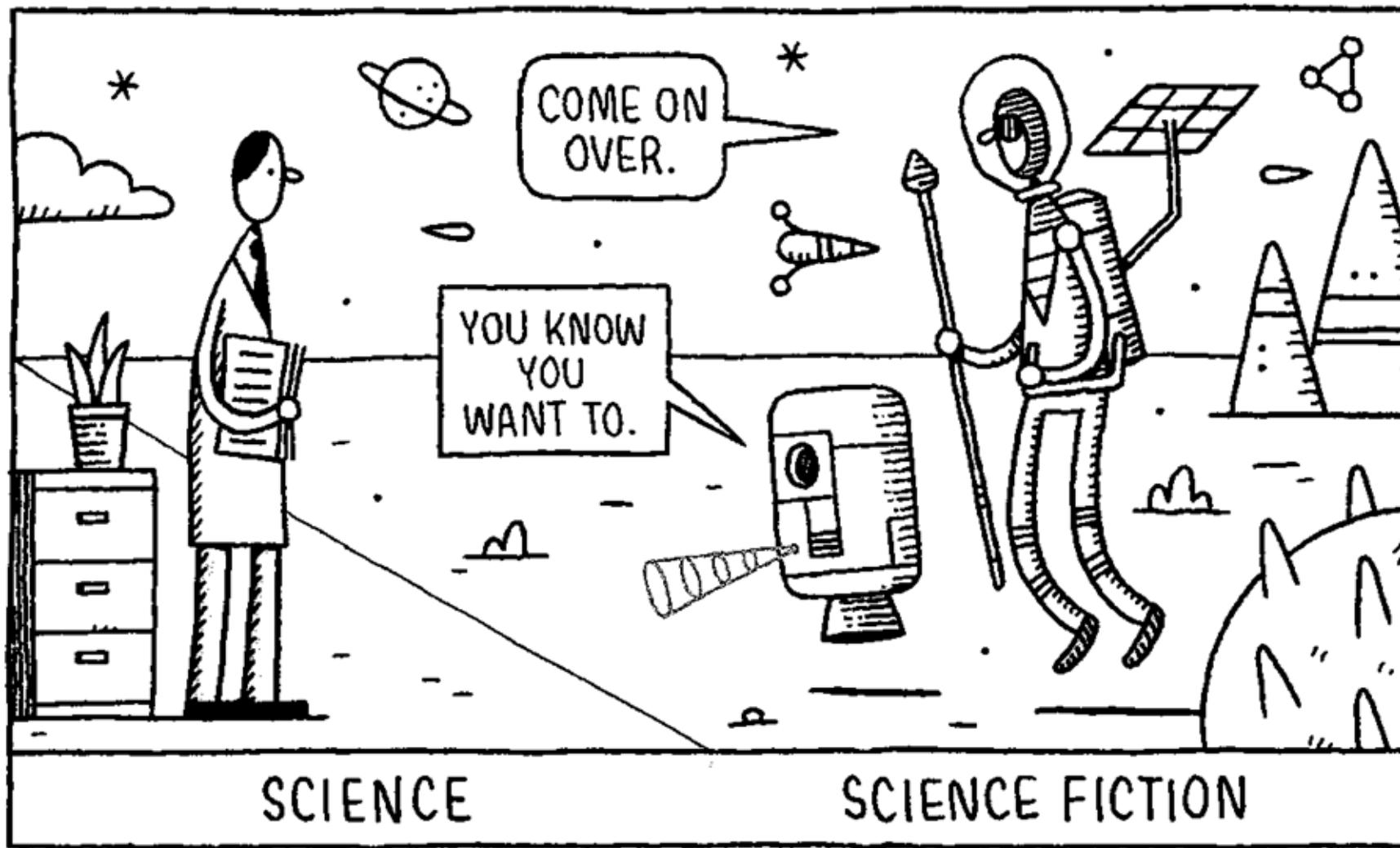


# AUGMENTING IDEATION AND SENSEMAKING IN THE AGE OF LLMs

Concepts, Examples, and Opportunities from an HCI Perspective

as told by Gonzalo Ramos  
[goramos@microsoft.com](mailto:goramos@microsoft.com)



