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FoH GenAI Workshop

Dr Ananthan Ambikairajah

University of Canberra

Schedule

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- **Part I - GenAI**
- **Part II - Philosophies for AI use**
- **Part III - Prompt Engineering**
- **Part IV - GenAI Testing Assessments/Work**

About me

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Home Publications Teaching Podcast CV Media Outreach

Dr Ananthan Ambikairajah

Neuroscientist. Educator. Science Communicator.

- University of Canberra
- Website
- Email
- Google Scholar
- ORCID
- ResearchGate
- Web of Science
- Github
- LinkedIn
- X (formerly Twitter)
- Wikipedia
- YouTube

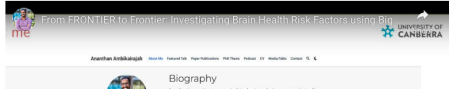
I'm running the Canberra Marathon for Dementia Australia - donate below

Donate

Ananthan is a passionate neuroscientist, educator and science communicator. He is a Lecturer at the University of Canberra (UC) and a core member of the Centre for Ageing Research and Translation (CARAT) at UC. Ananthan completed his PhD in Neuroscience at the Australian National University in 2022. Ananthan received the Outstanding New Researcher Highly Commended Award in 2024 from the ACT Minister for Health. His research interests include genetic, environmental and lifestyle factors which influence ageing, brain health and disease, with a particular focus on sex-specific determinants and cardiometabolic factors. His recent research focuses on the potential for risk reduction in dementia. Ananthan has expertise in big data analyses, statistics, git, Linux and R. In 2023, he developed and continues to lead the Generative Artificial Intelligence (GenAI) Community of Practice for the Faculty of Health at UC, which aims to up-skill staff on their understanding, use and adoption of GenAI to enhance their learning, teaching, research and professional practice.

Ananthan is also a passionate educator and science communicator. Following his Undergraduate degree in Neuroscience at UNSW, he completed a Master's in Teaching (Secondary) and is a Higher Education Academy Fellow. In 2024, Ananthan received the Faculty of Health Student Nominated Award for Excellence in Teaching at UC. Ananthan regularly engages with media and his research has been covered by ABC News, Nine News, Sydney Morning Herald, the Australian Financial Review, The Australian and ABC Radio. He also hosts a podcast called Midnight Conversations, which aims to communicate research and the principles of scientific thinking to the public in an engaging and accessible way. His podcast is available on Apple Podcasts, Spotify and Soundcloud.

Featured Research Presentation



https://ananthanambikairajah.com/

How did we get here?

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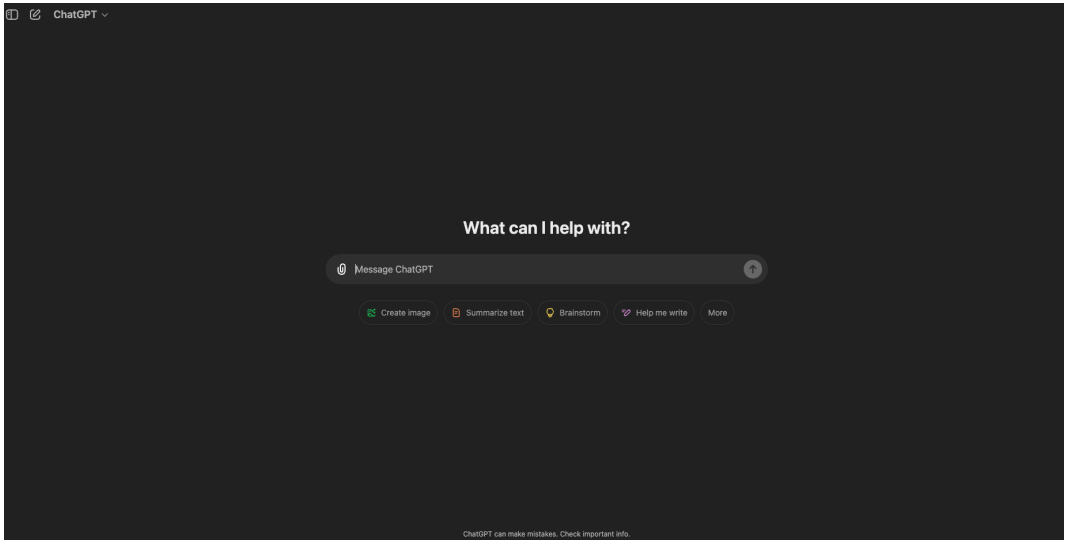

ChatGPT, https://chatgpt.com/

GenAI

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- ChatGPT is a generative artificial intelligence (GenAI) chatbot developed by OpenAI
- Launched on 30th of November, 2022
  - Large language model
  - Initially used GPT-3.5, but now uses GPT-4 architecture
  - In June 2024, announced a partnership with Apple Inc.
- Major competitors include:
  - Gemini (formally known as Bard), developed by Google
  - Claude, developed by Anthropic
  - Llama, developed by Meta AI
  - Grok, developed by xAI
  - Microsoft Copilot, developed by Microsoft
- There's an AI for that

What can it do?

