



Conversations over Clicks:

Impact of Chatbots on Information Search in Interdisciplinary Learning

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GenAI IS **EVERYWHERE**



There is so much news about GenAI these days, with its promises and precautions.

An interdisciplinary field like bioinformatics will likely benefit tremendously from GenAI through personalization and self-directed learning.



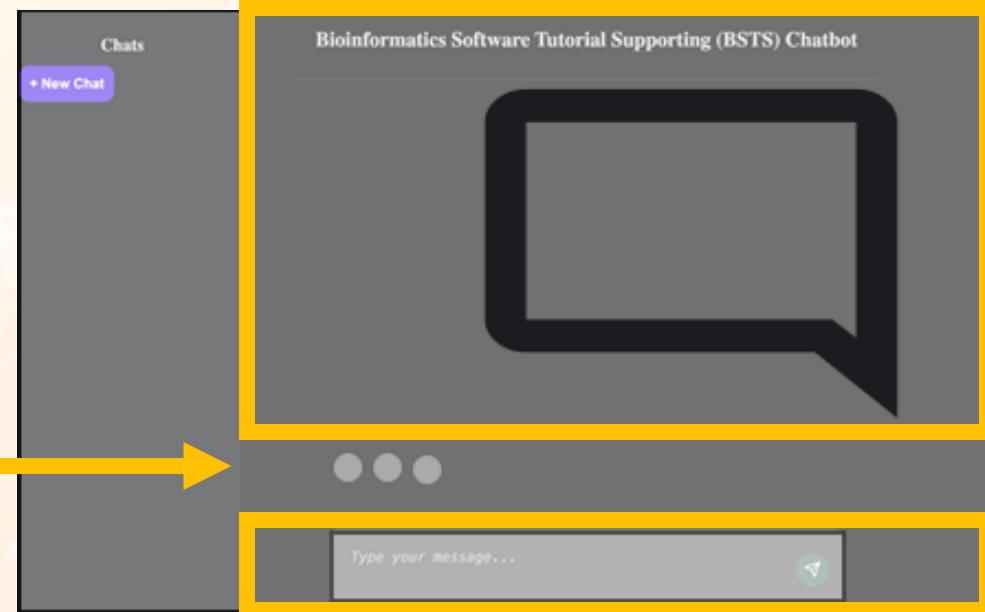
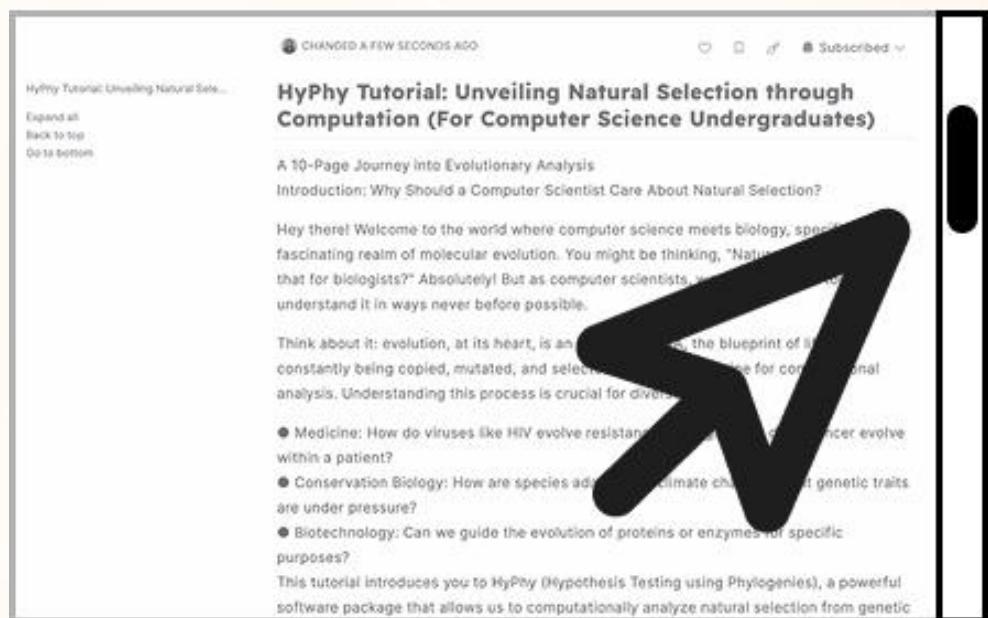
GenAI IS EVERYWHERE

One of the proposed methods of tackling the uncertainty of the GenAI era in class is to teach **AI literacy**.

We investigated how the way we seek information changes with GenAI and how AI literacy can be beneficial or limited.



