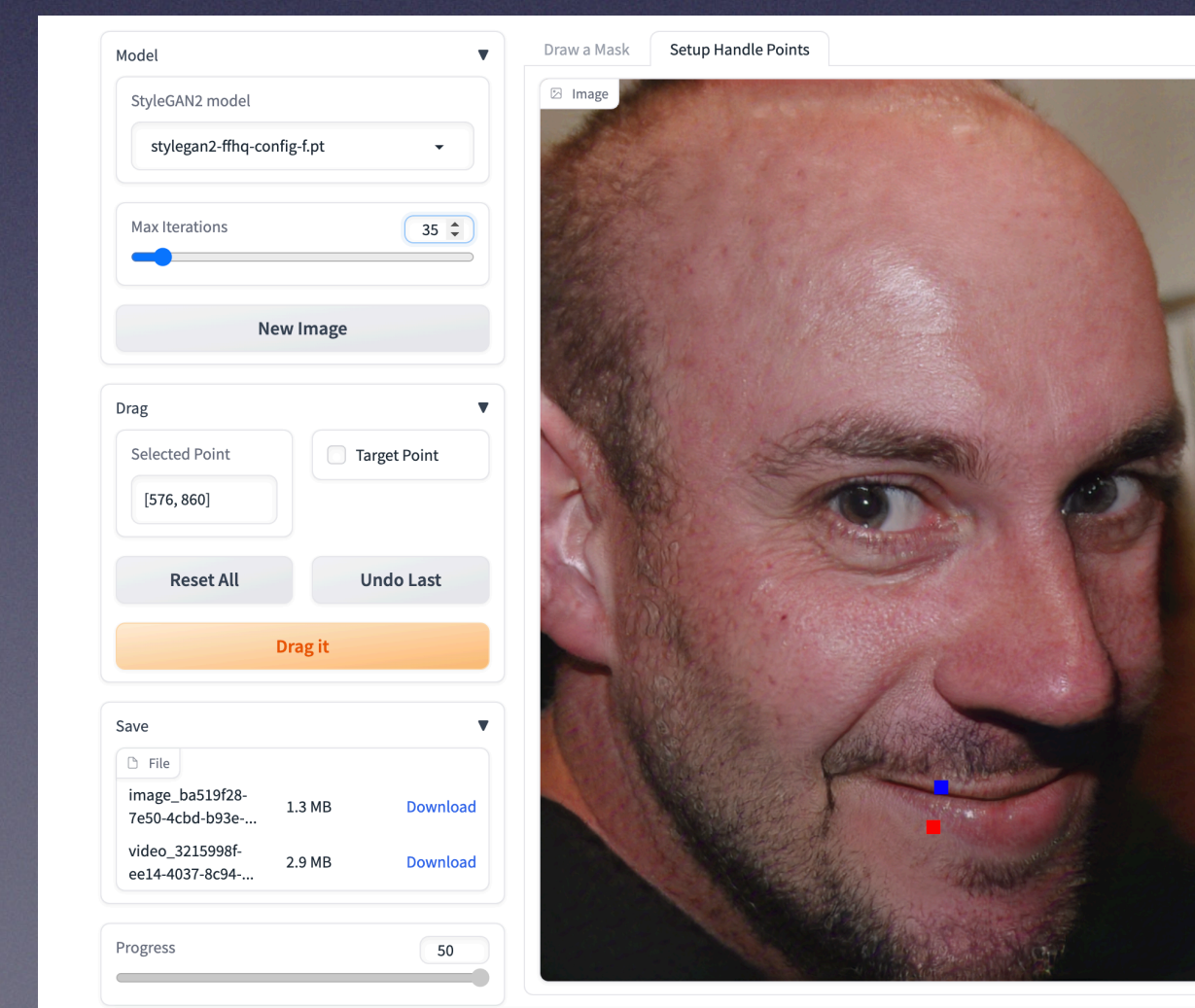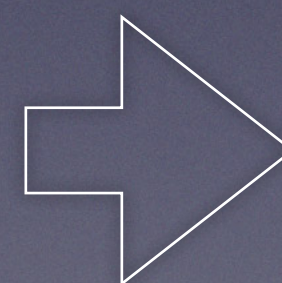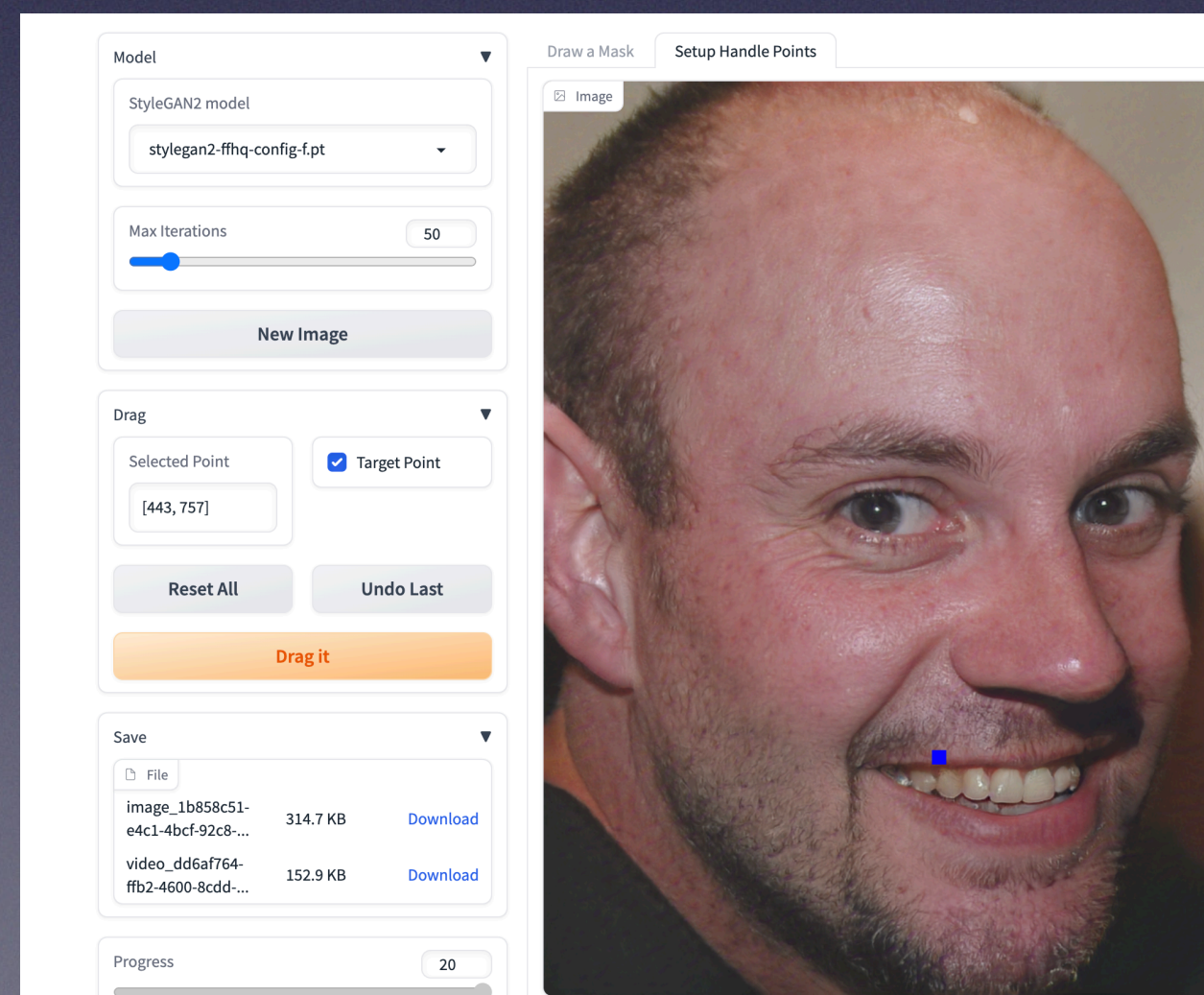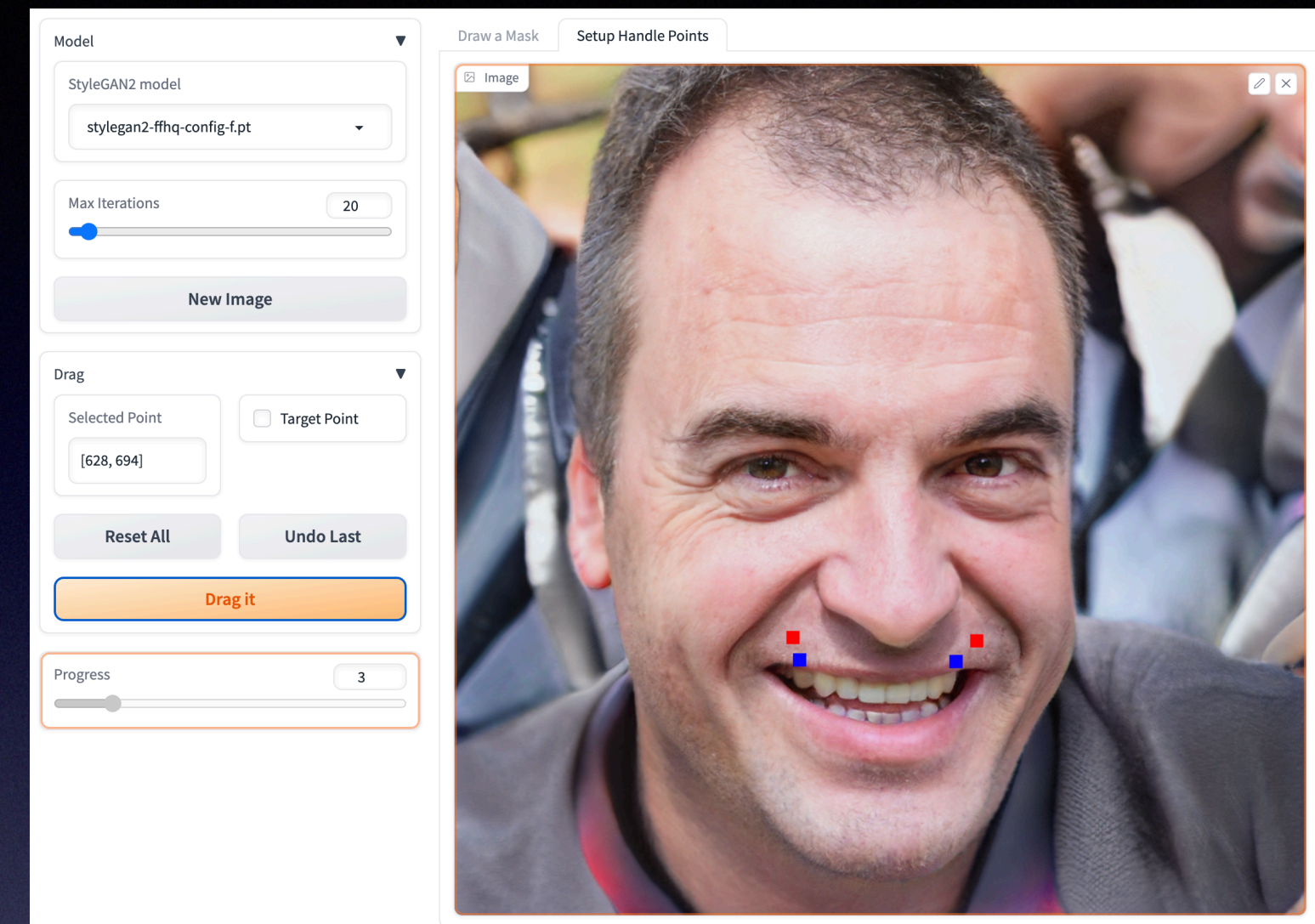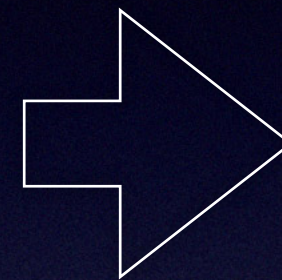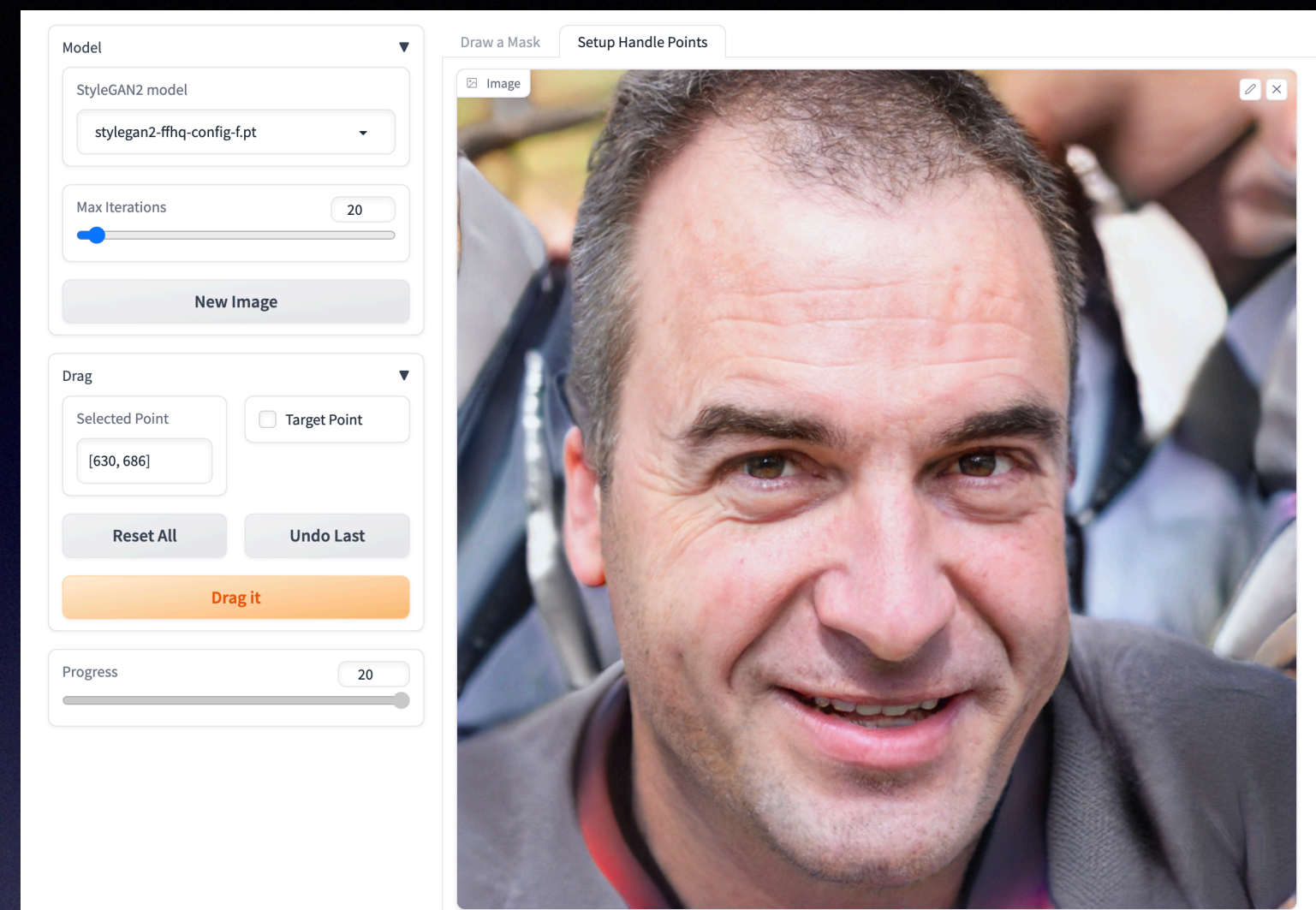
Midjourney Bot ✓BOT Today at 1:14 PM
art and graphic design of a galaxy in a glass ball at sunset in the afternoon, in the style of xbox 360 graphics, rural landscapes, minimalist landscapes, organic sculptures, realistic depictions, stock photo, rendered in cinema4d --ar 146:141 --v 5 --v 5 - @dami (fast)