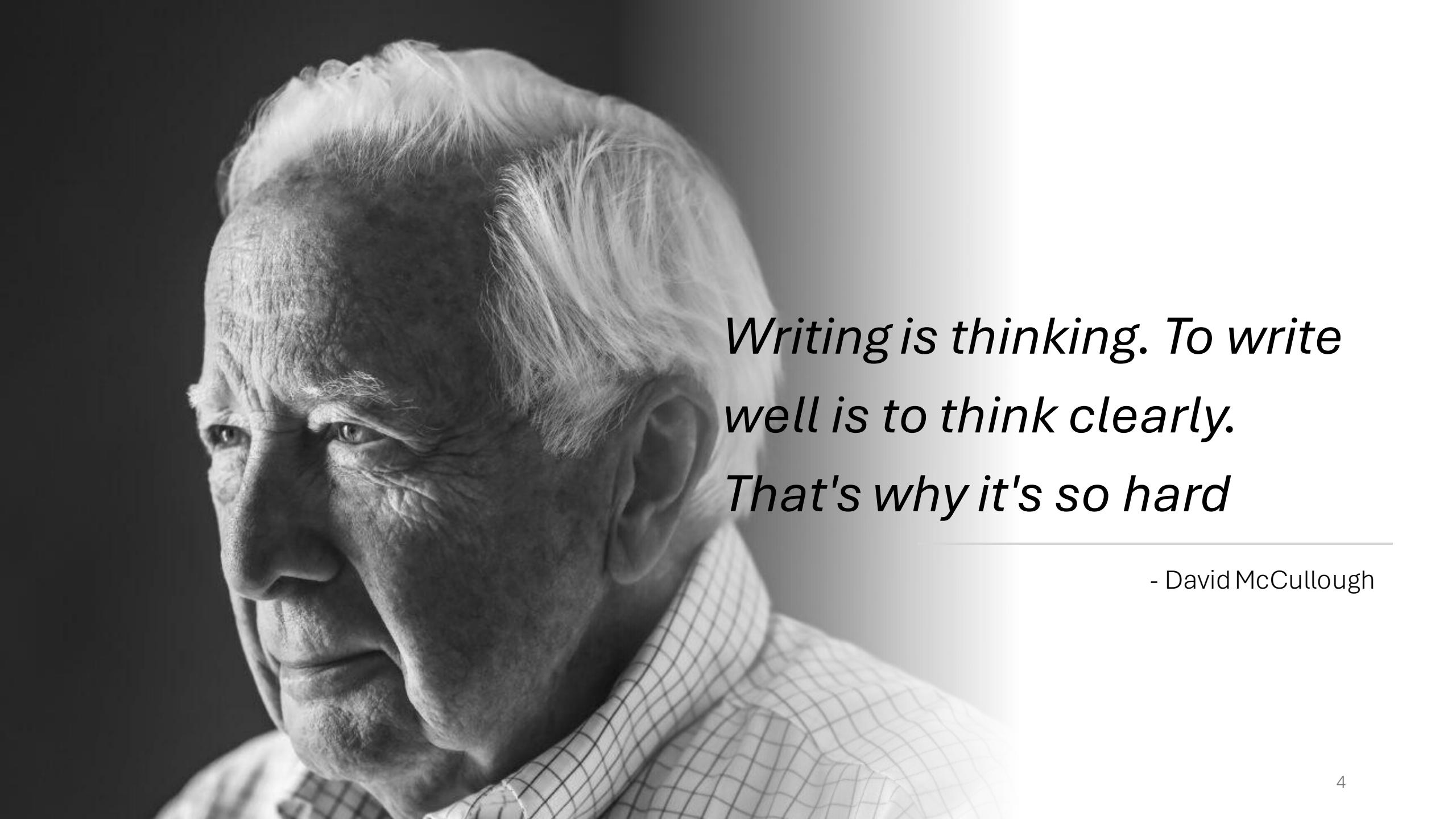
TOM GAULD for NEW SCIENTIST

*What a computer is to me, is it's the  
most remarkable tool that we've ever  
come up with, and it's the equivalent of a  
bicycle for our minds.*

---

- Steve Jobs





*Writing is thinking. To write  
well is to think clearly.  
That's why it's so hard*

---

- David McCullough

# IN THIS LECTURE...

- Frameworks to help us think about augmenting thinking
- Sensemaking & its augmentation opportunities
- Ideation / creativity & its augmentation opportunities
- Main takeaways and provocations

(with follow-up activities!)

# ON THE DIFFERENT TYPES OF THINKING

(a non-exhaustive list)

Diverge

Reflect

Recall

Plan

Converge

...



# DISTRIBUTED COGNITION – Hutchins et al.

A primer

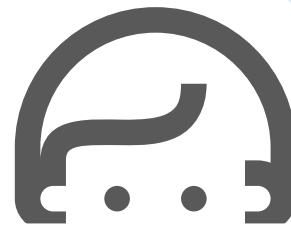
Cognition is distributed across people, artifacts & the environment.

Some key perspectives

- There are internal and external media
- Involve the propagation of states across participants
- Knowledge in these systems is resilient (redundant)

Hollan, J., Hutchins, E.L., & Kirsh, D. (2000). Distributed cognition: toward a new foundation for human-computer interaction research. ACM Trans. Comput. Hum. Interact., 7, 174-196.

Rogers, Y. (1997). A brief introduction to Distributed Cognition.



# THE EXTENDED MIND – Clark & Chalmers

A primer

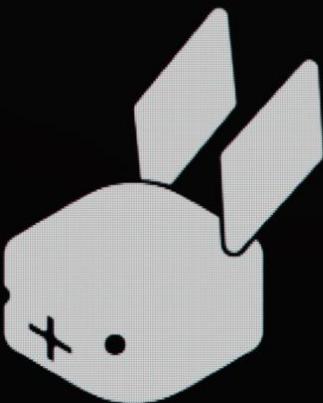
When external elements can become part of the cognitive system.

This happens when they...

- Are a constant and reliable presence.
- Are directly, easily available.
- Are automatically endorsed, trusted when accessed.
- Have been consciously endorsed in the past.