GenAI e-tutorials are prominently different from traditional e-tutorials

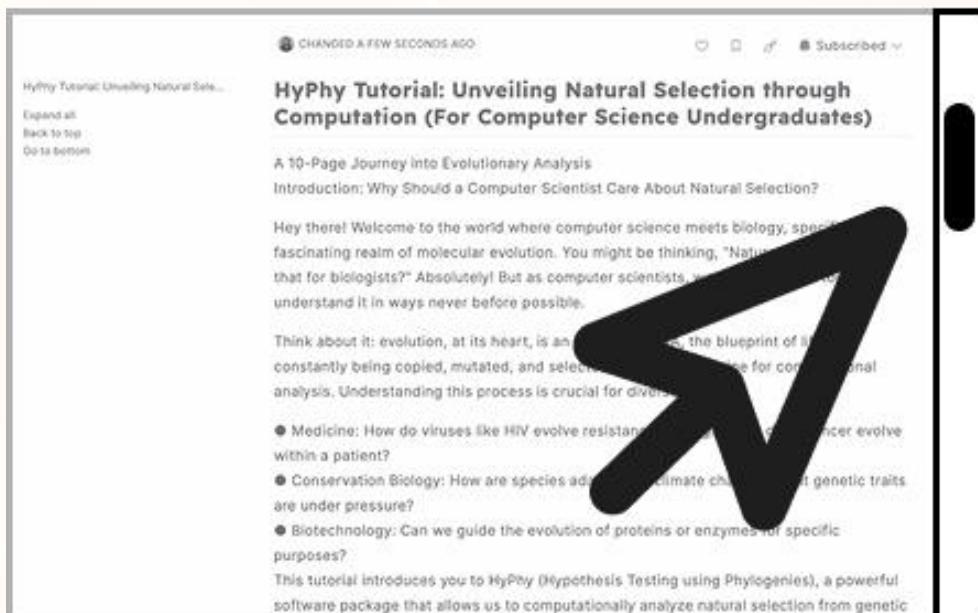


Difference 2:
Conversational

Difference 1: Query box interface

Difference 3: Dynamic structure of content

However, they are comparable because they are both summary of information by nature



CHANGED A FEW SECONDS AGO

HyPhy Tutorial: Unveiling Natural Selection through Computation (For Computer Science Undergraduates)

A 10-Page Journey into Evolutionary Analysis

Introduction: Why Should a Computer Scientist Care About Natural Selection?

Hey there! Welcome to the world where computer science meets biology, specifically the fascinating realm of molecular evolution. You might be thinking, "Natural selection? That's for biologists?" Absolutely! But as computer scientists, you can understand it in ways never before possible.

Think about it: evolution, at its heart, is an algorithm. It's the blueprint of life, constantly being copied, mutated, and selected. This makes it a prime candidate for computational analysis. Understanding this process is crucial for diverse fields:

- Medicine: How do viruses like HIV evolve resistance to drugs? How does cancer evolve within a patient?
- Conservation Biology: How are species adapting to climate change? What genetic traits are under pressure?
- Biotechnology: Can we guide the evolution of proteins or enzymes for specific purposes?

This tutorial introduces you to HyPhy (Hypothesis Testing using Phylogenies), a powerful software package that allows us to computationally analyze natural selection from genetic



Chats

+ New Chat

Bioinformatics Software Tutorial Supporting (BSTS) Chatbot

...

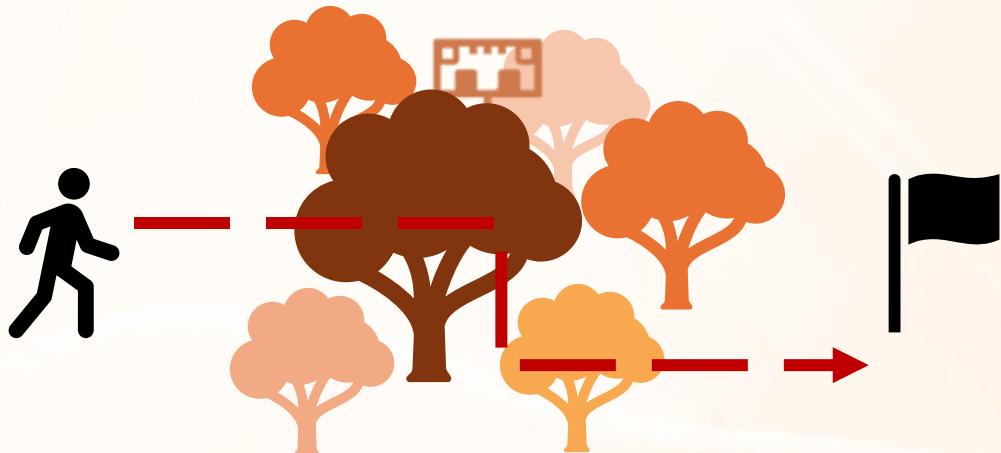
Type your message...

How would having different interfaces influence learner behaviors?



Two Research Questions with Information-Seeking Framework

RQ1: How do interactions with a GenAI chatbot influence learners' **orienteering** behaviors?