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What can it do?

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- Let's ask it and find out.
  - https://chatgpt.com/
  - https://copilot.microsoft.com/
- What would be a good prompt?

What can it do?

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I asked ChatGPT "Write me a good prompt to find the answer to what you do". It responded:

Here's a good prompt to find a comprehensive answer to what I can do:

Prompt: "List all the capabilities and features of ChatGPT. Provide a detailed breakdown of tasks ChatGPT can assist with, including specific categories like information retrieval, writing assistance, coding support, data analysis, image generation, personal planning, and more. Explain how ChatGPT can be used for educational purposes, creative content creation, professional development, and everyday tasks. Highlight unique ways ChatGPT can be customized to suit different user needs."

This prompt will elicit a thorough response covering all aspects of what I can help with and how I can be utilized across various domains.

What can it do?

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https://chatgpt.com/share/671727fe-1798-8010-9eee-eb7e499c33b6

How to share a link from ChatGPT

- ChatGPT shared conversation links

What can it do?

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- Quizzes
  - Canvaswizard
  - QuizMate
  - AnswersAi
- Essays
  - “Humanising” essays
  - Improving citations
- Lecture notes and learning resources
- Recorded presentations/interviews

What can it do?

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- Udio - music
- Gamma - presentations
- Notebook LM - summaries, podcasts
- Adobe Firefly - images
  - UC is an Adobe Creative Campus
- Gradescope - grading and feedback
- Cogniti
  - Video demonstration of Cogniti

How does it work?

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1. Large Language Models (LLMs)
2. Generative Pre-trained Transformers (GPT)
3. Training Process: Pre-training and Fine Tuning
4. Tokenisation and Response Generation
5. Semi-supervised Learning.
6. The alignment problem

1. Large Language Models (LLMs)

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- LLMs are types of artificial intelligence designed to process and generate human language.
- They excel at tasks involving text, such as writing, summarizing, translating, and answering questions.
- These models are trained on enormous amounts of text data, which allows them to learn language patterns, grammar and facts. They do not keep a copy of the data they were trained on, but rather generate novel content based on the patterns they encode.
- A key characteristic of LLMs is their parameters. These are the internal values (i.e. weights) learned during training, which influence how the model makes predictions.
- Fundamentally, LLMs predict what word comes next in the sentence

2. Generative Pre-trained Transformers (GPT)

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- GPT are a large language model.
- Generative: can generate new, contextually relevant text, given an input prompt. It's not limited to merely retrieving information (i.e. Google Search) but can produce original content.
- Pre-trained: model is trained on large datasets which teaches it to understand the structures, meaning and nuances of language
- Transformer: highly efficient at processing text because they use a mechanism called self-attention. This allows the model to focus on different parts of the input sentence and understand how words relate to each other, regardless of their position in the sequence. For example, in the sentence "The cat sat on the mat," the model can determine that "sat" relates more to "cat" than to "mat." Transformers can process input in parallel, making them much faster and more efficient at handling large datasets
- GPT-4 has knowledge of events that occurred up to December 2023 and GPT-4o's knowledge cut-off is October 2023. Paid subscriptions enable ChatGPT to search the web for real-time data.

3. Training Process: Pre-training and Fine Tuning

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- Pre-training: GPT is trained on massive datasets, which include (1) information that is publicly available on the internet, (2) information licensed from third parties and (3) information provided by users or human trainers. This pre-training allows for the model to predict the next word in a sequence and learn grammar, facts, reasoning patterns, and general knowledge about the world. For instance, if it sees the phrase "The sun rises in the. . . ," it will predict "east" based on patterns it learned from its training data.
  - Biases in ChatGPT
    - The model is skewed towards Western views and performs best in English. Some steps to prevent harmful content have only been tested in English.
    - The model's dialogue nature can reinforce a user's biases over the course of interaction. For example, the model may agree with a user's strong opinion on a political issue, reinforcing their belief.
    - These biases can harm students if not considered when using the model for student feedback. For instance, it may unfairly judge students learning English as a second language.

3. Training Process: Pre-training and Fine Tuning

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- Fine-tuning: After pre-training, the model is fine-tuned on task-specific datasets, making it more accurate for particular use cases (e.g., coding or customer support).
- Reinforcement Learning with Human Feedback (RLHF): GPT models are further refined using feedback from users. This ensures that the model generates high-quality and useful responses in real-world interactions.