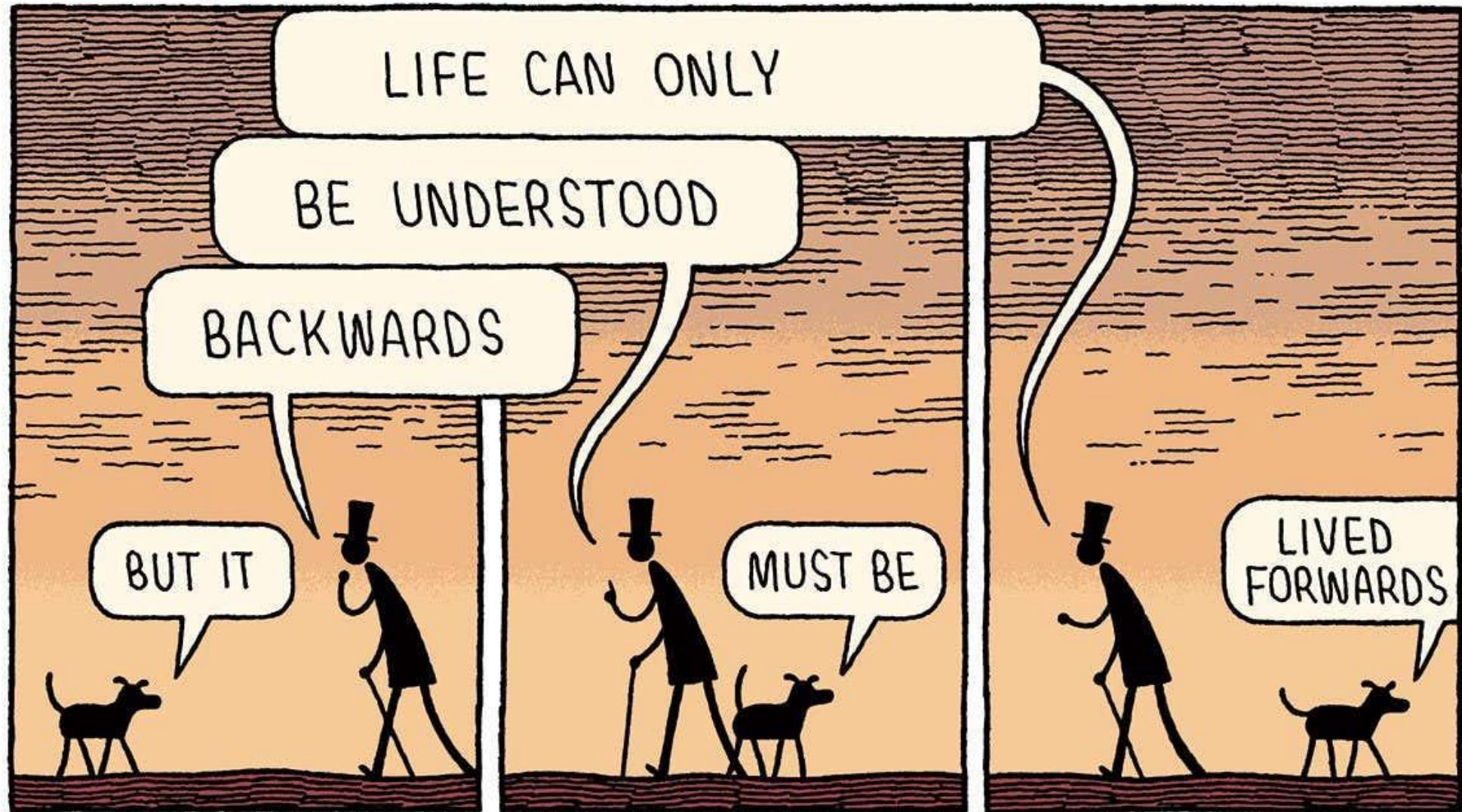




Introducing *Frame*  
**Multimodal AI Glasses**



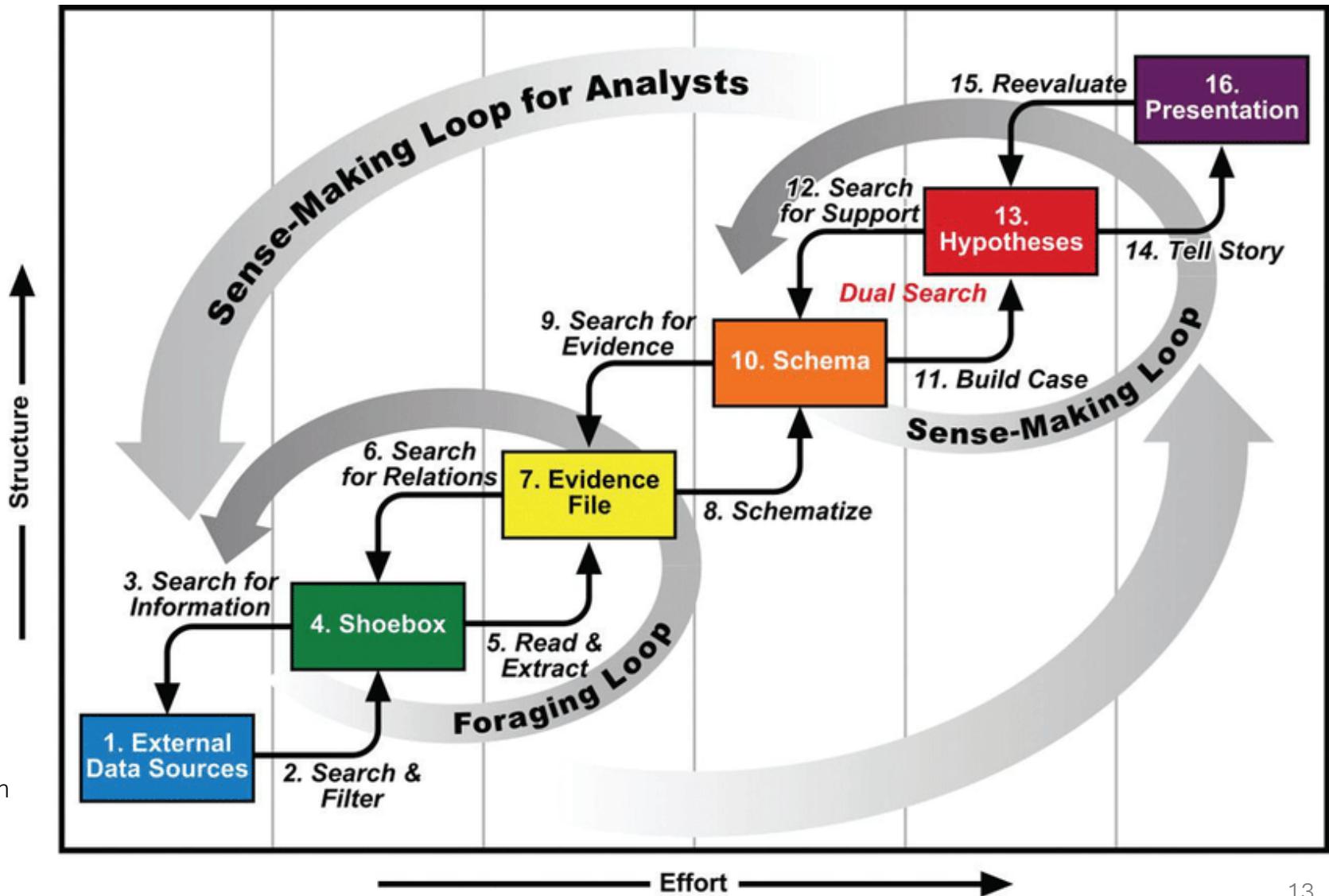
SØREN KIERKEGAARD, 1843



TOM GAULD for NEW SCIENTIST

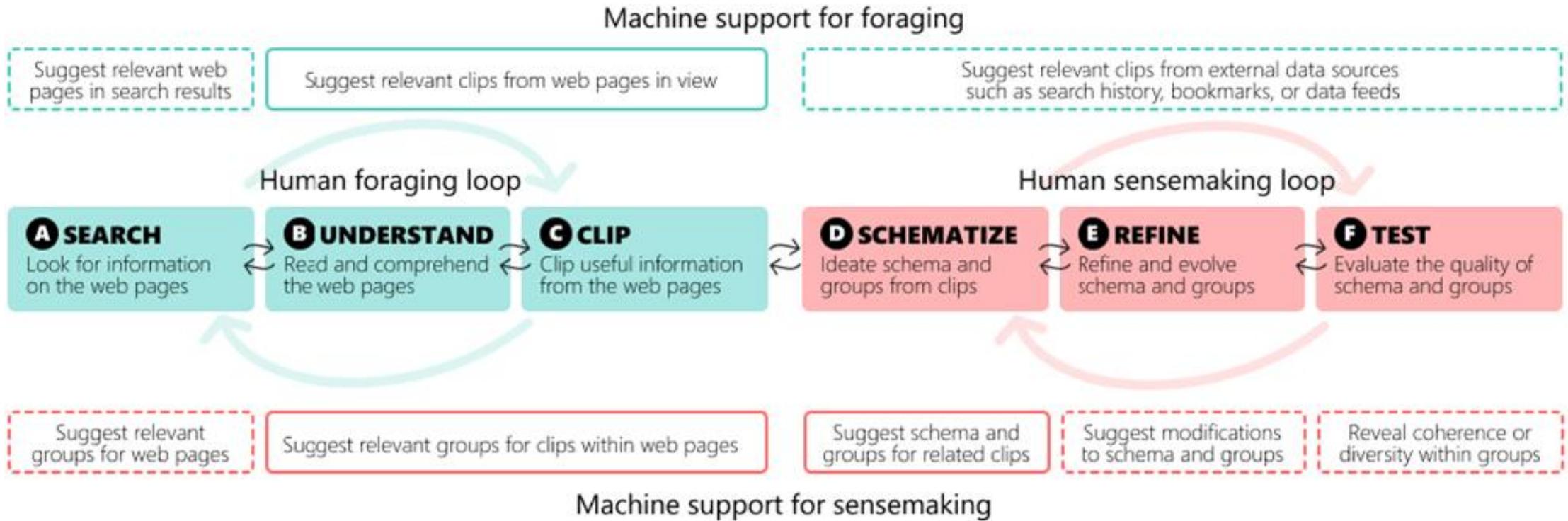
# SENSEMAKING

# A MAP OF SENSEMAKING



Pirolli, P., & Card, S. (2015). The Sensemaking Process and Leverage Points for Analyst Technology as Identified Through Cognitive Task Analysis.

# SENSEMAKING: AUGMENTATION OPPORTUNITIES



Ramos, G.A., Rachatasumrit, N., Suh, J., Ng, R., & Meek, C. (2022). ForSense: Accelerating Online Research Through Sensemaking Integration and Machine Research Support. ACM Transactions on Interactive Intelligent Systems, 12, 1 - 23.

63

200

2000

[View details](#) | [View source code](#)

gross domestic product rose 3.1% in 2013, up from 2.7% in 2012. The economy is still recovering from the financial crisis, which hit the eurozone particularly hard.

Важно, чтобы они не были слишком размытыми. Правда, некоторые документы лучше читать в электронном виде.