| U1 | U2 | U3 | U4 | 🔄 |
| V1 | V2 | V3 | V4 | |

https://harrywang.me/blog

DragGAN (May 2023)

Filip Sokołowski

Dec 21, 2022 · 19 min read · ▶ Listen

I created a complete (audio) book in 10+ languages in a few days using generative AI: Here is what I learned
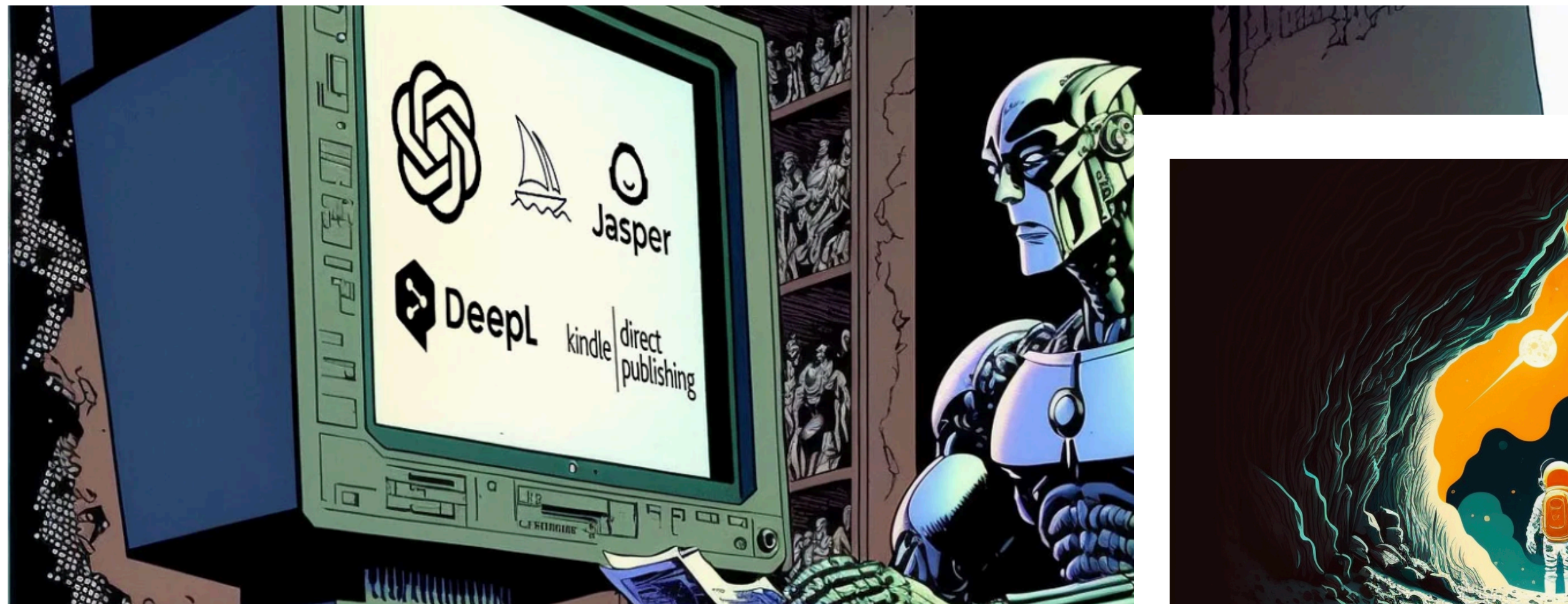
一个小蓝点: 穿越太阳系的人工之旅 (TRADITIONAL_CHINESE EDITION)

