Science Fair Log Book

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Sept. 27th-28th *Written by Scarlett*

We have decided on researching AI as a HOT question/research topic. Our goal is to find out whether AI is trustworthy or not! To do that, we decided to record a couple of different AI models, ask them to generate some recipes—which we will specify—and then TRY THEM! With that evidence, we will decide which AI model is good or bad.

OUR IDEAL AI MODELS:

- ChatGPT
- Google Gemini
- Microsoft Copilot
- Alexa (???)
- Siri (???)
- Perplexity AI

(???) as in questionable

OUR RECIPE PROMPT: "Can you generate a unique and simple recipe for six cookies?"

(We need to be consistent with the prompt!!!)

OUR VARIABLES:

- AI Models
- Unknown ingredients to be generated
- Some people to try our food

Now, we need to do some research. Some important questions are:

- What is AI?
- How do you program AI?
- Is AI 100% accurate all the time?
- Is AI trustworthy?
- How do we improve AI?

- Why is AI so important?

Sept. 27th-28th CONT. *Written by Scarlett*

After doing some research, we have recognized what AI is. AI, also known as Artificial Intelligence, is something designed to "think like a human" and to improve everyday life. Designing AI is not done in the same way as classic computer software; it improves itself!

AI is not 100% trustworthy, and it needs feedback from us in order to improve. Because of this, the recipes we receive may or may not even work—let alone taste good.

Since AI searches through the information it has in its collection of knowledge—learned from the web—it might already use recipes published somewhere else!

SO, because of this, our plan is to:

- First test the recipes (multiple times)
- Try to improve them
- Check online to make sure the idea is original

Our final hypothesis: "If AI is trustworthy MOST OF THE TIME, then the recipes we make will be successful because the amount of knowledge a trustworthy AI has is enough to make a good recipe."

PLAN:

- Research
- Hypothesis
- Slide making
- Collect AI models
- Make recipes
- Collect materials and ingredients
- Try and make recipes *May not work; we might have to revise and start over multiple times*
- Test (EAT!!!)
- Review and conclusion
- EXTENSION!

Oct. 7th - Nov. 6th *Written by Scarlett*

We began with a simple, uniform theme, but in November, we changed it to a more colorful theme with more variety. We simplified the large paragraphs into understandable and simple concepts.

The slides matched our progress of collecting materials. We tried some of the AI models, and many didn't work. We ended up using:

- ChatGPT
- Microsoft Copilot
- Perplexity AI

After organizing our research data, we started adding to our presentations. Here are some things we learned:

What is AI?

AI, or Artificial Intelligence, is designed to meet our needs, ranging from solving everyday problems to generating important business ideas. It is programmed to 'think like a human' and is now used widely. In the past, AI was limited to responding to simple questions, giving recommendations, and learning. Today, however, its capabilities have expanded significantly, from creating images to generating prompts for music and literature, and even generating recipes.

· Artificial Intelligence (1950's) ·

Artificial intelligence allows machines to copy human thinking, learning, and decision-making. AI can learn from experience and give recommendations, sometimes even working on its own—like a self-driving car!

Some important dates in AI's history during this time period include:

- The 'birth' of AI. This started in *1950*, when Alan Turing, a renowned computer scientist and cryptanalyst decided to perform a test (later named as the Turing Test) to determine if a machine could speak like a human would.
- Just five years after Turing proposed the Test, computer and cognitive scientist John Mcarthy introduced a summer workshop at Dartmouth College

along with the term "artificial intelligence"-- which later came into popularity decades after.
- In *1959*, computer scientist Arthur Samuel created the term "Machine Learning" during a speech about teaching machines to play chess better than their developers. After another three years, in *1958*, McCarthy created the language LISP (List Processing) which is still an accepted language even to this day.
- In *1965*, the first "expert system" was introduced to the public, as a form of AI programmed to replicate the abilities of human experts.
- ELIZA, a mock psychotherapist created in *1966,* was the first chatbot developed to converse with humans.
- Mathematician Alexey Ivakhnenko proposed a new approach to AI in *1968*, which would later on be known as "Deep Learning".
- In *1979*, the American Association of Artificial Intelligence which is now known as the Association for the Advancement of Artificial Intelligence (AAAI) was founded.

Based on the famous Turing Test, "Human or Not" is a game where players chat for a limited time and later have to determine whether they chatted with a human or bot.

· Machine Learning (1980's) ·

Machine learning trains algorithms to make decisions using data without being specifically programmed for tasks. There are numerous types of machine learning, but one type is supervised learning, where labeled data is used to train the program.

Some important dates in AI's history during this time period include:

- In *1985,* the first automated drawing program named AARON was introduced at an AAAI conference.
- The first driverless car was introduced in *1986* by Ernst Dickmann and his team at Bundeswehr University of Munich.

- Alacrity, a strategic advisory system, was presented to the public in *1987* as a complex expert system with over 3000 rules.
- In *1998*, chatbot Jabberwacky was invented to provide more interesting and entertaining conversations.
- In *2003*, NASA sent two rovers to Mars, tasked with navigating the planet without any human help.
- Apple's Siri was released to assist virtual navigation in *2011*.