May 2000, *Journal of the American Statistical Association*, Vol. 95, No. 450, pp. 107-118.

**Project Start** indicates Project Window is  
already open for project creation. It can be  
offered instead of **File > New**.

[View Details](#) [Edit](#) [Delete](#)

Highly developed, often referred to as "best".  
However, for research it's quite impractical.  
Because of "noise" from varying from 0 to 1.

Table 1

1124

**Open-File Report**

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the copyright owner. Further reproduction  
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In support, this panel will bring together members from Australia, Canada, Germany, Japan, Italy, France, Switzerland, and the United States to examine a common

## Additional

[View details](#)

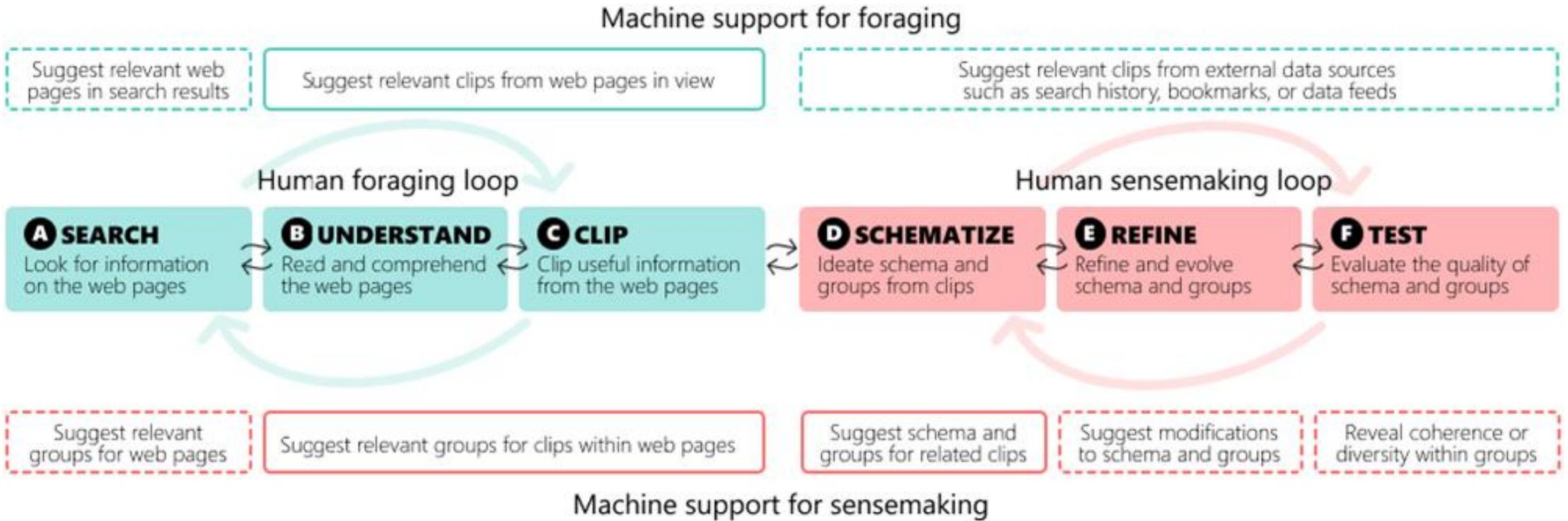
**11.4** Determining Economic Break-Even: \$2.5 million of \$300/year "locked-in" equipment & 10% maintenance on half of a license fees from 100 base stations (assume each base station \$10,000).