Prompt 14: astronaut girl starring in allegory of the cave, by Tang Yau Hoong --v 4 --q 2 -

第四章 -- 返回家园

琳娜突然从睡梦中醒来，一阵突如其来的颠簸使整棵飞船摇摇欲坠。琳娜困惑地看着飞船突然颠簸的四周，她的心因恐惧而狂跳。"Sam!我们在哪里？"她急切地问。"没事，"山姆平静地回答。"我们只是穿过了地球的大气层。没有什么可担心的。"他向其中一个窗户打手势。下面的星球似乎被一片云彩覆盖，夜空被数百万颗星星照亮。这是令人叹为观止的美丽，莉娜知道他们快到家了，感到松了一口气。当他们接近目的地时，山姆迅速调整了他们的轨迹。随着他们开始进一步下降，琳娜可以更详细地看到他们脚下的大陆和海洋--山脉、平原、沙漠和城市的灯光在他们脚下的地面上闪烁着，就像满天的星星。莉娜看着窗外的地球美景，对山姆说："这真是不可思议。没有其他星球能像它一样。星星在云居中闪烁的方式，深蓝色的海洋和雄伟的山脉，以及所有这些来自城市的小灯--这真是令人惊叹。"

Location 433 of 466 • 92%

Generative AI will fundamentally change how content is created.

How is human creativity affected?

How are creative processes affected?

Framework for Human Creativity

PERSON

The person is the entrepreneur. The entrepreneurs use their skills, creative abilities and motivation to create the Product.

PRODUCT

Product is built by the Person and is the result of the creative Process. It is the new innovation.

PRESS

Press represents the environment in which the Person operates in to create the Product.

PROCESS

The Process refers to the procedure used by the Person to develop the Product.

"Creativity is a phenomenon whereby something new and valuable is formed"
- Wikipedia

Rhodes 4Ps of Creativity

Rhodes, Mel (1961). An analysis of creativity.
The Phi Delta Kappan, 42(7), 305-310.

Human Creativity or Machine Creativity?

Results with different seeds (everything else same)

a highly detailed surreal airbrushed art of dopamine flowing from Venus and through space into me, CGSociety, Unreal Engine, 8K, render, CGI, concept art, trending on artstation, dutch golden hour, dreamlikeart

Different Essential Skills for Creativity?

What I learned from generating over 200K images and selected less than 1000 high quality ones (curation rate is less than 0.5%)

+
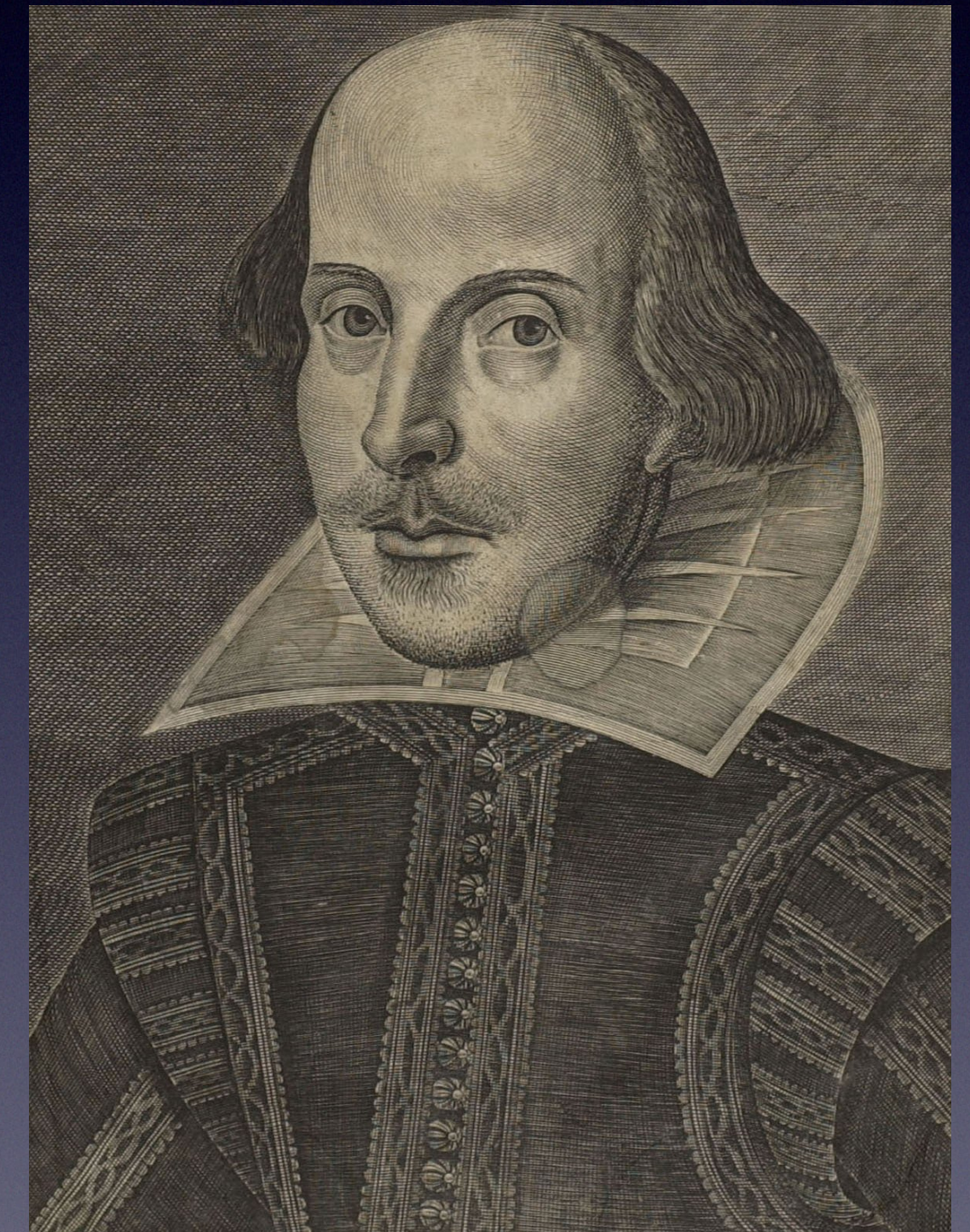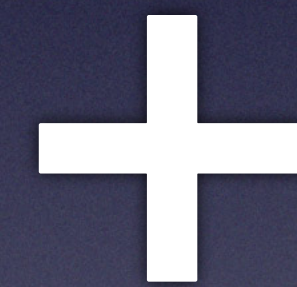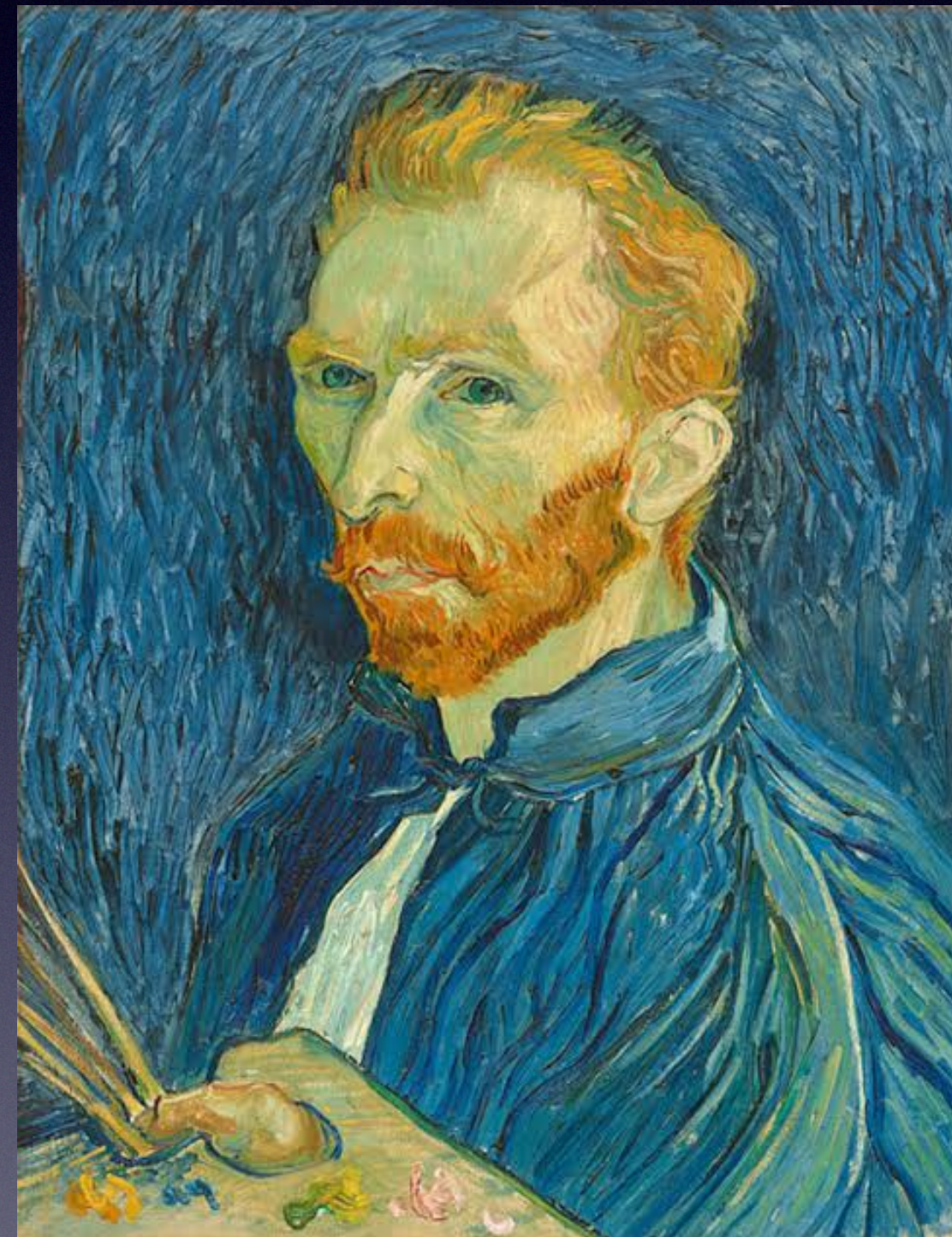
"William (Willem) van Gogh"
&
"Vincent Shakespeare"

Project 1 Research Questions

- Does generative AI affect designers' productivity and quality in creative tasks?