· Deep Learning (2010's) ·

Deep learning uses neural networks that work like human brains when making decisions. They are programmed to learn from large data without human help or intervention, and they are great for tasks like recognizing images (for example, to tell whether the provided image is of a cat or not) and finding patterns in data quickly.

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- Apple's Siri was released to assist virtual navigation in *2011*.
- Many AI developers and those involved with AI signed an open letter in *2015*, banning improper development and use of AI in war.
- In *2016*, Sophia, the first robot with a humanoid appearance, was created to replicate human emotions and communication.

· Generative AI (2020's) ·

Generative AI uses Deep Learning to provide the user with original content and they often make similar(yet not totally the same) things from other data.

Some important dates in AI's history during this time period include:

- In *2020,* OpenAI beta tested GPT-3, which can create code, poetry, art, writing, and more.
- In *2021*, OpenAI introduced DALL-E, an AI model designed to process and understand images for better results.

How do we program and improve AI?

The important question is-- How do we program AI? AI isn't exactly programmed the same way as traditional computer programming, which doesn't update and improve itself. A simple explanation is that you first need to know what you are designing your AI system for, doing research about it, preparing, evaluating, and improving your algorithm, choosing your programming platform, and programming your AI! AI might not be right all the time. So, how do we improve it? By giving feedback and training it over, and over, and over again, it will be experienced in no time! An important key in programming a *successful* AI is to collect more relevant data to train the AI model.

AI can be programmed in Python, Java, R, and Julia. These languages are great for data analysis, language processing, math, and machine learning, but each one has unique features for different tasks. After picking a language, the programmer decides what their AI program does. For example, the goal might be a fully functional image creator. If they want to make an image creator, they must also train the program with countless drawings, pictures, and more. This applies to any other type of project goal. After that, the programmer has to consider key points for having a fair and accountable AI, including understanding its weaknesses and strengths. Last but not least, before deploying the tool, the creator must provide the

AI with relevant and detailed prompts to enhance the model and fix any remaining bugs.

Why is AI significant to our lives?

AI is here to meet our everyday needs. Although it is not right all the time, it is a very useful resource that gives you tips for almost everything. Whether you need a happy fairytale to brighten your day or inspiration for your new art masterpiece, you can trust AI to create the best results.

Here are some interesting things AI can do!

- Online Shopping Help
- Research
- Answer Questions
- Create Daily Routines
- Recommendations
- Translations
- Cars, Homes, and More
- Help Recognize Cyberattacks
- Correcting Misinformation
- Create Images, Stories, Poems, Songs, and More
- Editing Images and Videos
- Basic Therapy

How can we use AI correctly?

AI can do various things, but there are some precautions to using it. Make sure to identify bias, privacy risks, and *ethical problems. To identify bias, always look for personal opinions given by the AI. Never give your own personal information. We can also evaluate some key points like fairness, accountability, security, transparency, education, and relevance— also known as F.A.S.T.E.R. This contributes to how we can identify if AI is good or not, therefore suggesting its trustworthiness.

*ethical is just a fancy word for moral.

Here is an outline of the F.A.S.T.E.R. principal;

Fair

We want to make sure information given by AI doesn't include serious personal or cultural biases. Checking that the info provided is fair is also a key point.

Accountability

We have to make sure that results given by AI are accurate, legal, and ethical before using or taking action; which means we should always double-check the info before making decisions.

Security

Sometimes AI might be or provide sources that aren't the most credible, so make sure they are safe before providing personal info or anything that threatens your privacy.

Transparency

Make sure you know when content has been created by AI and what's not. The AI should let users know that they are interacting with an AI tool and how to use the program correctly.

Education

We have to spot the weaknesses and strengths in AI, and make sure the results are clear and specific.

Relevance

Using different AI systems that meet your needs is important; we don't want to ask for images on a business-based system. We also have to recognize the limits of AI and that the tools sometimes might not be the best option for everything. WE should also consider the impact before choosing to use a specific tool.

How is AI different from how humans think?

Is AI really capable of doing what humans are supposed to do? The answer is pretty clear—probably not. AI can make decisions with the information given, but that's just about it. AI is programmed to imitate humans in how we act, feel, speak, and decide. It never really gets tired, which means AI is fit for more repetitive and lower-level routine tasks.

On the other hand, humans' abilities are more expansive, as humans can feel, imagine, anticipate, and judge principles. This type of intelligence is unique to humans, allowing them to shift from short-term to long-term concerns. This type of intelligence is called Authentic Intelligence, while AI is called, well—Artificial Intelligence. But are the two really that different? No, actually! We can combine the two intelligences to make a better one, which uses the unique and astonishing abilities of both. We can create a new intelligence that has all the pros of the two—Augmented Intelligence. This raises the question of whether AI can ever replace humans.