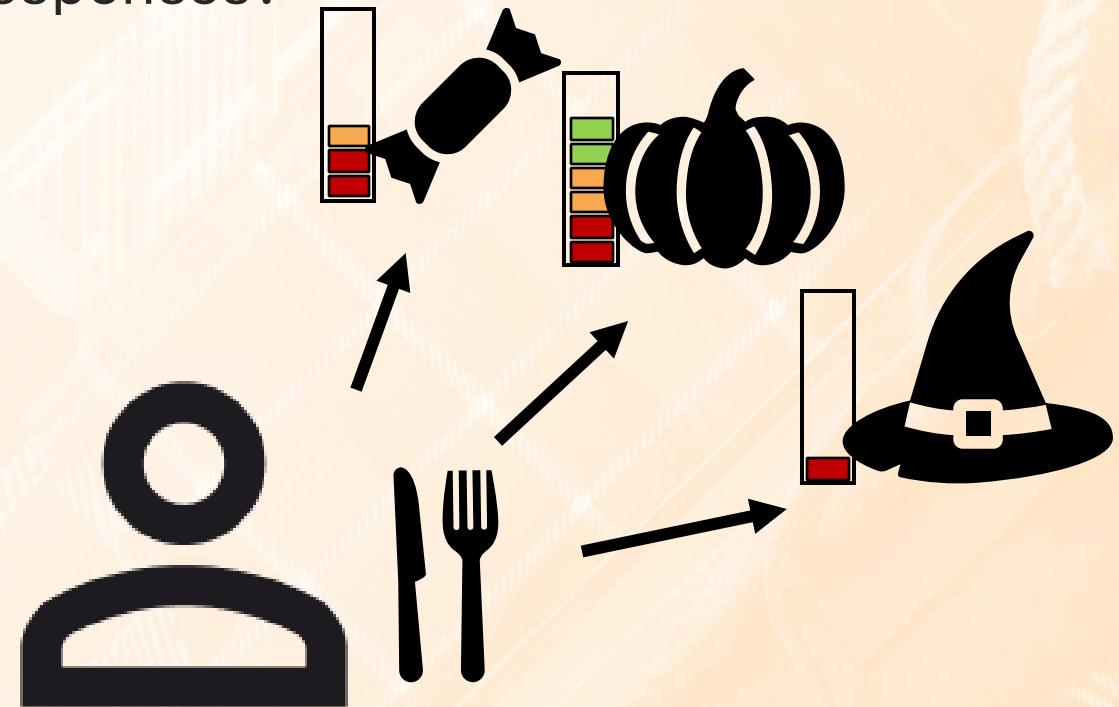
Monitoring

Following a plan

Exploring

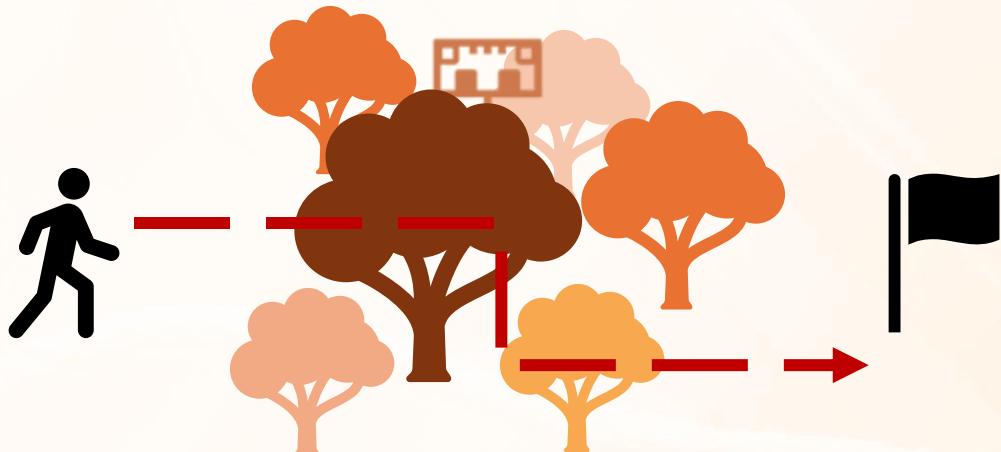
O'Day and Jeffries,
CHI 1993

RQ2: How do learners identify **information scent** in GenAI chatbot responses?



Two Research Questions with Information-Seeking Framework

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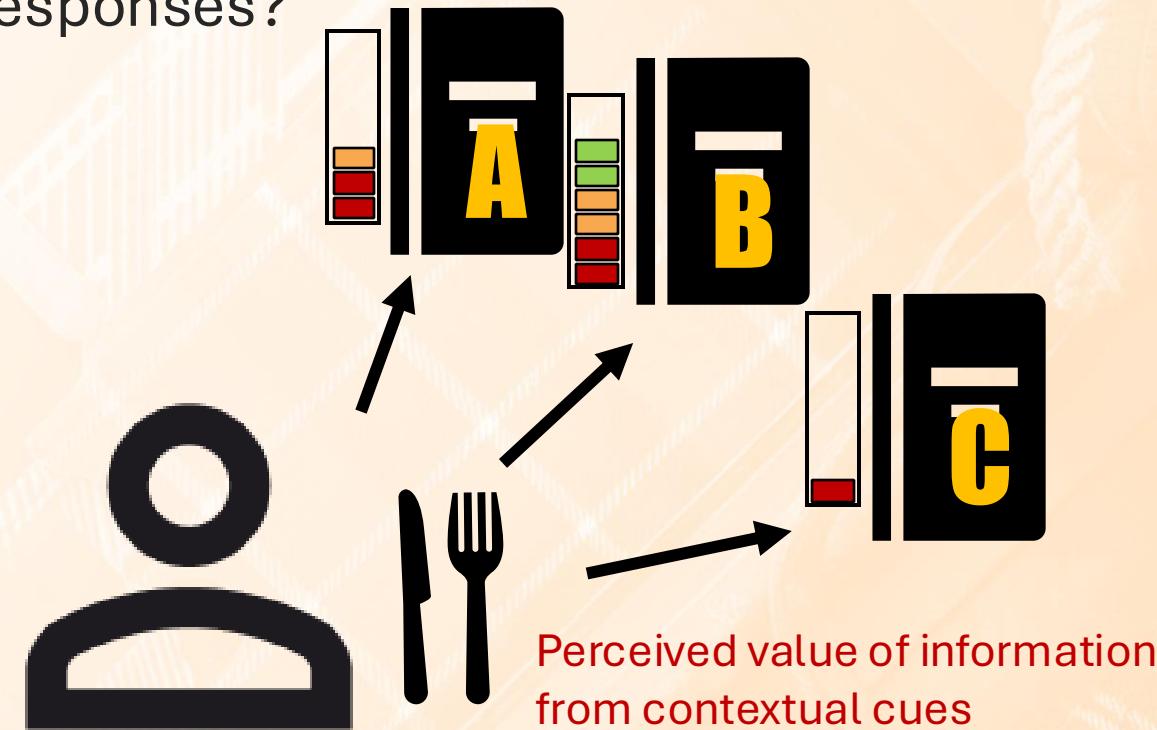
Monitoring

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O'Day and Jeffries,
CHI 1993

RQ2: How do learners identify **information scent** in GenAI chatbot responses?