Big Apple Books, 1000 Broadway, New York, NY 10036, 212-727-0100, fax 212-727-0101, e-mail: [bigapple@bigapplebooks.com](mailto:bigapple@bigapplebooks.com), Web site: [www.bigapplebooks.com](http://www.bigapplebooks.com)

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The more you try to keep an issue from becoming more widely known, the more it will spread.

# SENSEMAKING: AUGMENTATION OPPORTUNITIES



Ramos, G.A., Rachatasumrit, N., Suh, J., Ng, R., & Meek, C. (2022). ForSense: Accelerating Online Research Through Sensemaking Integration and Machine Research Support. ACM Transactions on Interactive Intelligent Systems, 12, 1 - 23.

# SENSEMAKING AUGMENTATION AS A DESIGN PROBLEM

How might we...

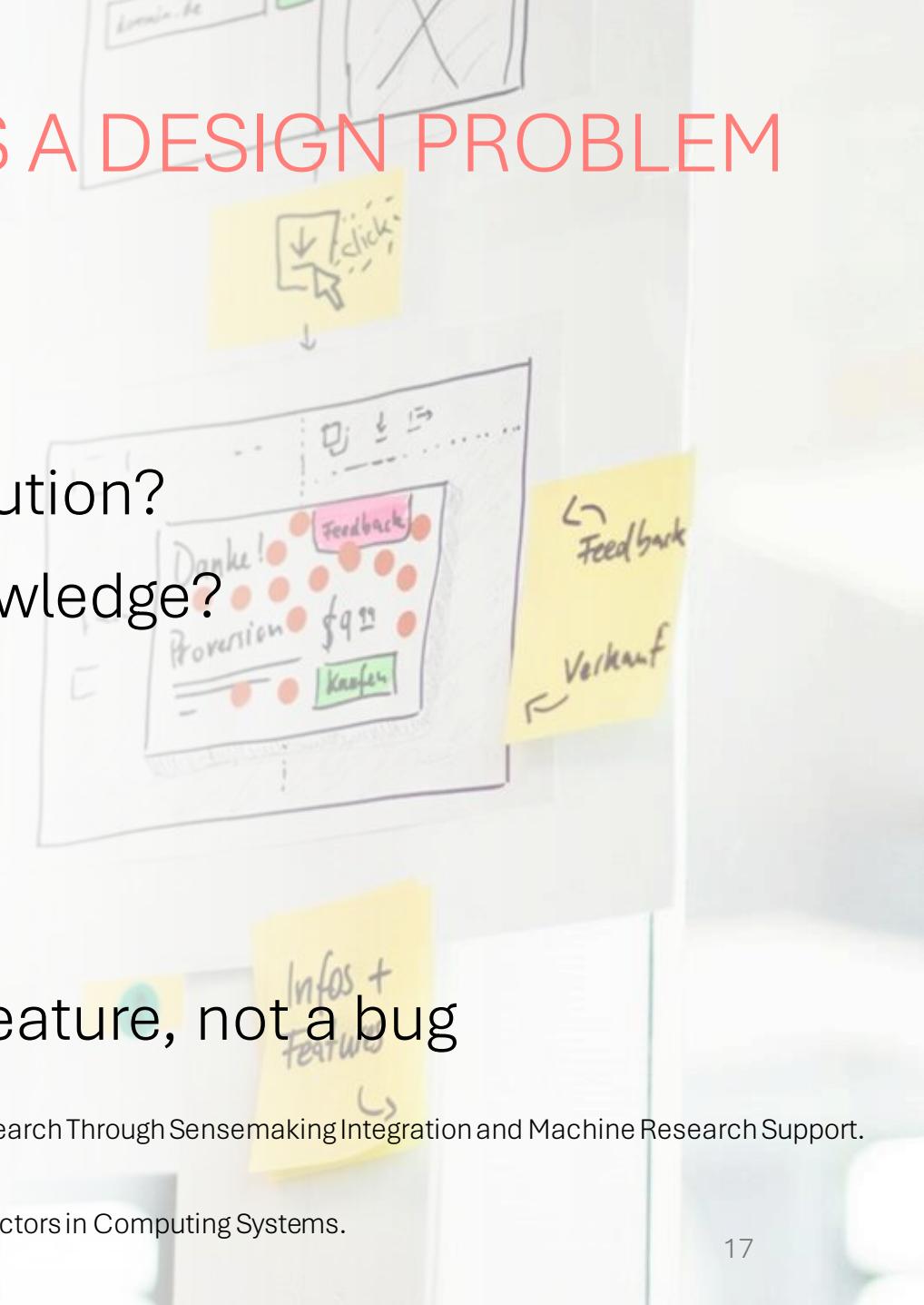
- Balance people & machine agencies?
- Reduce the gulfs of evaluation and execution?
- Support people's willingness to give knowledge?

We...