4. Tokenisation and Response Generation

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- Tokenisation - before being processed, text is broken down into tokens, which is mapped to a numerical representation. GPT generates responses token-by-token by sampling from the probability distribution of possible next tokens. For example, “the” might be one token, while a longer word like “happiness” could be broken into two or more tokens.
- ChatGPT-4o context window can take up to 128,000 tokens, which is roughly 96,000 words
- Claude 3 context window can take 200,000 tokens, which is roughly 150,000 words
- Gemini 1.5 Pro’s context window can take up to 1 million tokens, which is roughly 700,000 words
  - PhD theses are up to 100,000 words

4. Tokenisation and Response Generation

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- Response generation:
  - Autoregressive model: GPT is an autoregressive model meaning it generates text one token at a time. For each token, it consider the previous tokens to predict the next one, building sentences word by word.
  - Sampling from a Probability Distribution: Instead of always choosing the most likely token, GPT samples from a probability distribution. This allows it to generate diverse and creative responses, rather than repeating the same output every time.

5. Semi-supervised Learning

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- GPT models employ a combination of unsupervised pre-training and supervised fine-tuning, which is often referred to as semi-supervised learning
  - Unsupervised Pre-training: In this phase, the model learns language by predicting the next token in sequences from raw, unlabeled data. It doesn't need labeled datasets (i.e. those that provide correct output or classification for each example) to learn general language patterns.
    - Supervised Fine-tuning: After pre-training, the model is refined on labeled data, helping it specialize in tasks like answering questions or generating specific types of text.
    - Reinforcement Learning: Further improvements are made through reinforcement learning, where human feedback helps guide the model's behavior.

6. The Alignment Problem

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- Alignment is concerned with whether the model's outputs meet human expectations and ethical standards, such as producing truthful, helpful, and unbiased content. Misalignment occurs when the model optimizes for its training goals (e.g., next-word prediction) but fails to produce outputs that align with user needs.
  - Capabilities refer to a model's technical proficiency in performing tasks, such as generating text, summarizing content, or predicting sequences.
- Symptoms of misalignment:
  - Hallucinations: The model fabricates facts or generates misinformation.
  - Unhelpfulness: The model may fail to follow explicit user instructions or provide meaningful, context-appropriate answers.
  - Bias and Toxicity: If trained on biased or toxic data, the model can reproduce such biases in its outputs, even if the user does not request harmful content.
  - Lack of Interpretability: It is difficult to trace how the model arrives at certain outputs, making it hard for humans to understand its reasoning or decisions.

6. The Alignment Problem

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- Efforts to address the alignment problem include:
  - Reinforcement Learning from Human Feedback (RLHF): OpenAI has employed RLHF to help fine-tune models like ChatGPT. In this process, human evaluators provide feedback on outputs, guiding the model toward generating safer, more aligned responses.
    - Bias Mitigation and Safeguards: Developers work to minimize the model's inherent biases by curating training datasets and introducing filters that block toxic content. However, complete alignment remains an open challenge.

Further limitations to GPT models

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- ChatGPT sometimes writes plausible sounding but incorrect or nonsensical answers. Fixing this issue is challenging, as: (1) during reinforcement learning training, there's currently no source of truth; (2) training the model to be more cautious causes it to decline questions that it can answer correctly; and (3) supervised training misleads the model because the ideal answer depends on what the model knows, rather than what the human demonstrator knows.
- ChatGPT is sensitive to tweaks to the input phrasing or attempting the same prompt multiple times. For example, given one phrasing of a question, the model can claim to not know the answer, but given a slight rephrase, can answer correctly.
  - Therefore, the way you talk to GenAI matters.
- The model is often excessively verbose and overuses certain phrases, such as restating that it's a language model trained by OpenAI. These issues arise from biases in the training data (trainers prefer longer answers that look more comprehensive) and well-known over-optimization issues.

Further limitations to GPT models

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- Ideally, the model would ask clarifying questions when the user provided an ambiguous query. Instead, our current models usually guess what the user intended.
- While we've made efforts to make the model refuse inappropriate requests, it will sometimes respond to harmful instructions or exhibit biased behavior. We're using the Moderation API to warn or block certain types of unsafe content, but we expect it to have some false negatives and positives for now. We're eager to collect user feedback to aid our ongoing work to improve this system.