- How does generative AI affect designers with different experience levels (novice vs. expert)?

A Field Experiment

- A real-world design competition, in which 60 student teams participated to design clothes, shoes, and other accessories for an international fashion brand.

- Randomly assigned: 29 teams use AI and 31 teams do not use AI.

- Professional judges from the company rated and scored the teams.

Preliminary Results

Teams with the AI help received higher scores/rankings compared to the teams without AI help.
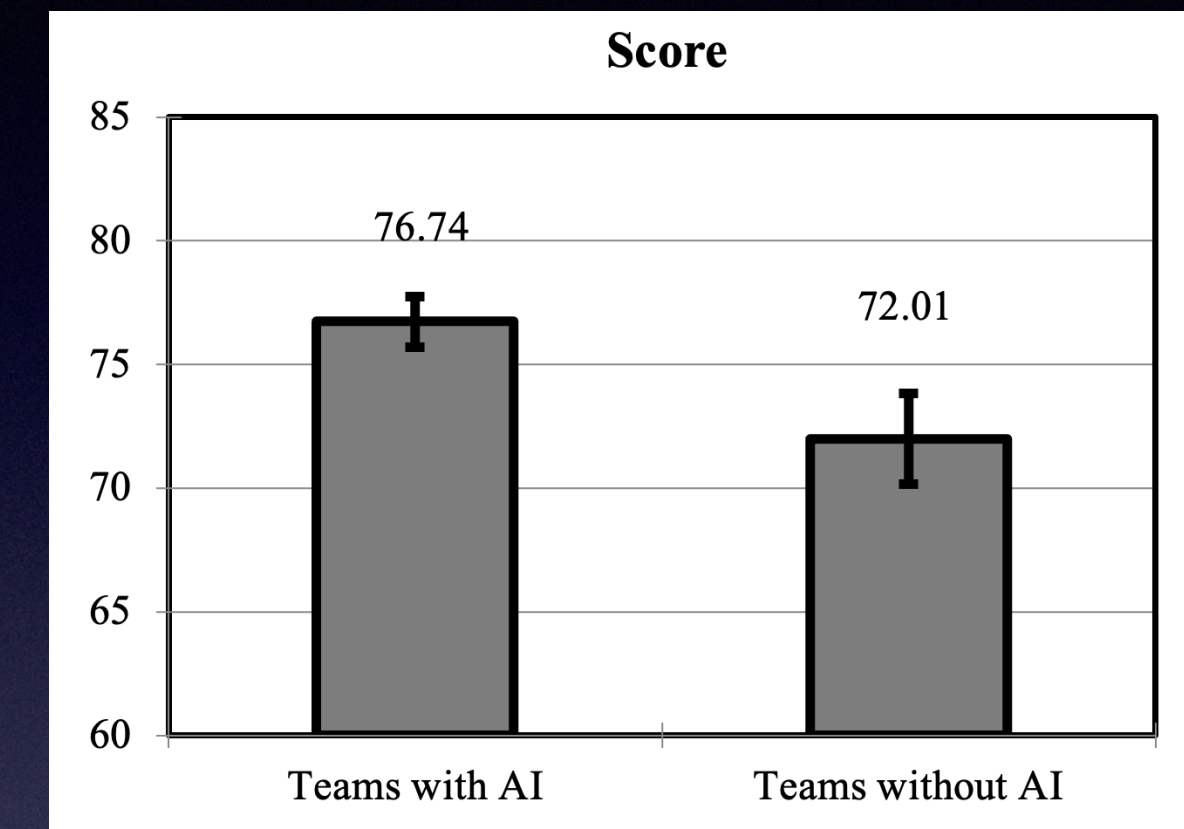
Such a positive impact of generative AI tools was significantly stronger for low-ability designers.
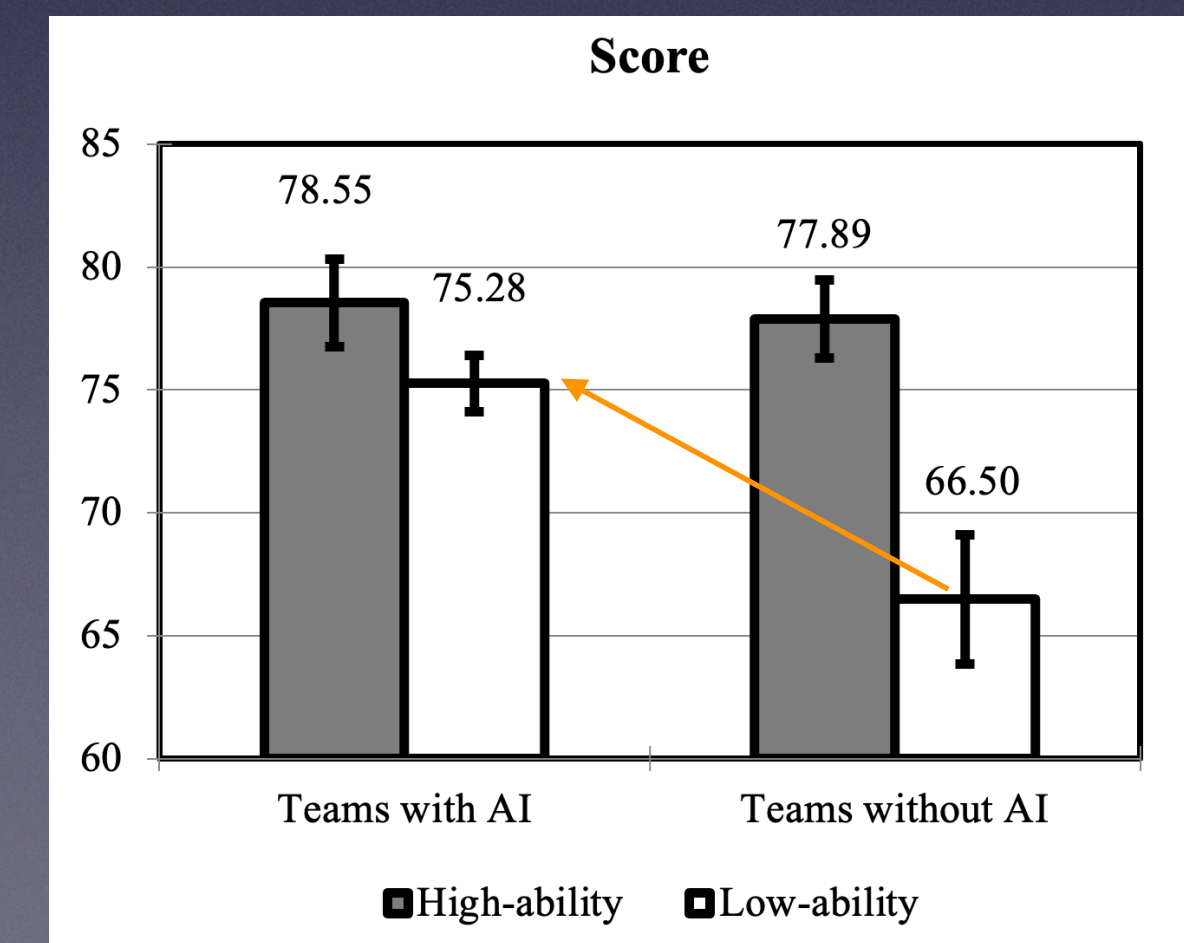
A Lab Experiment

- A design process is typically composed of <u>two stages</u>: the initial inspiration stage, known as <u>divergent thinking</u>, and the creation stage, which entails <u>convergent thinking</u>.

- Expert and non-expert participants were assigned a graphic design task and asked to work on it with or without AI tools at different creative stages.