- Complement, do not replace
- Blend into the flow, do not break it
- Prediction/Completion errors can be a feature, not a bug

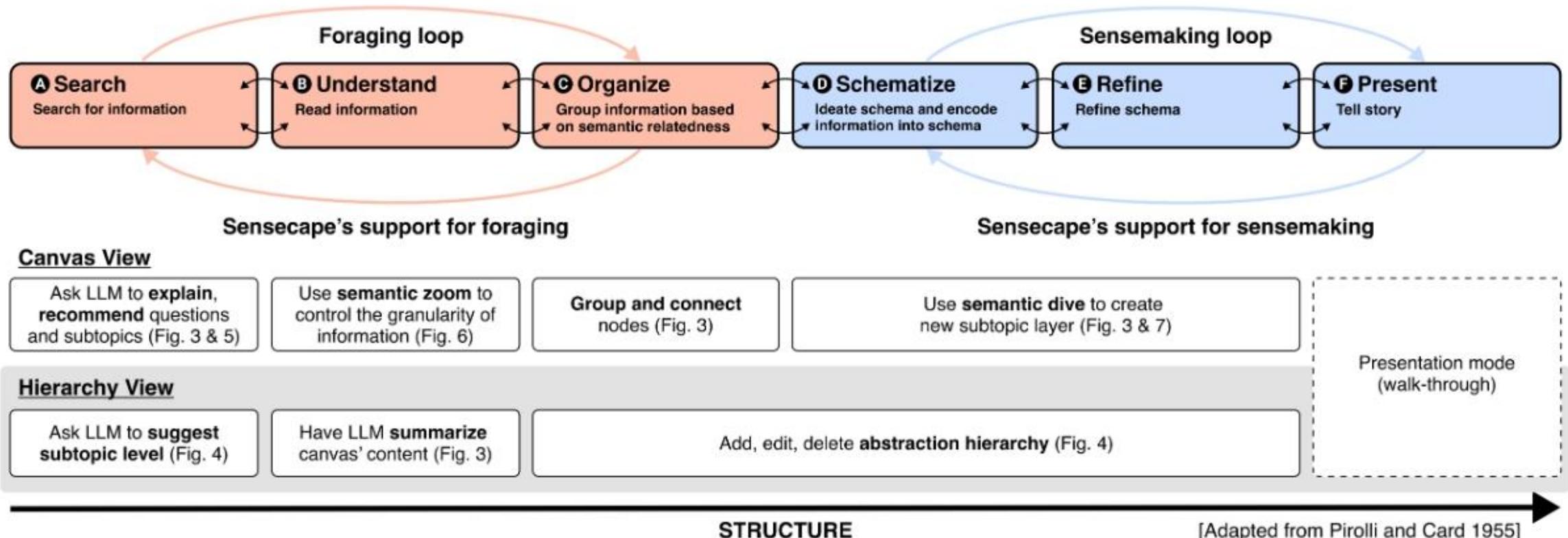
Ramos, G.A., Rachatasumrit, N., Suh, J., Ng, R., & Meek, C. (2022). ForSense: Accelerating Online Research Through Sensemaking Integration and Machine Research Support. ACM Transactions on Interactive Intelligent Systems, 12, 1 - 23.

Horvitz, E. (1999). Principles of mixed-initiative user interfaces. International Conference on Human Factors in Computing Systems.



# SENSEMAKING AUGMENTATION OPPORTUNITIES

Another example



Suh, S., Min, B., Palani, S., & Xia, H. (2023). Sensecape: Enabling Multilevel Exploration and Sensemaking with Large Language Models. Proceedings of the 36th Annual ACM Symposium on User Interface Software and Technology.

# Sensecape

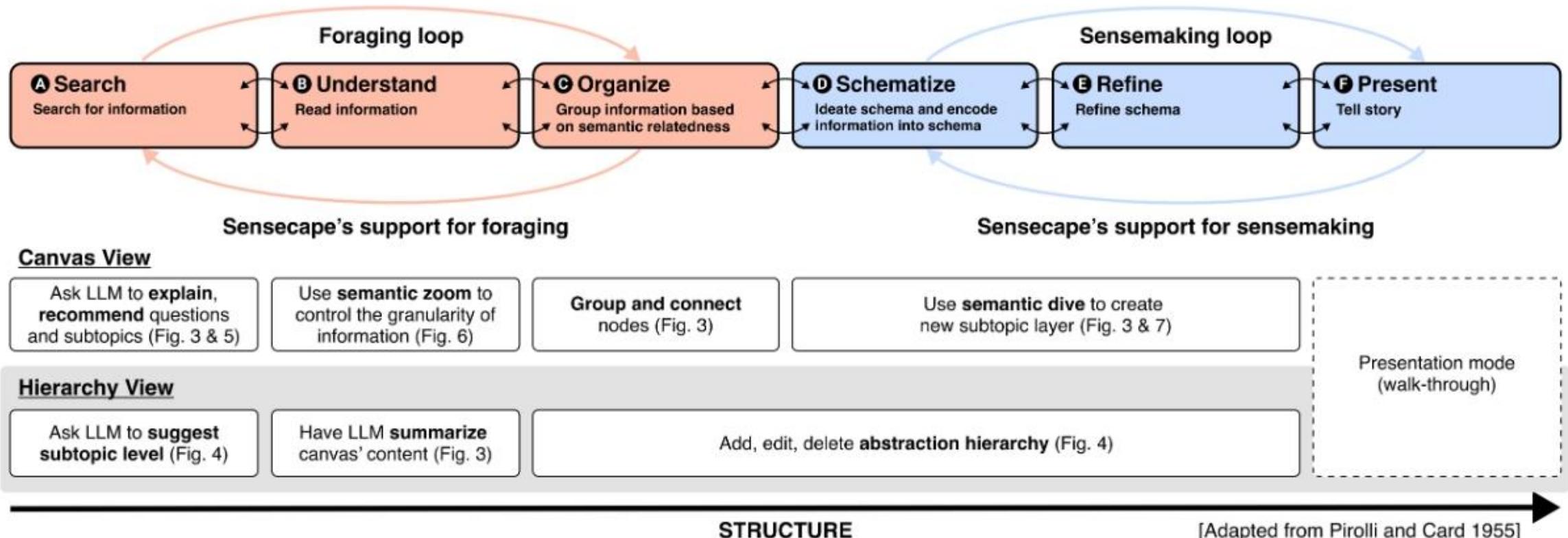
**Enabling Multilevel Exploration and Sensemaking  
with Large Language Models**

**[creativity.ucsd.edu/ai](http://creativity.ucsd.edu/ai)**

**Creativity Lab** University of California San Diego

# SENSEMAKING AUGMENTATION OPPORTUNITIES

Another example



Suh, S., Min, B., Palani, S., & Xia, H. (2023). Sensecape: Enabling Multilevel Exploration and Sensemaking with Large Language Models. Proceedings of the 36th Annual ACM Symposium on User Interface Software and Technology.