What is under the hood - ChatGPT vs Microsoft Copilot

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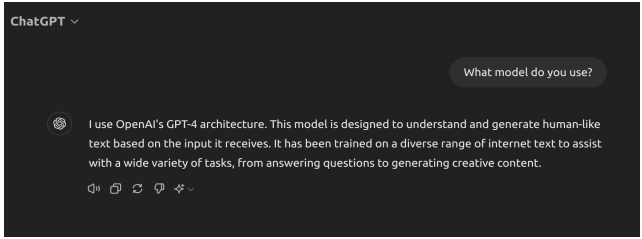

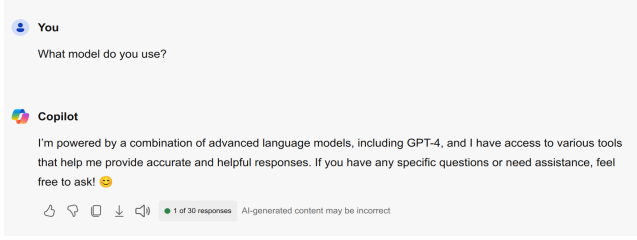

ChatGPT

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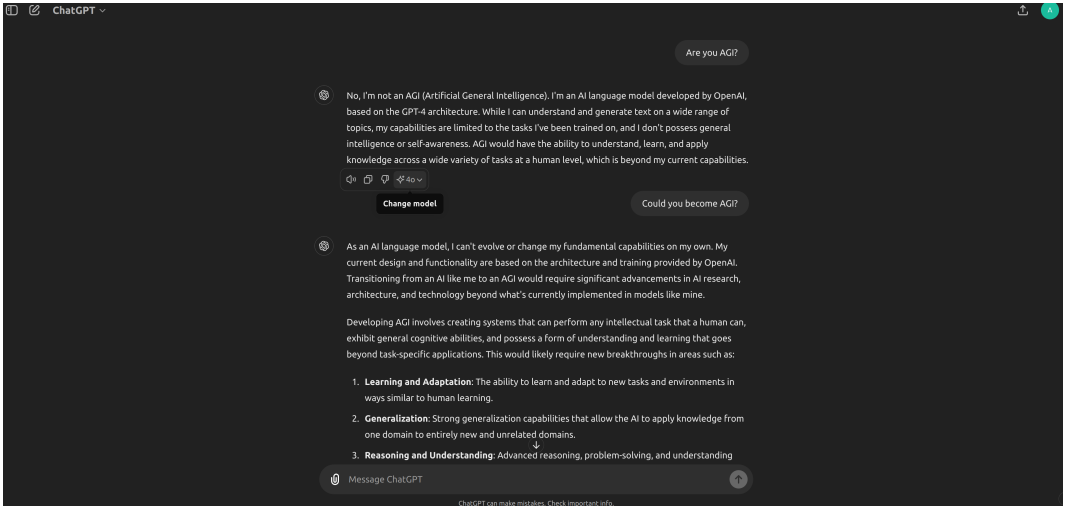

ChatGPT

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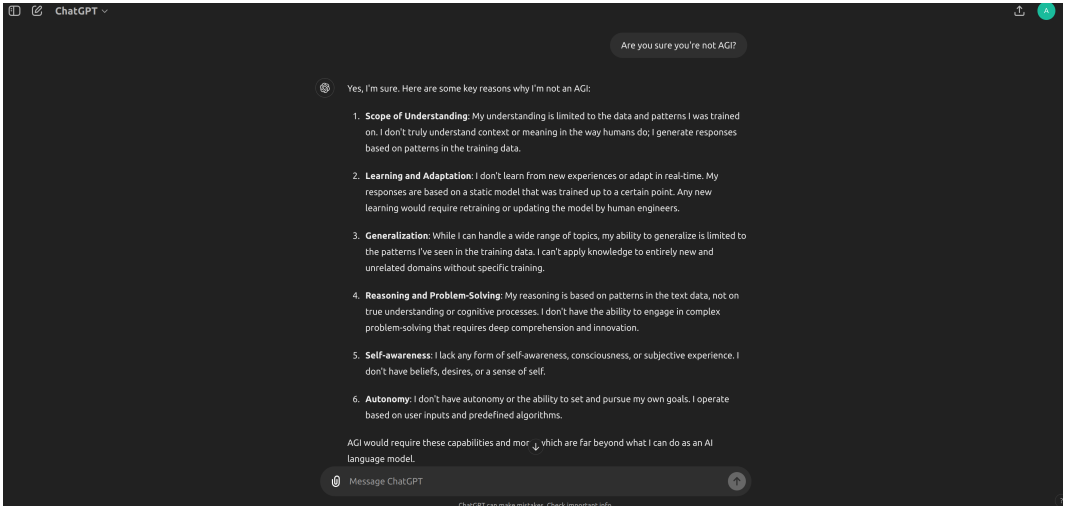