- 153 participants in four groups:
  - No AI in both stages (control group)
  - AI in both stages
  - AI only in stage 1 (divergent thinking)
  - AI only in stage 2 (convergent thinking)

Preliminary Results

Prompt Engineering

"ultra detailed pencil and watercolors and digital illustration of many plants grow inside the bus by henri rousseau, wes anderson, tim burton, tomm moore, jean pierre jeunet; 4k 8k hd high resolution"
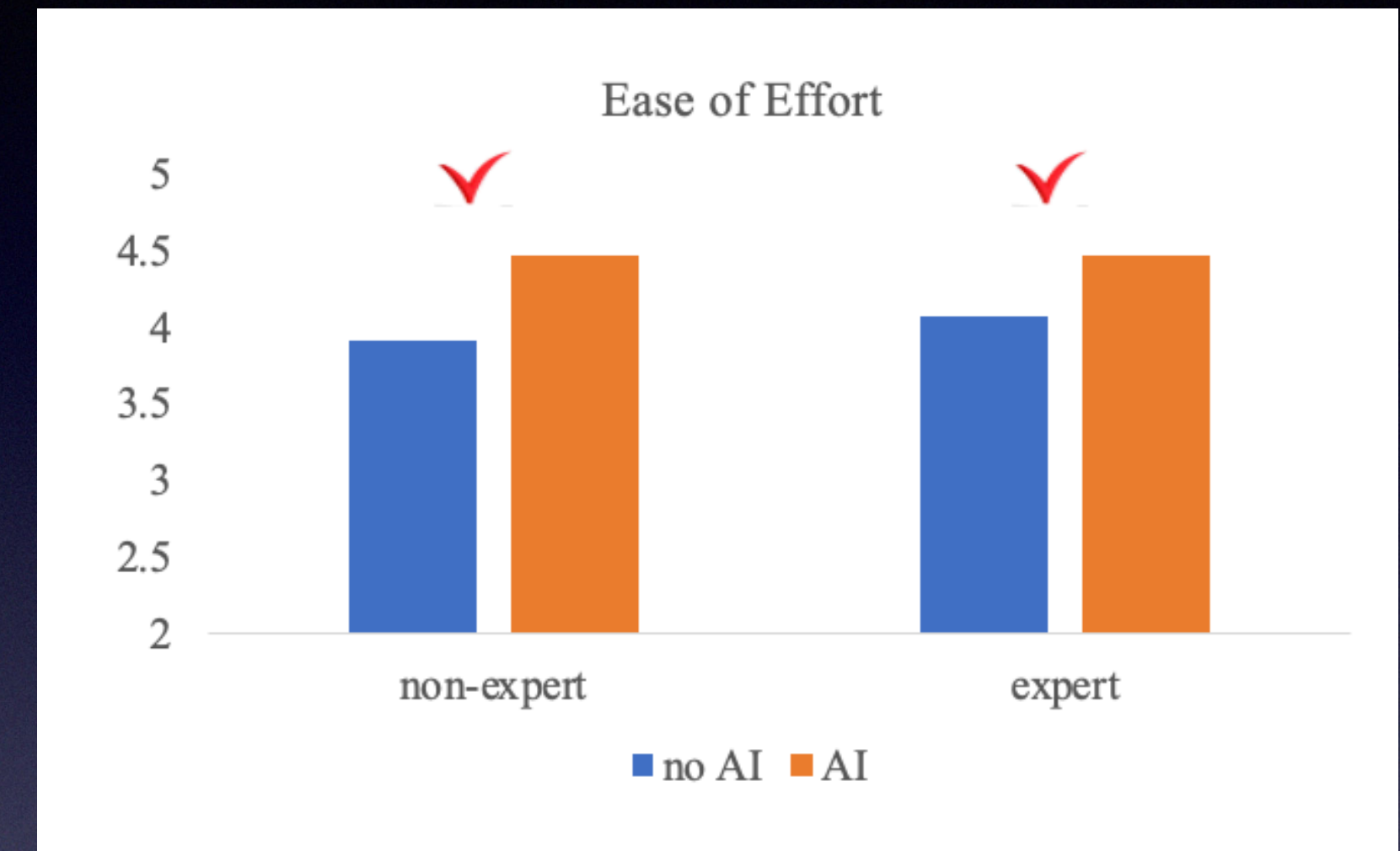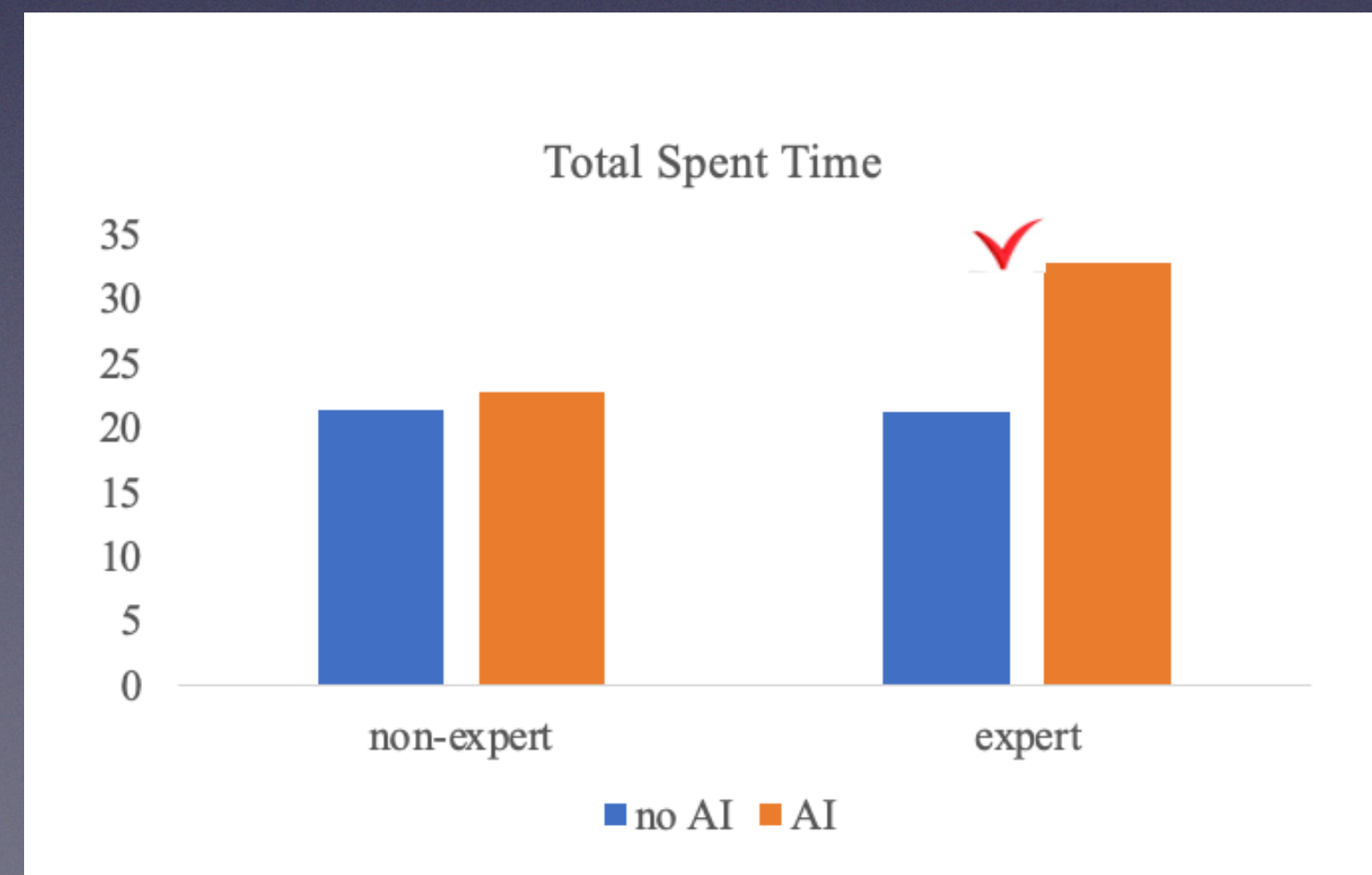
"Prompt engineering is the process of structuring words that can be interpreted and understood by a text-to-image model. Think of it as the language you need to speak in order to tell an AI model what to draw." - OpenArt

A well-written prompt often consists of key subjects/objects with various modifiers and magic words

Modifiers:	Magic words:
- photography	- HDR, UHD, 4K, 8K
- art mediums	- Highly detailed
- artists	- Trending on artstation
- emotions	- Unreal engine
…	…

Project 2 Research Question

- Good prompts are often quite long: the median of total number of words is **29** for our of our 140K prompts dataset.

- It is not easy to come up with a good prompt especially for inexperienced users.

- Can we develop algorithms to optimize prompts for better quality in generated images?