Pirolli and Card,
Psychological review 1999



Autoethnography

- This approach enables researchers to reflect on their own experiences within a cultural or technological context **by being participants themselves.**
- It gives detailed snapshots of interactions, revealing **experiential insights** that may be generalizable to similar learning contexts.

Kaltenhauser, Stefanidi, and Schöning,
CHI 2024



- HCI Researcher
 - Teacher



- Bioinfo Researcher
 - Teacher

Minimized bias via
teacher-learner
hierarchy



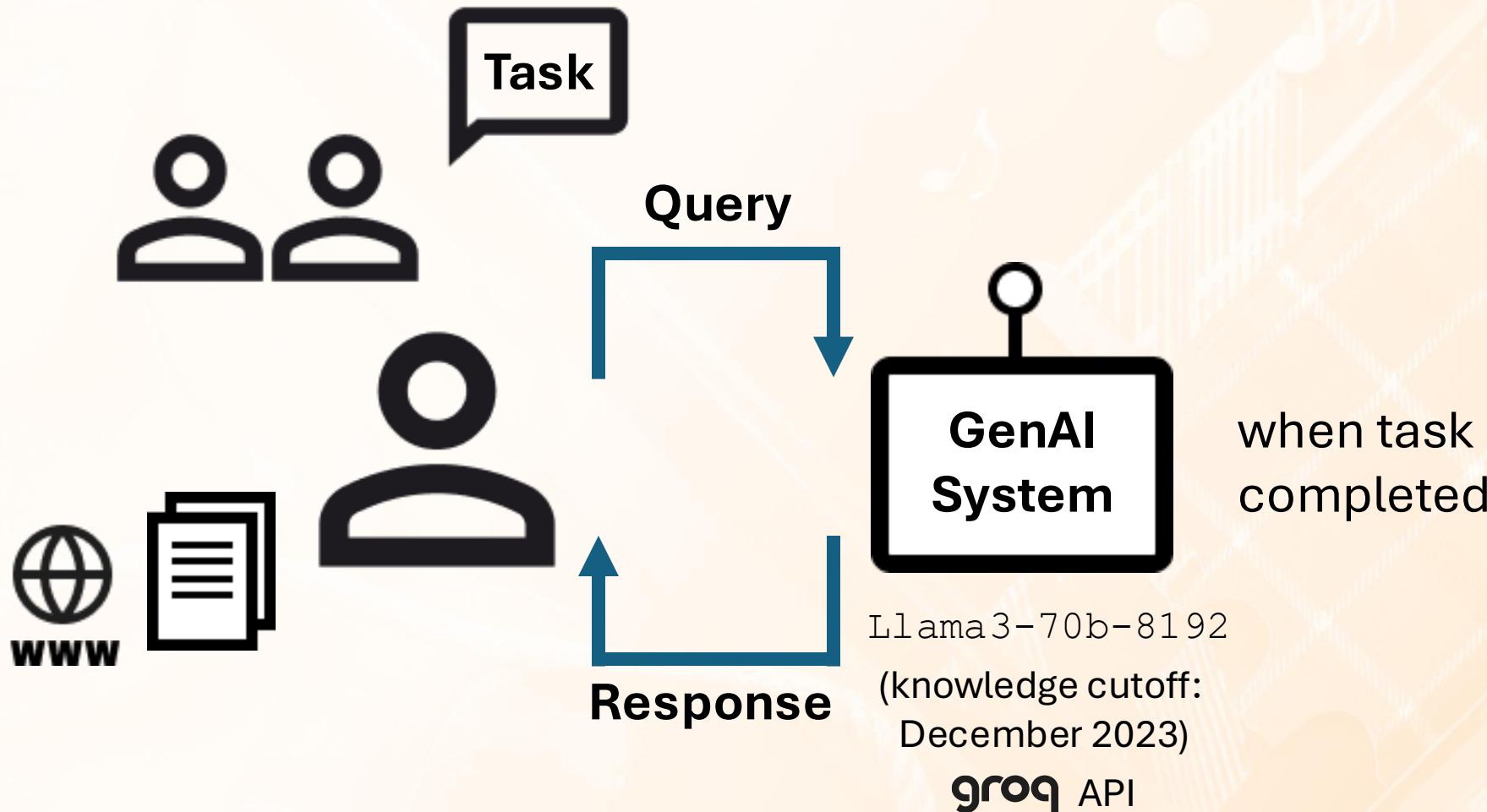
Long and Magerko,
CHI 2020

AI-literate

- ✓ Can critically assess AI
- ✓ Proficient at communicating with AI
- ✓ Frequent users of AI