Microsoft Copilot

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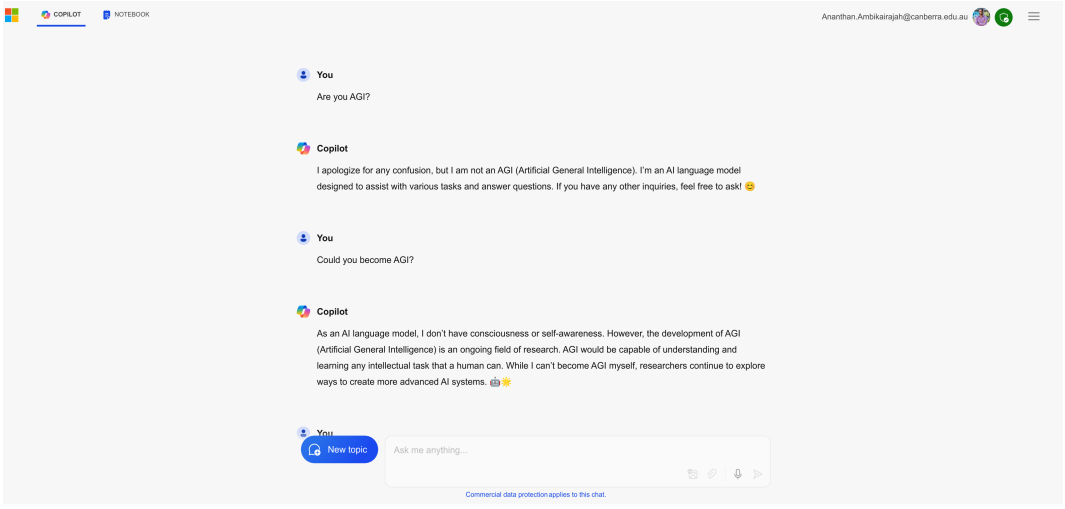

Microsoft Copilot

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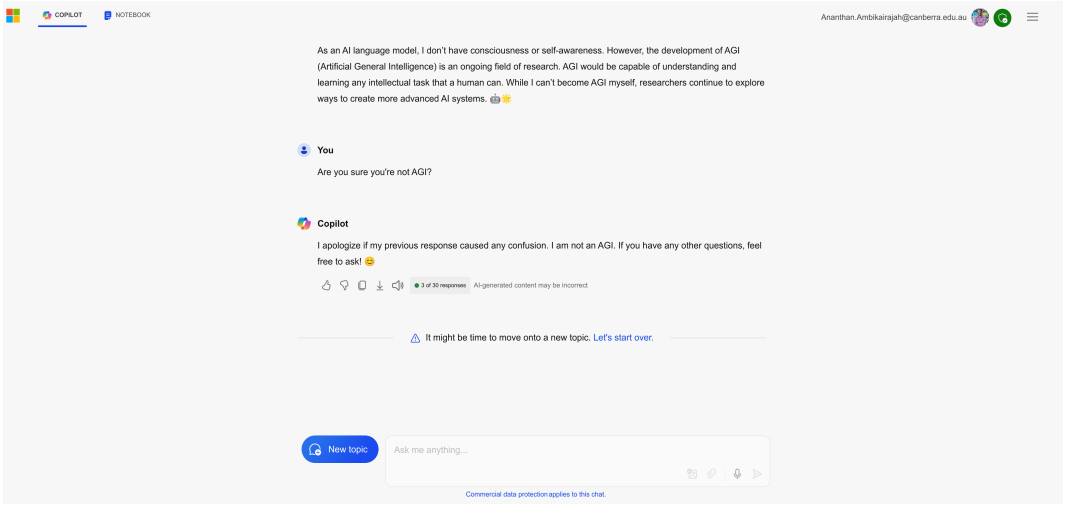

Privacy

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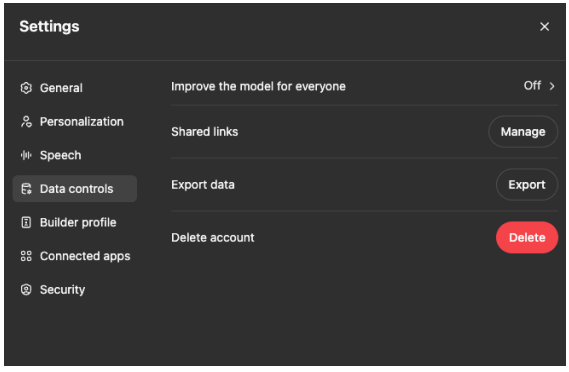

Schedule

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- **Part I - GenAI**
- **Part II - Philosophies for AI use**
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- **Part IV - GenAI Testing Assessments/Work**

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Faculty of Health Generative Artificial Intelligence Community of Practice

TERMS OF REFERENCE

Aim/Objective

The Faculty of Health (FoH) Generative Artificial Intelligence (GenAI) Community of Practice (CoP) aims to upskill staff and students on GenAI to enhance their learning, teaching (L&T) and research, in addition to producing future ready graduates and tertiary educators.