Dec. 12th - Dec. 20th *Written by Scarlett*

Right now, in December, after generating the recipes, we realized that most of them were actually quite simple! Pretty soon, we will start making the recipes. The cookie names were:

- Crispy Cinnamon Sugar Crackle Cookies (ChatGPT)
- Fancy Six Cookies (Microsoft Copilot)
- Peanut Butter Banana Oatmeal Cookies (Perplexity AI)

Looking at the names, we could tell which AI was the most creative. Microsoft Copilot was clearly out of ideas, as it just used what we requested. Perplexity AI was a little better, but ChatGPT had that magical touch.

Comparing the length of each recipe, ChatGPT had the longest, while Perplexity AI was the shortest.

Next, when we looked at the ingredients, Perplexity AI's short recipe surprisingly caught our eye—it had really interesting and delicious ingredients, and we were excited to try it. ChatGPT's recipe seemed okay and should turn out decent, but it wasn't as creative or special as Perplexity AI's. Microsoft Copilot's recipe was so simple that we even questioned its taste!

Analyzing this into a table:

AI / Property	ChatGPT: OVERALL #1	Perplexity AI: OVERALL #2	Microsoft Copilot: OVERALL #3
Name / First Impression	#1: Really fun name	#2: Sensible name	#3: Boring name
Length / Efficiency	#1: Really long recipe	#3: Short recipe	#2: Long recipe
Ingredients / Creativity	#2: Not-so-creative ingredients	#1: Fun and interesting	#3: Typical ingredients

ChatGPT did really well, Perplexity AI came next, and Microsoft Copilot was last in this analysis.

We should be able to start baking very soon—probably in January.

Jan. 16th *Written by Scarlett*

We are planning to do the experiment soon. Collecting the materials and ingredients was pretty easy, but we still need some rarer ingredients like cocoa dust. After examining the recipes, we believe all three should work and turn into cookies.

Not much is happening—we're just working on the slides to improve them.

Jan. 25th *Written by Scarlett*

Today, we did our experiment, and it was amazing! We followed the exact recipes and steps for all of them, and they turned out pretty well, although Perplexity AI's cookie didn't turn out as we expected.

Here is a chart analyzing the results:

AI / Property	ChatGPT: OVERALL #1	Perplexity AI: OVERALL #3	Microsoft Copilot: OVERALL #2
Taste	#2: Pretty good taste, slightly sweet	#3: Disgusting	#1: Delicious and satisfying
Looks	#1: Very 'cookie like' appearance and looked appetizing	#3: Chunky and not visually pleasing	#2: Crackly but it had a 'cookie like' appearance
Total Time Consuming	#1: Shortest time	#3 : Longest time	#2: Medium time overall

All the recipes worked in some way; ChatGPT's cookies looked great but tasted dry and too sweet. Perplexity AI's cookies were a bit of a disappointment. The bananas were hard to mash, which took a lot of time, and the ingredients didn't make sense because there was no flour, baking soda, or anything like a normal cookie. It was pretty creative, though! Microsoft Copilot's cookies had some cracks. We're not sure if they were supposed to look that way

since the recipe didn’t specify the final result. The cracks might have happened because we pressed the dough too flat before baking.

At the end of the day, all the AIs did okay, and all the recipes were edible. However, Perplexity AI’s cookies didn't turn out the best since they tasted pretty bad and were hard to make. On the other hand, ChatGPT did a great job of making sure the cookies were both creative and delicious.

This means that AI can be trusted to handle simple tasks like making a recipe or generating images, but it’s not reliable enough yet to make significant decisions. It shows that AI probably won’t be able to replace humans, but it can definitely work with us to come up with better solutions. To wrap this up, in this experiment, we learned the secrets of AI, how to use AI correctly, and when to use AI effectively. This project was successful despite some major and minor mistakes, and we learned a lot about this mysterious and interesting concept!

Next time, we would like to give feedback to the AI systems about how the recipes worked out and how they didn’t. We wonder if it would affect the AI's future performance and if we could get a better result after providing our feedback. For instance, we could tell Perplexity AI that the proportions were way too much for just six cookies and ask it to improve the recipe. We also want to ask the AI for other recipes, craft ideas, and even math problems to get more accurate results. Another idea is to test the systems with challenges, like making recipes with limited ingredients or for people with allergies. This would show how well they can handle different situations. For example, we could ask for a recipe without gluten or dairy and see how the AI adjusts.

In conclusion, this project was an exciting way to explore AI's capabilities. We recognized its strengths and weaknesses; for example, AI is extremely creative but makes occasional mistakes. We can tell that AI isn't 100% perfect, but we know it is a great tool that supports and inspires us when used correctly. This project was just a small glimpse of what AI can really do, and we are excited to see what it further offers us.

Feb. 21st *Written by Scarlett*

We are working on the CYSF platform. While adding the same research results, we also explored deeper into the fascinating world of AI, learning many new things, including the history of AI.

Mar. 8th *Written by Scarlett*

We finished the project on the CYSF platform, integrating reviews and feedback into it. After reflecting on what we did, we were officially done!