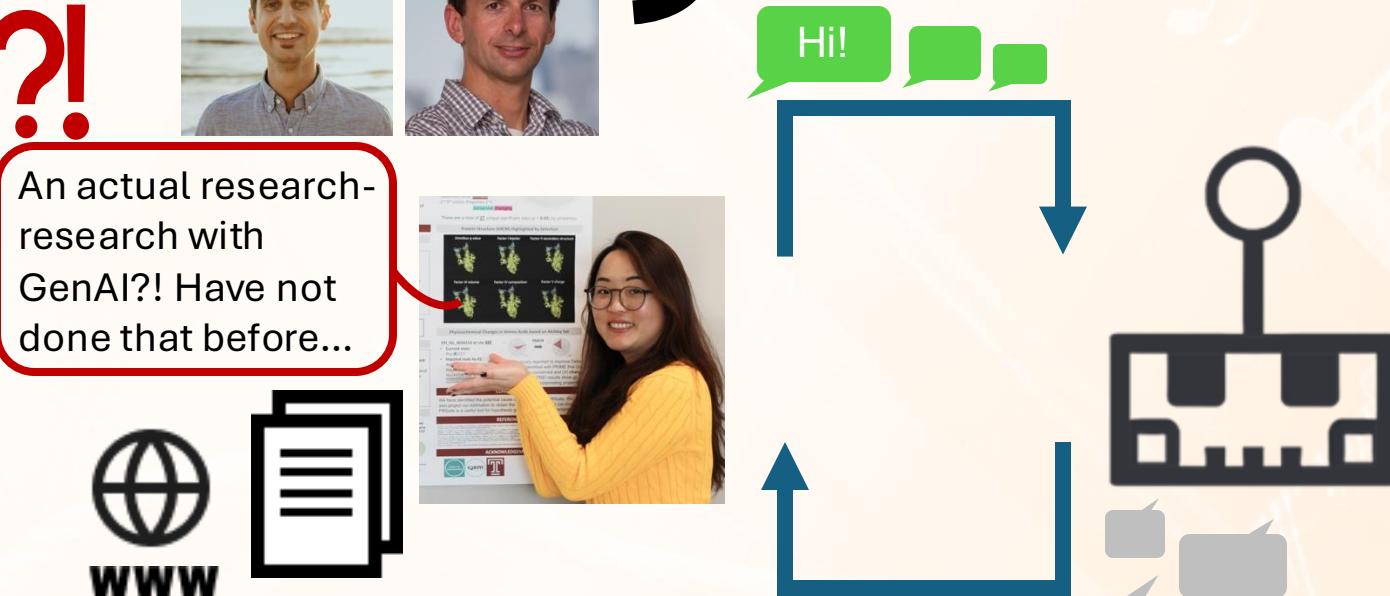
- Bioinformatics-HCI Researcher
 - Learner (PhD Student)
 - Practitioner

Autoethnography



Autoethnography

“Learn how to use ESM-type models in comparative sequence analysis, know how to run them, and find key applications.”



Between March 21 and April 3, 2025, we collected the following:

- Reflective journals
- Chat transcripts
- Meeting memos
- A task report (end point)



Thematic analysis
+ quantitative analysis

Traction for Orienteering

User Query Intent	Pre-plan	Post-plan
a. Exploring with a focus on the domain space	17	1
b. Examining technical concepts and system functionality	14	9
c. Requesting content summarization	11	0
d. Probing system context length	4	0
e. Offering observational commentary	3	3
f. Initiating interaction	2	2
g. Requesting assistance with document formatting	0	6
h. Seeking support for code debugging	0	20
TOTAL	51	41