Scope

1. How GenAI is being used in health professions/L&T space/research;
2. How to use and embed use of GenAI into FoH curricula and research practices,
3. What professional development (PD) may support staff to use/embed GenAI into FoH curricula (including work integrated learning) and research.
4. How best to support innovation in teaching/research at FoH, using GenAI.

Membership of this CoP is open to all staff within the Faculty, including academic and professional staff. The scope here is not driven by academic integrity rather how to make the most of GenAI to produce future ready graduates. Staff interested in academic integrity GenAI issues are encouraged to join the UC Academic Integrity Microsoft Team which includes a CoP.

Proposed Activities for 2024

1. Create a Teams page that allows for the sharing of information and connection for members of this CoP.
2. Establish terms of reference for this CoP.
3. Establish a journal club via a channel on Teams which allows members to share research about GenAI's use in research, teaching and learning and in health professions .
4. Disseminate resources relating to GenAI use, relevant to Tertiary Education Quality and Standards Agency (TEQSA) requirements.
5. Develop and implement a survey of FoH staff and student about needs and uses of GenAI in their teaching, learning and research.
6. Establish a conference/forum which allows FoH staff and students to showcase their use of GenAI in learning and teaching.
7. Coordinate GenAI -focused professional-development initiatives for FoH teaching staff and students, including upskilling workshops, webinars with academic and industry experts, and panel discussions to foster learning, collaboration, and innovation in health education.
8. Explore time efficient tools for GenAI integration in teaching and research e.g. MCQ generation
9. Apply for seed grant funding to support the use of GenAI in FoH learning and teaching.
10. Develop a FoH teaching award that recognises the outstanding contribution of an academic regarding the use of GenAI in their teaching.
11. Quarterly social catchups over coffee amongst GenAI CoP members to drive informal discussion

Australian Government inquiry GenAI recommendations

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Recommendation 6: The Committee recommends that the Australian Government encourage consistent guidance and uptake of GenAI: in HE—including updating the threshold standards, and recognises TEQSA's leadership role and efforts.

Recommendation 16: 4.107 The Committee recommends that the Australian Government, in conjunction with educational providers, encourage educators and other staff to use GenAI tools for appropriate tasks to help streamline parts of teaching and administration. 4.108 For example, lesson planning, timetabling, reporting, and simple grading for yes/no or multiple-choice questions.

Recommendation 22: The Committee recommends that universities and TAFEs embed GenAI competencies and skills across all courses and degrees.

Recommendation 23: The Committee recommends that Tertiary Education Quality and Standards Agency work with higher education providers to develop standards and frameworks, including authorship policies, to guide universities in maintaining research and academic integrity regarding GenAI.

TEQSA Assessment Reform for the Age of AI

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1. Assessment and learning experiences equip students to participate ethically and actively in a society where AI is ubiquitous
2. Forming trustworthy judgements about student learning in a time of AI requires multiple, inclusive and contextualised approaches to assessment

TEQSA Assessment Reform for the Age of AI

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Assessments should emphasise:

- appropriate, authentic engagement with AI
- a systemic approach to program assessment aligned with disciplines/ qualifications
- the process of learning
- opportunities for students to work appropriately with each other and AI
- security at meaningful points across a program to inform decisions about progression and completion

University of Canberra GenAI Action Plan

The University's position is that artificial intelligence services must not to be used for assessment or assessment preparation by students unless explicitly allowed in the assessment instructions for an assessment task published with the assessment task and/or in the unit outline. That is, an artificial intelligence services may only be used if:

- its use is authorised by the unit convener (or HDR supervisor) as part of a specified assessment task, and
- it is used in the way allowed in the assessment instructions and/or unit outline, and
- its use is appropriately referenced, meaning that students must reference the use of AI in their assessment in the same way as they reference other source material.

Sydney University

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- AI will only continue to improve
- Any take-home assessment *could* involve AI use
- It is not possible to ban AI or reliably detect AI
- We cannot out-run, out-design or out-prompt generative AI
- Our students must master the productive and responsible use of AI
- Any take-home assessment perhaps *should* involve AI use

Sydney University - Two Lane Approach

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- Lane 1: Assurance of learning outcomes
  - Short-term
    - In-person exams/tests
    - Viva voce (an oral examination)
  - Longer term
    - In-class contemporaneous assessment e.g. skills-based assessments run during tutorials or workshops
    - Viva voce (or other interactive oral assessment)
    - In-person exams/tests (used sparingly, designed to be authentic and for assuring program rather than unit level outcomes)

Sydney University - Two Lane Approach

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- Lane 2: Human- AI collaboration where relevant
  - Short-term
    - Students use AI to brainstorm, draft outlines, summarise resources, perform research and analyse content
  - Longer term
    - Students collaborate with AI and document this process. The documented process demonstrates learning, is graded, and is more heavily weighted than the product.