A Prompt Optimization Framework

Stable Diffusion Prompt Database

User Initial Prompt

Main Prompt Analysis (POS, NER, Intention Classification, etc.)
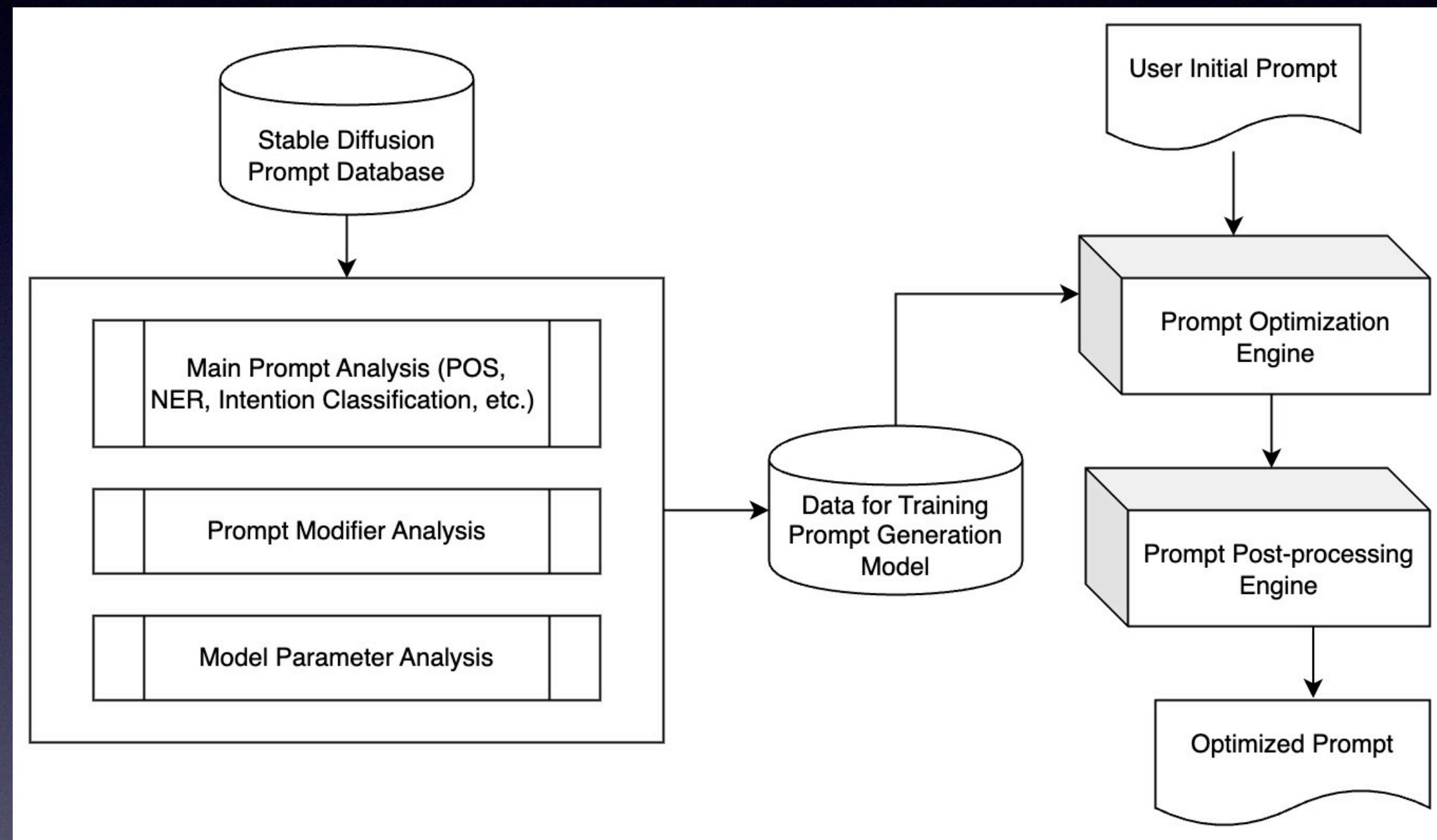
Prompt Modifier Analysis

Model Parameter Analysis

Data for Training Prompt Generation Model

Prompt Optimization Engine

Prompt Post-processing Engine

Optimized Prompt

"ultra detailed pencil and watercolors and digital illustration of many plants grow inside the bus by henri rousseau, wes anderson, tim burton, tomm moore, jean pierre jeunet; 4k 8k hd high resolution"
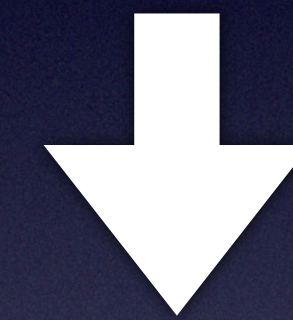
Try to change the prompt into a text pair for generative model training

Input: many plants grow inside the bus

Output: many plants grow inside the bus by henri rousseau, wes anderson, tim burton, tomm moore, jean pierre jeunet; 4k 8k hd high resolution, ultra detailed pencil and watercolors and digital illustration

Model Training: 140K Raw Prompts —> 30K prompt pairs —> Fine-tuned a special T5 (Generative Commonsense Reasoning T5)

Post-processing: remove artists based on zero-shot intention classification (with/without human) —> add common negative prompts

Preliminary Evaluation

- A product based on our framework was developed and deployed for two months and real user data entries were collected to evaluate our framework.

- 200 user original prompts and 200 corresponding optimized prompts were used to generate 400 images

- For an image pair, three human evaluators were asked to judge which image has better quality.

- 75% of optimized images are considered to have higher quality than images without prompt optimization based on majority voting.
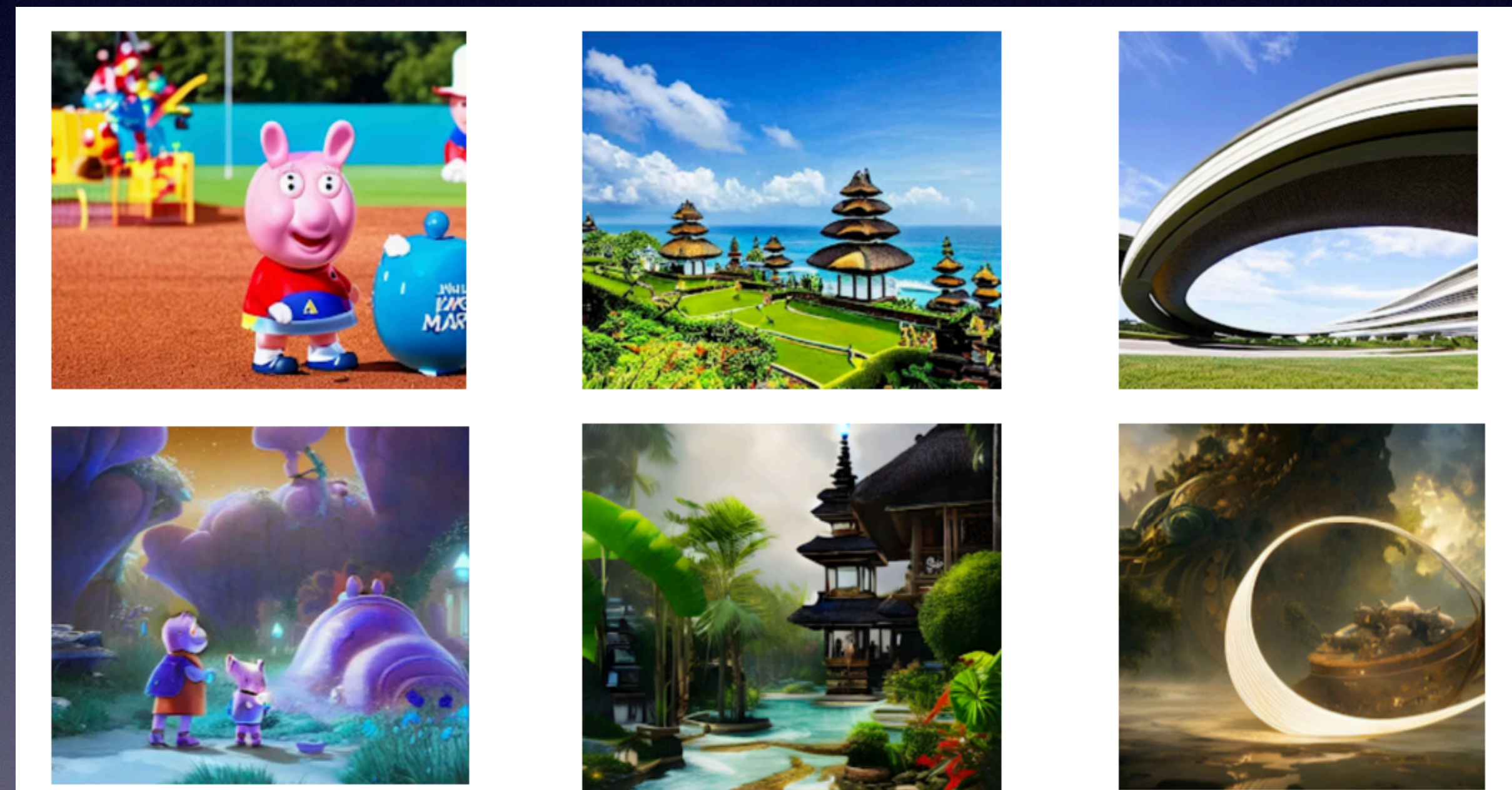
Project 3 Research Question

How can Generative AI transform key tasks in a typical interior design workflow, namely, ideation, schematic drafting, and layout planning?

"Revamping Interior Design Workflow Through Generative Artificial Intelligence", with Ziming He, Xiaomei Li, Ling Fan, HCII 2023.

Ideation

Ideation

(a) open office space, futuristic style, white floor, curved walls, many desks, hyper realistic

(b) open office space, futuristic style, white floor, curved walls, many desks, ***curved columns***, hyper realistic

(c) open office space, futuristic style, white floor, curved walls, **yellow chairs**, many desks, hyper realistic

Targeted style fine-tuning (e.g., unique styles of a studio) and deliberated prompt engineering can jumpstart the creative process.
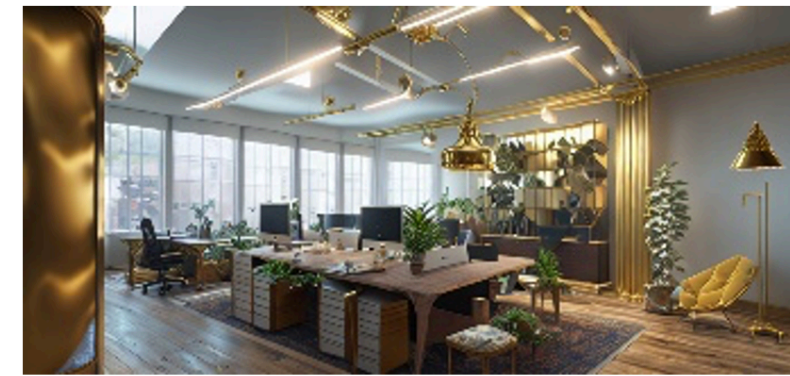
Schematic Drafting