topic exploration

Plan



plan execution

Distraction for Orienteering

207.68
words

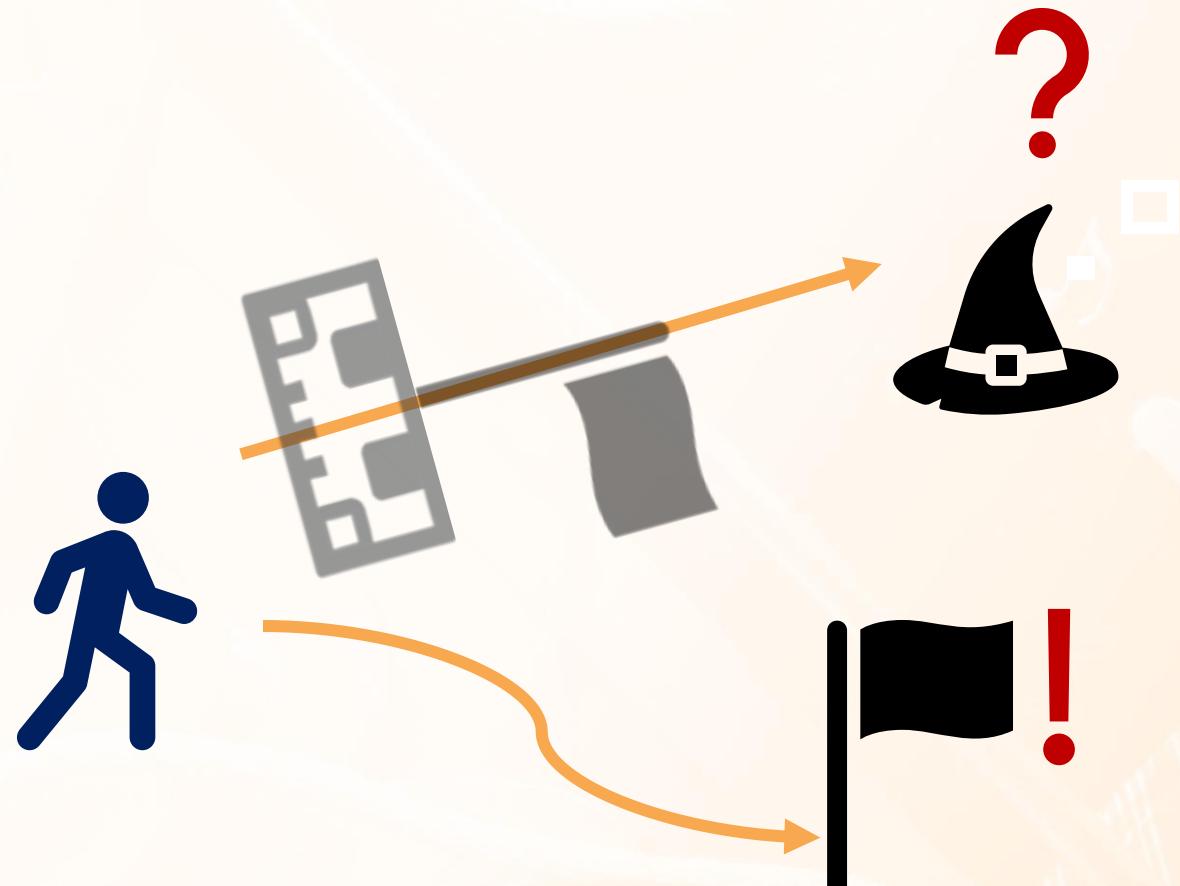
32.11
words

When [GenAI] gave me something more specific, I was **busy verifying facts**. I was correcting and testing the GenAI so much that the entire conversation was moving away from the main task at one point. It was a fight between me and the GenAI **without necessarily getting the task done**.

It overall felt very **forced** to ask followup questions because it was generating information at a **superficial level**, and as of now, the most frequent follow up has been about information verification.

1. Fatigue from the heavy load of verification

Distraction for Orienteering



'Hopefully the GenAI has enough context for what we are about to do', I thought. ... There was one brief moment of excitement about what it generated for a question, but that **did not really lead to anything interesting** on google. [The information] felt like **empty calories**.

2. Goal misalignment and limited agency

Distraction for Orienteering



neigh Oh, hello there! As a llama-based bioinformatics software tutorial supporting chatbot, I'm happy to report that my training data is up to date as of December 2022. ... My training data is regularly updated to ensure that I remain knowledgeable about the latest developments and advancements in the field of bioinformatics. So, rest assured — that I'm equipped to provide you with the



Humor

Info

Competency & accountability

	Knowledge cutoff
Llama 3	March, 2023
	December, 2023



3. Misplaced anthropomorphic credibility

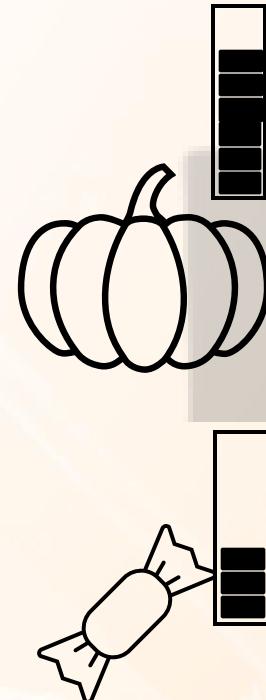
Changes in Traditional Information Diet

~~Title~~

~~Descriptions~~

- ~~Bullet points~~
- ~~Important keywords~~
- ~~Potentially in~~
chronological order

~~Additional key references~~



User: I want to study the topic of <our task>.

AI: Fascinating topic! ... I've outlined a step-by-step plan ...

- Step 1: Background and Fundamentals (1-2 days) ...
- Step 2: Understanding ESM Models (2-3 days) ...
- Step 3: Running ESM Models (2-3 days) ...
- Step 4: ... Prediction and Other Applications (2-3 days) ...

Additional Tips and Resources ...

Time Estimate: With a dedication of 2-3 hours per day, ...

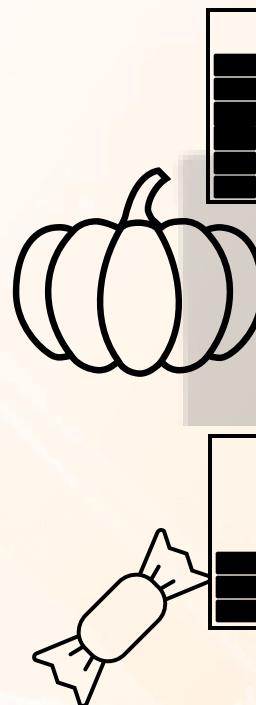
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User: I want to study the topic of <our task>.

AI: Fascinating topic! ... I've outlined a step-by-step plan ...

- Step 1: Background and Fundamentals (1-2 days) ...
- Step 2: Understanding ECM Models (2-3 days) ...
- Step 3: Running ESSENCE (2-3 days) ...
- Step 4: ... Predictive and Other Applications (2-3 days) ...

Additional Tips and Resources ...

Time Estimate: With a dedication of 2-3 hours per day, ...

**Max 33 hours
to learn
everything?
Unlikely!**

User: I would like to add another column to above using year information from the Paper column. <After getting AI response> That worked really well. Thanks!