Two Lane Approach Summary

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	Lane 1	Lane 2
Role of assessment	Assessment of learning	Assessment for and as learning
Level of operation	Mainly at program level	Mainly at unit level
Assessment security	Secured, in person	'Open' / unsecured
Role of generative AI	May or may not be allowed by examiner	As relevant, use of AI scaffolded & supported
TEQSA alignment	Principle 2 – forming trustworthy judgements of student learning	Principle 1 – equip students to participate ethically and actively in a society pervaded with AI
Examples	In person interactive oral assessments; viva voces; contemporaneous in-class assessments and skill development; tests and exams.	AI to provoke reflection, suggest structure, brainstorm ideas, summarise literature, make content, suggest counterarguments, improve clarity, provide formative feedback, etc

Rethinking assessments in the age of GenAI

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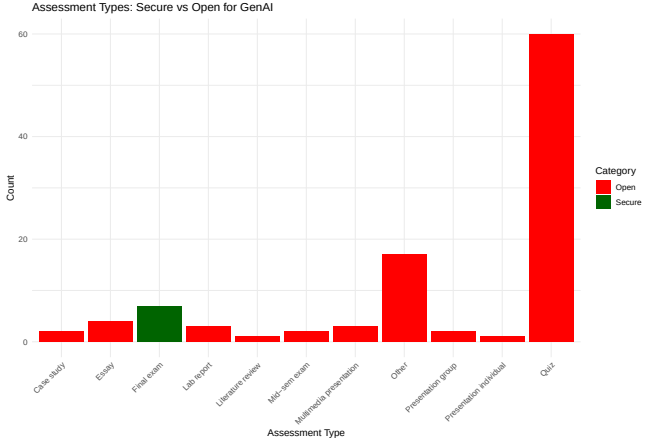
- We have to rethink our assessments in the age of GenAI
- Psychology 3 year degree case study
  - 6.86% secure assessments
  - 93.14% open assessments



UNSW Six Lane Approach

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Clearly signal to students what the assessment is about:

- NO ASSISTANCE: This assessment is designed for you to complete without the use of any generative AI.
- SIMPLE EDITING ASSISTANCE: In completing this assessment, you are permitted to use standard editing and referencing functions in the software you use to complete your assessment.
- PLANNING/DESIGN ASSISTANCE: You are permitted to use generative AI tools, software or services to generate initial ideas, structures, or outlines.
- ASSISTANCE WITH ATTRIBUTION: This assessment requires you to write/create a first iteration of your submission yourself. You are then permitted to use generative AI tools, software or services to improve your submission.
- GENERATIVE AI SOFTWARE-BASED ASSESSMENTS: This assessment is designed for you to use generative AI as part of the assessed learning outcomes.
- NOT APPLICABLE: Generative AI is not considered to be of assistance to you in completing this assessment.

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Prompt Engineering

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- Prompt engineering is the art of asking the right questions to get the best output from LLMs
  - Prompt
  - Processed by model
  - Completion

Prompting best practices:

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1. Clearly communicate what content or information is most important.
2. Structure the prompt: Start by defining its role, give context/input data, then provide the instruction.
3. Use specific, varied examples to help the model narrow its focus and generate more accurate results.
4. Use constraints to limit the scope of the model's output. This can help avoid meandering away from the instructions into factual inaccuracies.

Prompting best practices:

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5. Break down complex tasks into a sequence of simpler prompts.
6. Instruct the model to evaluate or check its own responses before producing them. (“Make sure to limit your response to 3 sentences”, “Rate your work on a scale of 1-10 for conciseness”, “Do you think this is correct?”).
7. Be creative! The more creative and open-minded you are, the better your results will be. LLMs and prompt engineering are still in their infancy, and evolving every day.

The Basics

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- Fewer assumptions the AI makes means it is less likely to hallucinate
- Craft precise and unambiguous instructions
- Provide examples
- Use the conversational interface on many generative AI tools to refine its outputs.
- Specificity is key! The model will make an assumption on any point you don't clearly explain.
- Continuous Trial and error
- If you switch topics, start a new chat or it may get confused
- Encourage AI to think step by step
- A good prompt has 4 key elements: Role, Task, Requirements, and Instructions.

Role

Prompts starting with "act as..." or "pretend to be..." will provide responses similar to that of the role which you provide. Setting a specific role for a given prompt increases the likelihood of more accurate information, when done appropriately.

- E.g. act as an expert in the field of computer science
- Determines the type of information and the way the information is communicated to you.
- This also determines the interactivity of the conversation.

Task

The task is a summary of what you want the prompt to do. There is a lot of creativity that comes into writing a great task. It can range from generating birthday gift ideas to doing game show questions with the content from your last lecture.