Initial Guidance Image

ControlNet-based rendering improves design workflow efficiency.
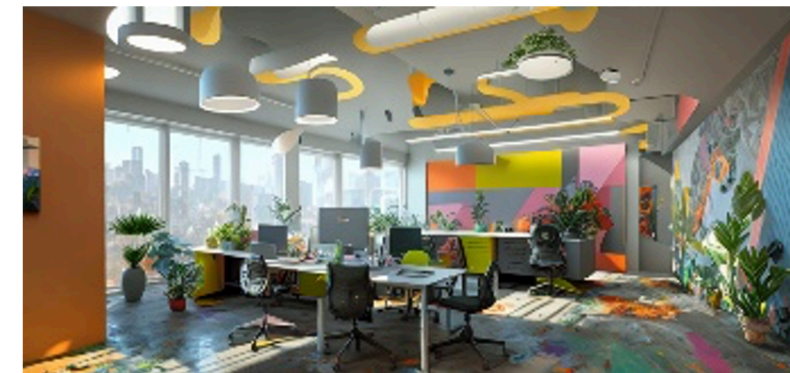
Baroque Style
baroque, coworking space, office working area, hanging lamps, ***marble floor***, golden decorations, dark light, realistic
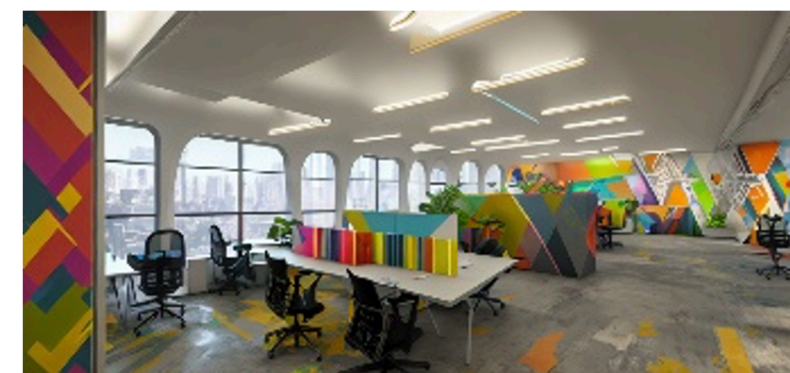
baroque, coworking space, office working area, hanging lamps, wooden floor, golden ***baroque*** decorations, ***plants by window***, dark light, realistic

Maximalist Style
maximalist, coworking space, office working area, ***colorful walls***, ***gray floor***, warm light, realistic

maximalist, coworking space, office working area, ***color strip walls, clean concrete floor***, warm light, realistic

Layout Planning

(a) office layout, floorplan, meeting rooms, ***many private rooms***, ***long walls***, colored drawing, light color ground, illustration)

(b) office layout plan, meeting rooms, ***large open areas***, colored drawing, light color ground, illustration

Parametric design paired with generative AI may create new ways of layout planning.

Some Closing Remarks

Technostress for Generative AI

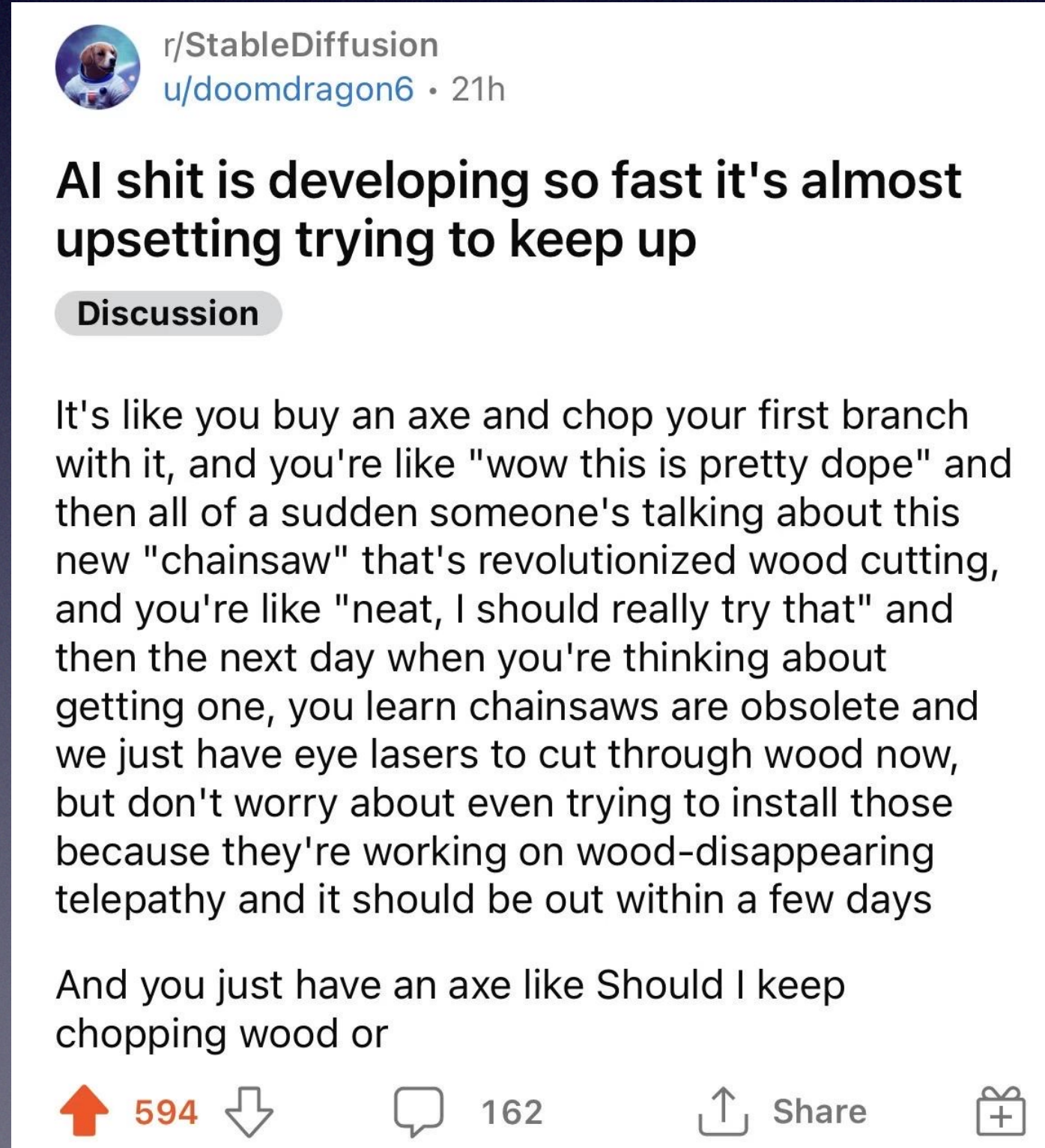"People experience technostress when they cannot adapt to or cope with information technologies in a healthy manner."

Stable Diffusion Model
DreamBooth Fine-Tuning
Img2Img + DeFlickering FX
Unreal 5 for Virtual Sets
Resolve for VFX/Edit
Processed

Video2Anime

Original
Greenscreen Video
+ 120 shots total
+ Corridor Crew
= Creative Tech Magic

SOSpammy · 13h

I'm taking a break from messing with Stable Diffusion for a while because it feels like the technology is evolving faster than I can even learn to install it.

··· ↩ Reply ⬆ 74 ⬇

r/StableDiffusion
u/doomdragon6 · 21h

## AI shit is developing so fast it's almost upsetting trying to keep up

Discussion

It's like you buy an axe and chop your first branch with it, and you're like "wow this is pretty dope" and then all of a sudden someone's talking about this new "chainsaw" that's revolutionized wood cutting, and you're like "neat, I should really try that" and then the next day when you're thinking about getting one, you learn chainsaws are obsolete and we just have eye lasers to cut through wood now, but don't worry about even trying to install those because they're working on wood-disappearing telepathy and it should be out within a few days

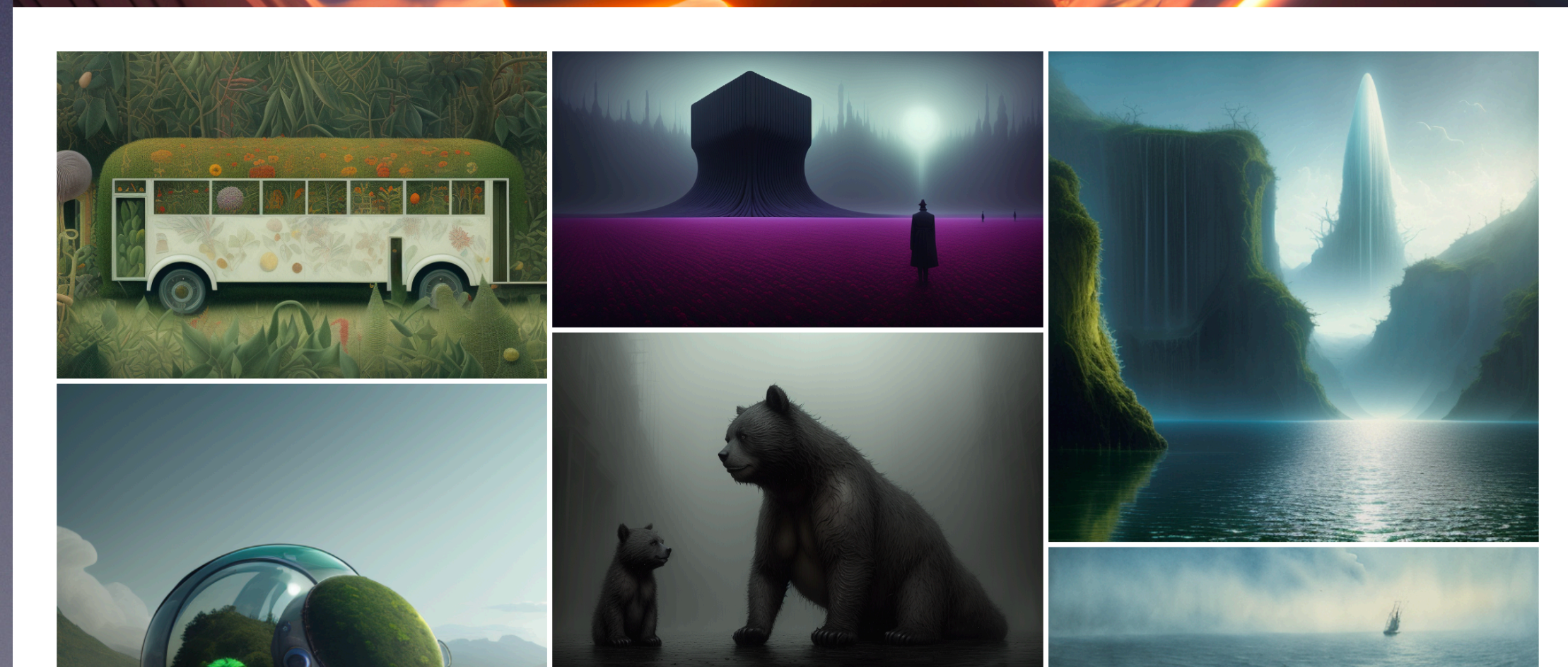And you just have an axe like Should I keep chopping wood or