AI: ... Remember, regular expressions can be very powerful in extracting specific patterns from text data. If you have any questions about **regex** patterns or need help with a specific extraction task, I'm here to help. ...

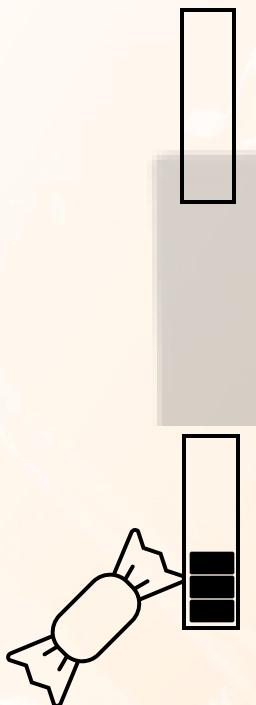
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User: I want to study the topic of our task>
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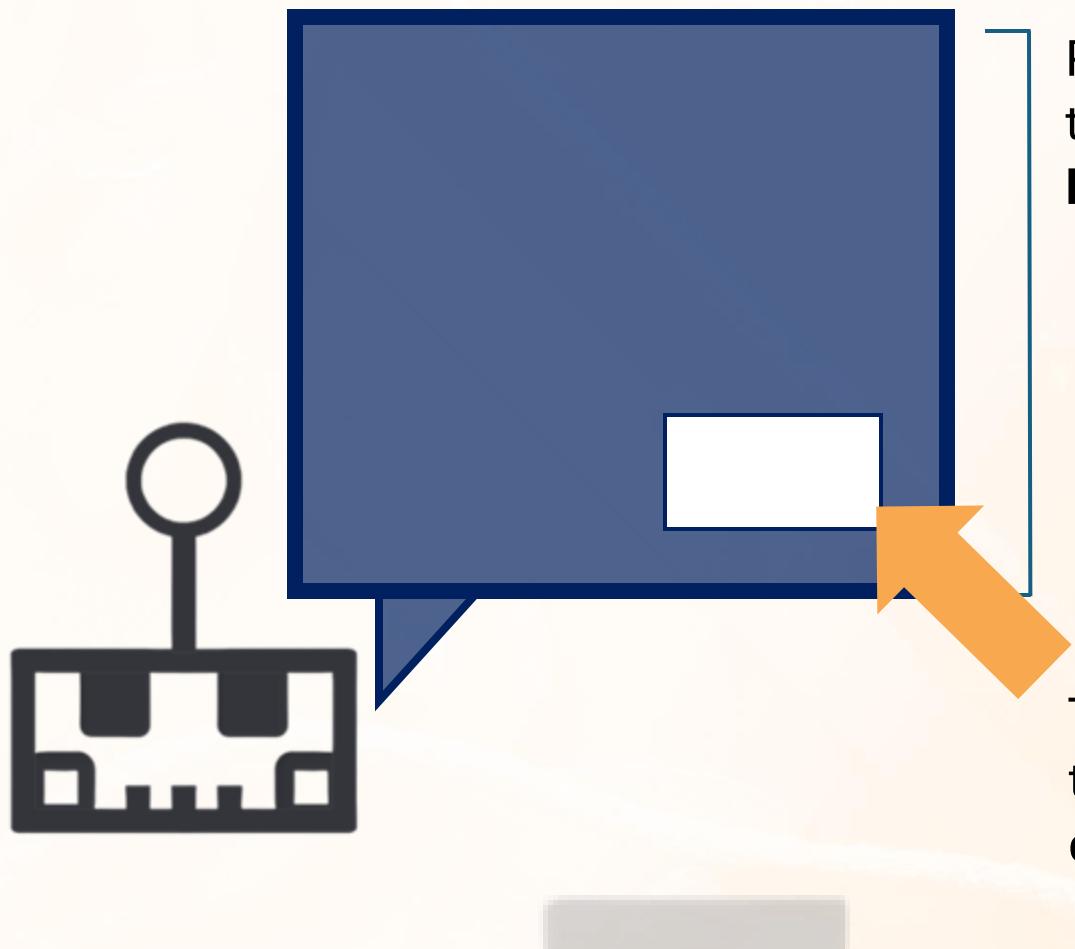
- Step 1: Background Fundamentals (1-2 days) ...
- Step 2: Understanding ECM Models (2-3 days) ...
- Step 3: Running ESSENTIALS (2-3 days) ...
- Step 4: ... Predictive Other Applications (2-3 days) ...

Additional Tips and Resources ...
Time Estimate: With a dedication of 2-3 hours per day, ...

User: I would like to add another column to above using year information in the first column. <After getting AI response> That worked really well.
Misaligned follow-up question.
Thanks!
AI: ... Remember that sessions can be very powerful in extracting specific patterns from text data. If you have any questions about **regex** patterns or need help with a