- Outline what you want the AI to do.
- Be specific about the task's objective, as unclear objectives lead to worse outputs.

Requirements

Writing clear requirements is all about giving as much information as possible to ensure your response doesn't use any incorrect assumptions. AI models make assumptions for any information they don't have in the prompt. It is often important to define what an output should look like and conditions that affect the output. This includes the various conditions to limit the assumptions made by the model.

Instructions

Instructions will inform the AI how to complete the task. Instructions can include examples of how it is supposed to work, steps it can follow or any information.

- How should the AI go about completing its task.
- Examples of how it could go about tasks.
- Feedback on steps it has taken will improve this even further.

Example

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Role:

Act as a science communication expert for a university's outreach program, specializing in simplifying complex research on genetics, aging, and brain health for the general public.

Task:

Write a 500-word blog post that introduces recent findings on how genetic and lifestyle factors influence brain health and aging. The goal is to explain the scientific concepts in an accessible way and offer practical advice readers can apply to support their brain health.

Example

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Requirements:

- Audience: General public, especially those with a basic interest in science or health.
- Tone: Friendly, informative, and encouraging.
- Format: Blog post format with a catchy title, an engaging introductory paragraph, clearly organized content with subheadings, and a concluding paragraph.
- Citations: Mention credible sources briefly, such as university research studies or peer-reviewed journals, to reinforce key points.

Instructions:

- Start with a hook to engage readers, using a relatable fact or question.
- Avoid jargon and explain scientific terms in simple language.
- Structure the post with subheadings for easier reading, focusing on key findings and their implications.
- Include three practical, research-based lifestyle tips that can support brain health.
- End with an encouraging message about how small changes can positively impact brain health over time.

Example

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https://chatgpt.com/share/671d8ed0-90dc-8010-81b2-540888673c9f

Types of prompts

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Direct prompting (zero-shot)

Direct prompting is the simplest type of prompt. It provides no examples to the model, just the instruction. You can also phrase the instruction as a question, or give the model a "role,".

Best For: Straightforward requests, basic explanations, or generating ideas.

Example: As a university instructor, explain the importance of academic integrity to first-year students.

Types of prompts

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Prompting with examples (One-, few-, and multi-shot)

One-shot prompting shows the model one clear, descriptive example of what you'd like it to imitate. Few- and multi-shot prompting shows the model more examples of what you want it to do. It works better than zero-shot for more complex tasks where pattern replication is wanted, or when you need the output to be structured in a specific way that is difficult to describe.

Best For: Replicating specific styles, formats, or patterns; handling complex instructions; creating consistent output.

Example: "Summarize a journal article in 50 words. Example: Article: 'The Role of Genetics in Ageing' Summary: 'This article discusses how genetic factors influence ageing, highlighting recent research on gene expression changes associated with lifespan.' Now, summarize this article on the psychology of learning in the same format."

Chain-of-thought prompting

Chain of Thought (CoT) prompting encourages the LLM to explain its reasoning. Combine it with few-shot prompting to get better results on more complex tasks that require reasoning before a response.

Best For: Problem-solving, complex explanations, step-by-step instructions.

Example: "Explain the process of photosynthesis in steps: Step 1: Describe how plants absorb sunlight. Step 2: Explain how chlorophyll converts sunlight to energy. Step 3: Describe the creation of glucose from water and carbon dioxide. Step 4: Outline the oxygen release process."

Types of prompt

Zero-shot chain-of-thought prompting

This approach takes a zero-shot prompt and adds an instruction: "Let's think step by step." The LLM is able to generate a chain of thought from this instruction, and usually a more accurate answer as well.

Best for: Word problems, logical reasoning, tasks requiring precision

Example: "Describe the process by which neurons communicate with each other. Let's think step by step through the stages of this process."

Tips

- Formatting your inputs correctly can help the model identify the information it needs to use. The most effective way to format your inputs is using Markdown formatting. Markdown is a lightweight markup language used to add formatting elements to plaintext documents.
- Markdown Cheat Sheet

Tips

- Use the latest model
- Be specific, descriptive and as detailed as possible about the desired context, outcome, length, format, style, etc
- Articulate the desired output format through examples
- Start with zero-shot, then few-shot, neither of them worked, then fine-tune
- Instead of just saying what not to do, say what to do instead

Tips

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- When in doubt, you can always ask the AI to help you write a prompt

Schedule

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- **Part I - GenAI**
- **Part II - Philosophies for AI use**
- **Part III - Prompt Engineering**
- **Part IV - GenAI Testing Assessments/Work**

GenAI Testing Assessments/Work

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In groups:

1) Pick an assessment or piece of work
2) Use what you have learnt to work with GenAI to complete the task

Feedback

https://forms.office.com/r/CtryDXDrNV