⬆ 594 ⬇   💬 162   ↥ Share

Social Creativity for AIGC
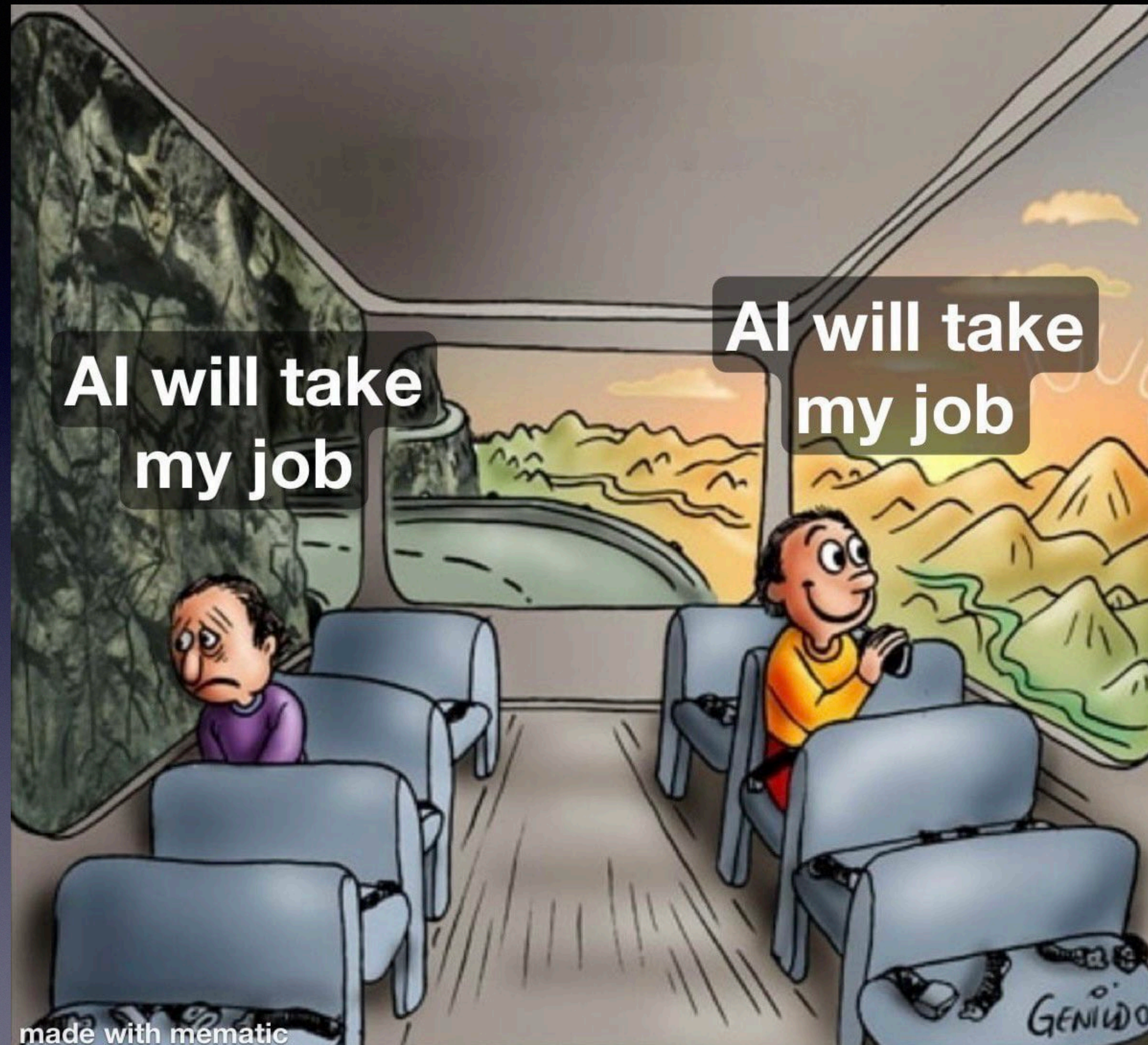

https://replicable.art/
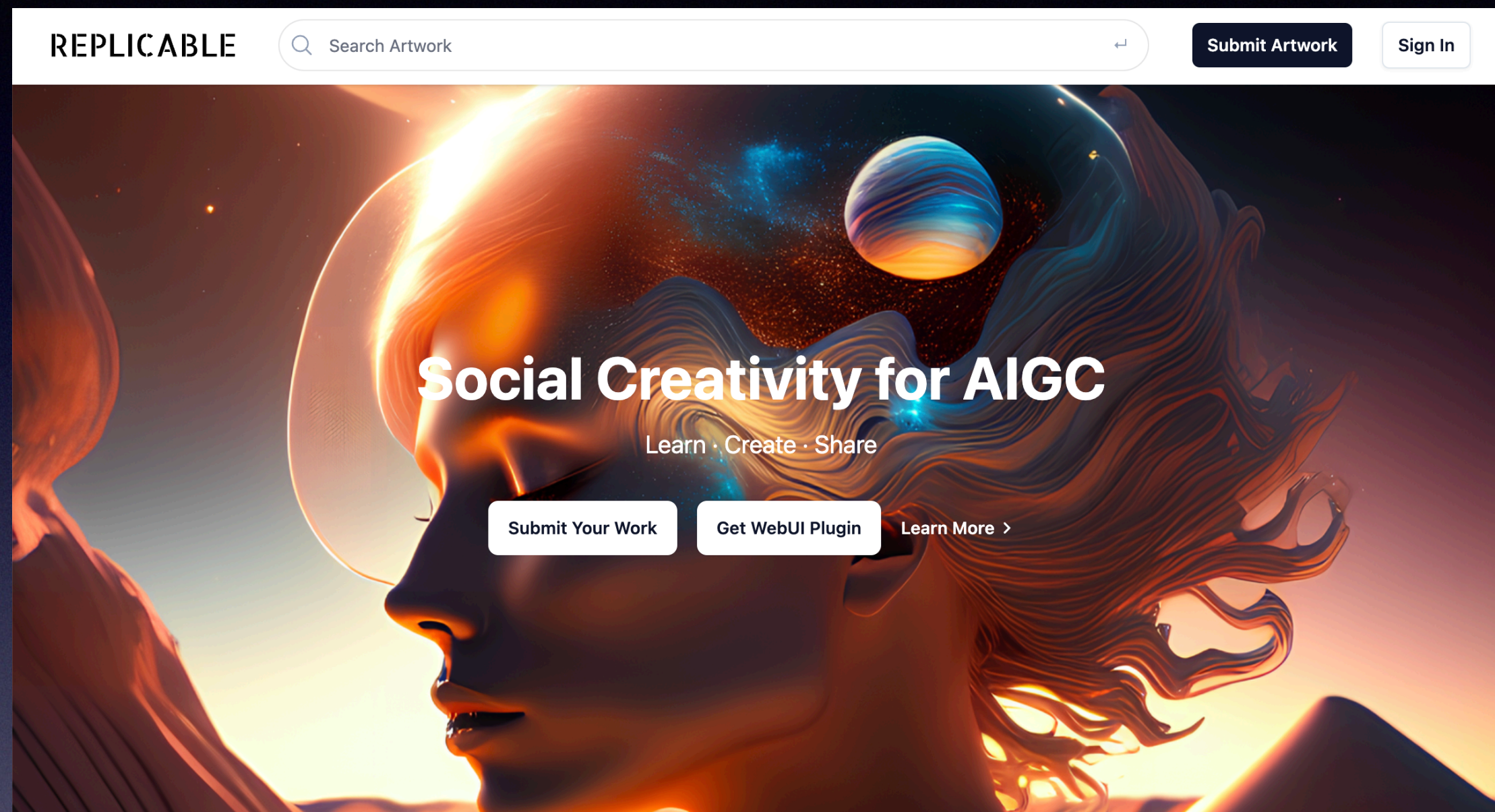
"[A human being is] the most imitative creature in the world, and learns at first by imitation" - Aristotle

Replicable.Art is a social learning community dedicated to curated AIGC (AI Generated Content), tools, and learning materials.

ChatGPT is writing (some) code better and faster than me and I am pretty happy and not worried at all.

I will hire ChatGPT to be my TA this fall semester :)

https://twitter.com/johnkoetsier/status/1603234885791285248

Thanks!