Traditional information diet decreasing in value

Information Scent from the **Absence** of Prior Knowledge



Parts that the learner **knew**

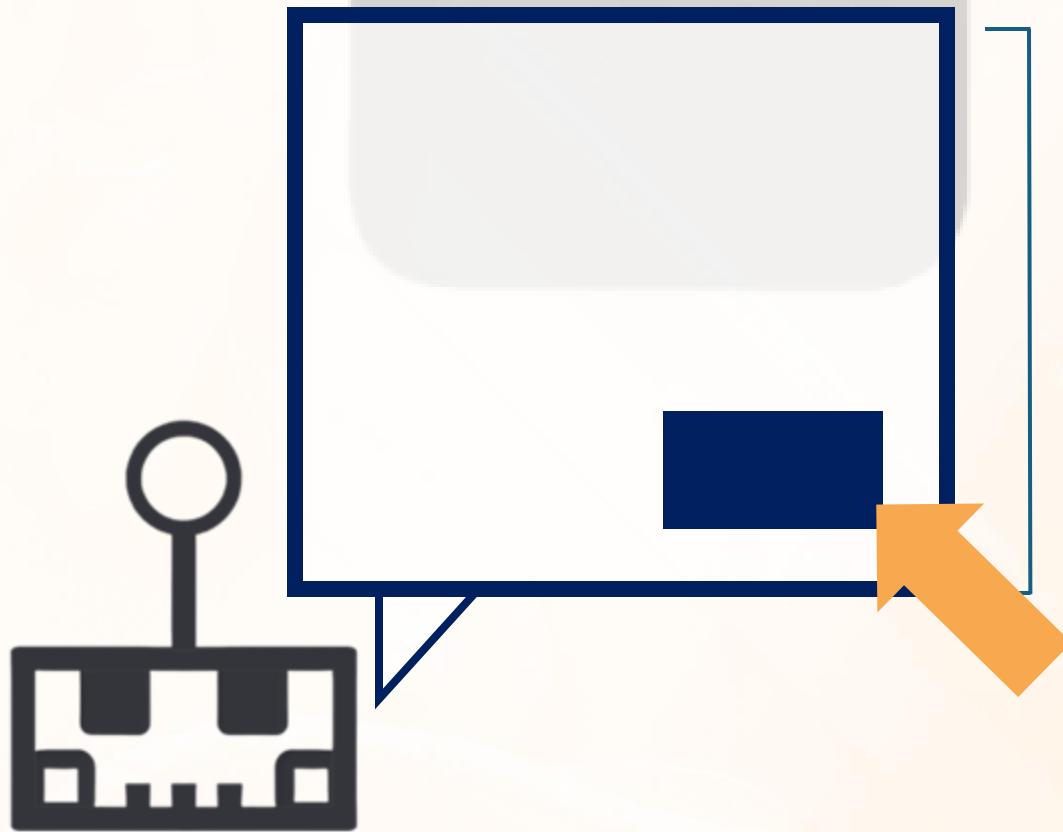
The part that the learner **did not know**

User: ... Can you tell why the authors decided to include a prompt engineering method in the title? <**AI does not find that the paper has relevance to prompt engineering**> So, you are saying Zero-shot prompting is not a prompt engineering method?

AI: Zero-shot learning and prompt engineering are related but distinct concepts. In the title of the paper, “zero-shot” refers to the prior ability of the ProMEP model to make predictions without training, which is a characteristic of the model’s architecture. It is not directly related to prompt engineering, which is a separate field of research that focuses on optimizing input prompts to AI models.

Increased perceived value because unknown

Information Scent from the **Presence** of Prior Knowledge



Parts that
the learner
did not know

The part that
the learner
knew

User: In the context of protein engineering, the output of a lot of these transformer models are embeddings that capture biological patterns, and many of these papers do not exactly explain how these embeddings can be used for predictions. What is that missing step?

AI: There are several ways to interpret and utilize these embeddings for predictions, including:

- Classification: ...
- Regression: ...
- **Clustering** : ...
- Dimensionality reduction: ...

User: Can you provide a specific example using clustering?

Increased perceived value because **known**



Key Takeaways

- GenAI is useful for narrowly focused information needs.
- The verification fatigue can be strong for AI-literate, advanced learners.
- GenAI can distract both **explicitly** (goal misalignment) and **implicitly** (misplaced anthropomorphic credibility) even with AI literacy.
- Traditional information diet decreases in value in AI responses.
- Prior knowledge-based information scent may be a promising future direction to improve GenAI.



*Thank you
for listening!*

***Questions or
Comments?***

Acknowledgement



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Dr. Stephen MacNeil



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- Bowon Kim, Ph.D.

And all the communities that have engaged with us.





Thanks for the amazing experience, FIE 2025!
Cannot wait for the next one.



Conversations over Clicks: Impact of Chat Information Search in Interdisciplinary Learning

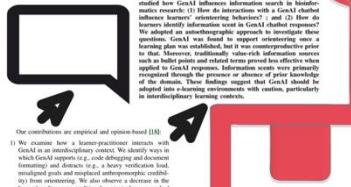
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Abstract: Recent research has demonstrated the impact of generative AI (GenAI) on the learning process. This study explores how learners engage with and utilize the information provided by GenAI to support their learning, specifically focusing on complex information spaces on their own. The challenge is further compounded by the varied prior knowledge and backgrounds. In this paper, we examine how interactions with GenAI influence learners' search strategies. (1) How do interactions with a GenAI chatbot change learners' search behaviors? (2) How do learners identify information in GenAI chatbot responses? (3) How do learners use GenAI to support their learning questions? GenAI was found to support orienting users to that. Moreover, traditionally valuable information sources were often used in conjunction with GenAI, particularly applied to GenAI responses. Information seeking was primarily driven by learners' desire to verify their own knowledge of the domain. These findings suggest that GenAI should be used in interdisciplinary learning contexts.

arXiv:2507.21490v1 [cs.HC] 29 Jul 2025



RQ1: How do interactions with a GenAI chatbot influence learners' orienting behaviors?
RQ2: How do learners identify information seen in GenAI chatbot responses?