# ACTIVITIES

## # Sensemaking

Define a set of documents to work with:

- Bookmarks
- browsing history
- Open tabs

Make sense, meaning...

- Propose Schema
- Given schema, organize documents
- Given schema + documents, communicate story/insights
- ...

# TECH GENIUS

THIS POOR WRITER  
IS STRUGGLING.  
I MUST HELP!

I'M FINE  
THANKS.



WHAT YOU NEED IS AN  
A.I. THAT DOES THE  
WRITING FOR YOU!

NO, I DON'T.  
I LIKE WRITING.



LATER:

SURPRISE!  
I BUILT AN  
A.I. FOR YOU.

BUT IT'S JUST  
CHURNING OUT  
DERIVATIVE DRIVEL.

ALL AT THE TOUCH  
OF A BUTTON!



HOW DO I  
MAKE IT STOP?!

IT NEVER  
STOPS!  
YOU'RE  
WELCOME!

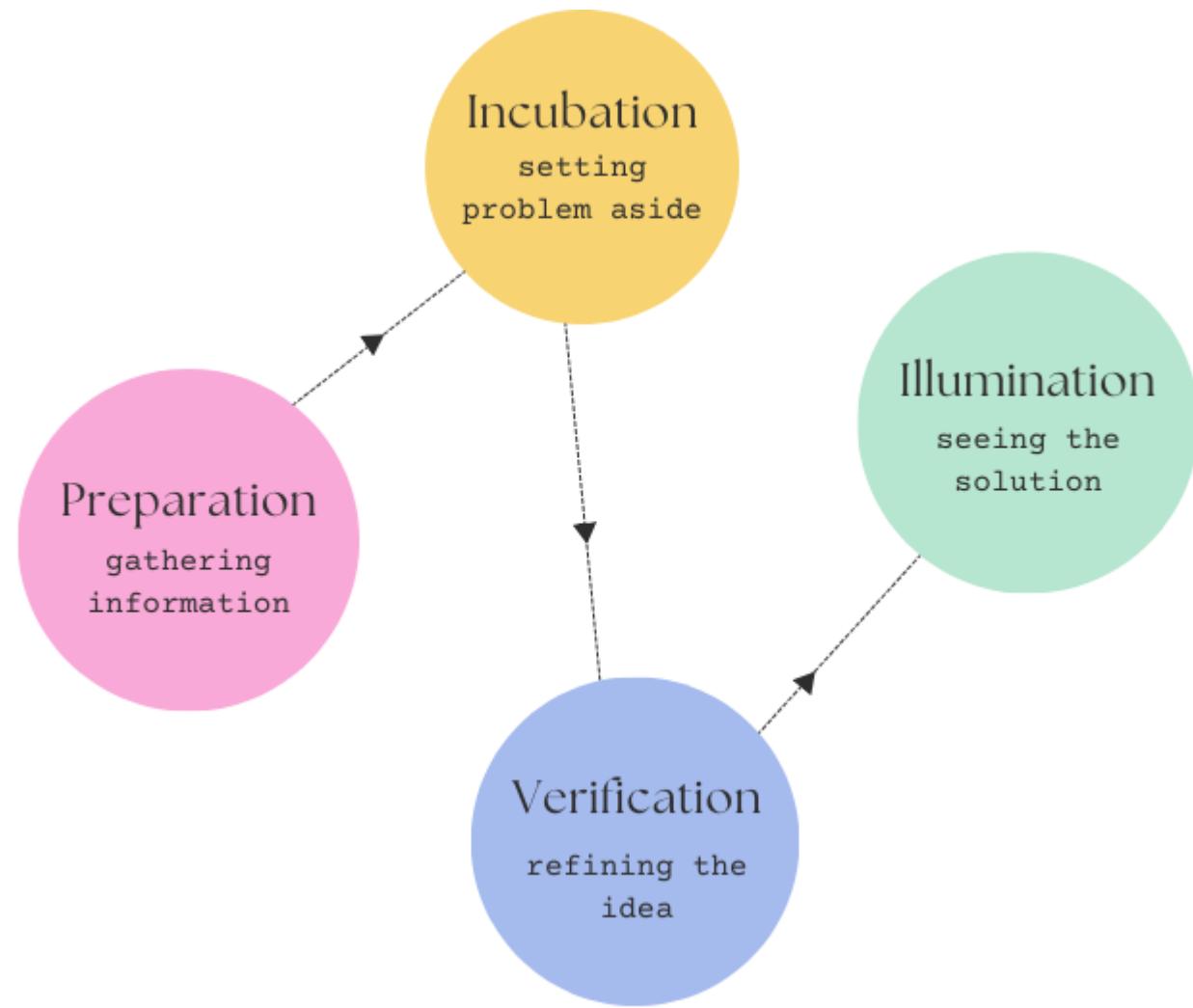


TOM GAULD

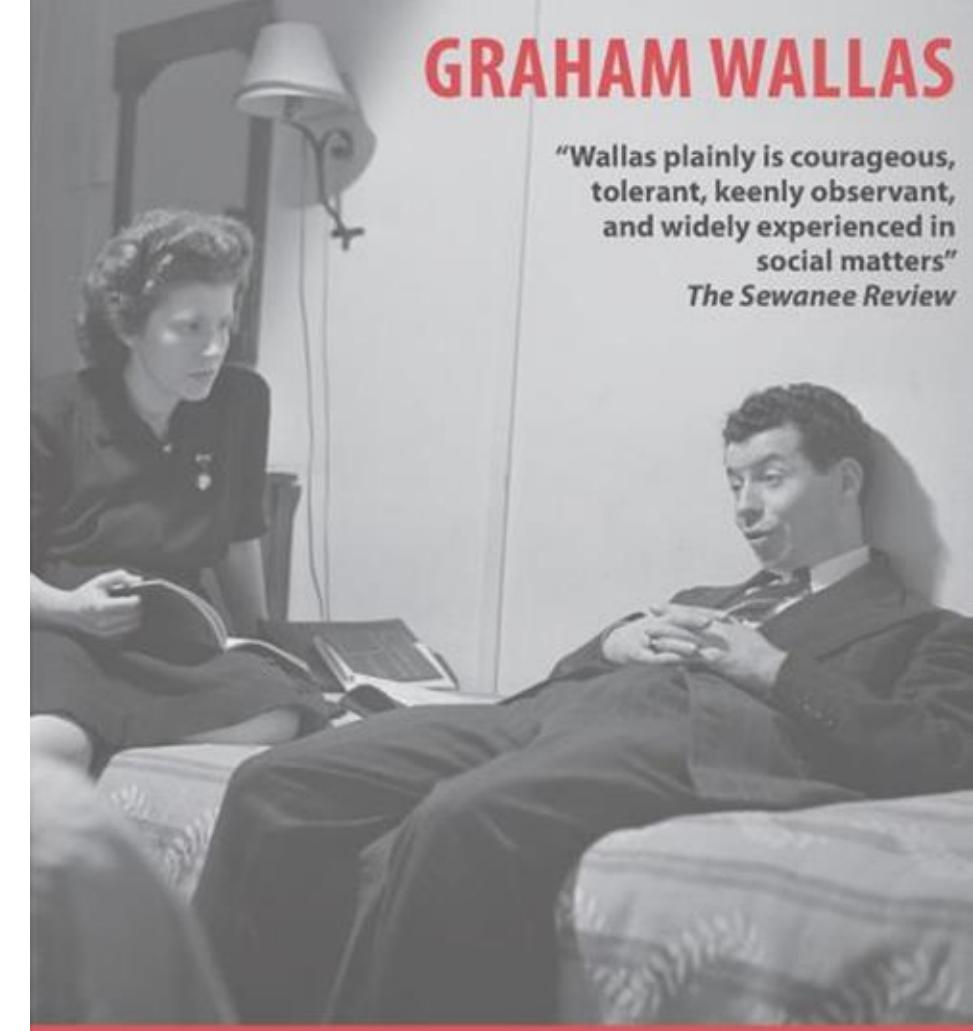
# IDEATION / CREATIVITY

# GRAHAM WALLAS

## CREATIVITY AS A PROCESS

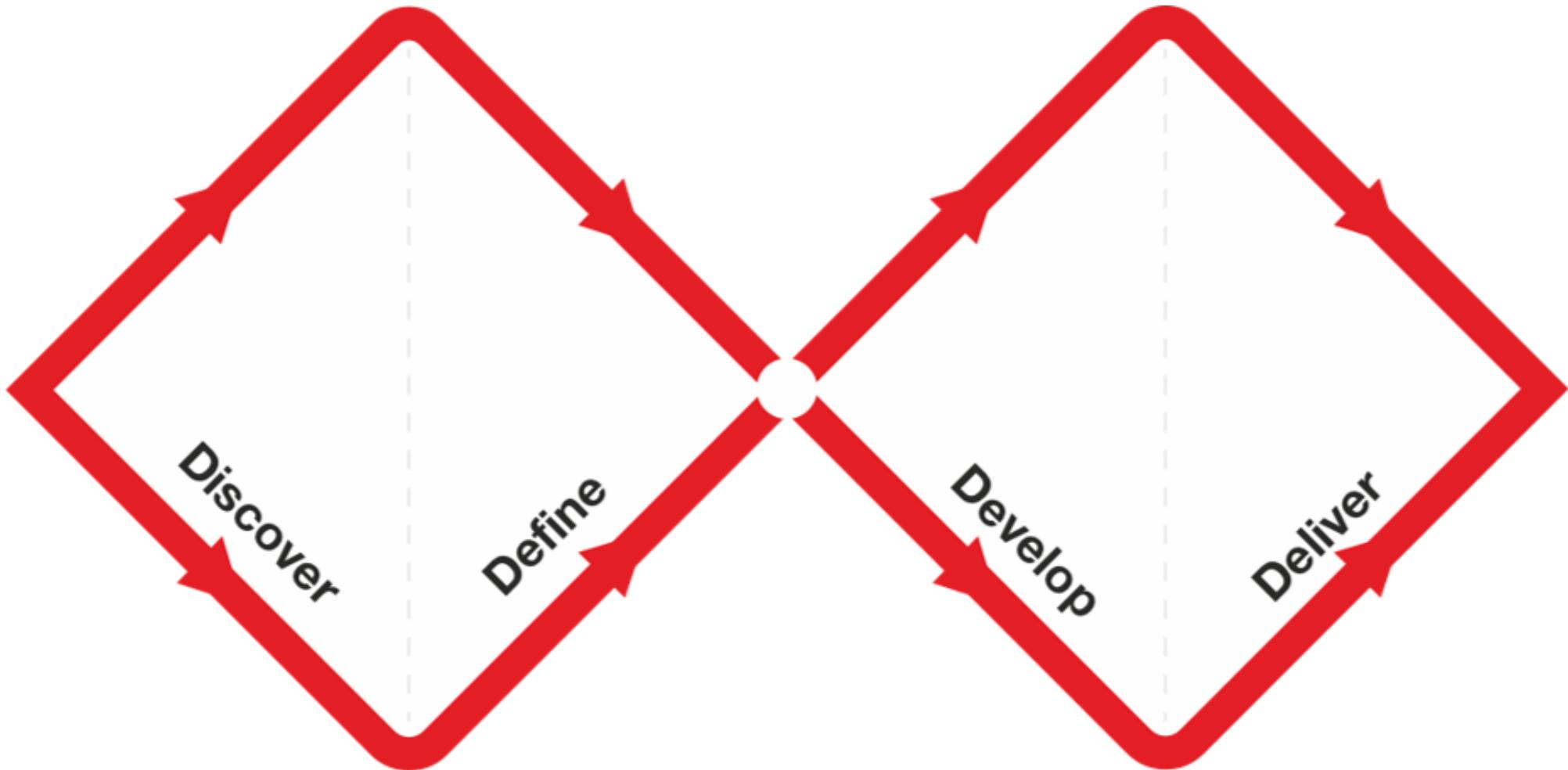


[The Art of Thought: A Pioneering 1926 Model of the Four Stages of Creativity – The Marginalian](#)



*The Art of  
THOUGHT*

# CREATIVITY AS A PROCESS (cont.)



<https://www.designcouncil.org.uk/our-resources/the-double-diamond/>

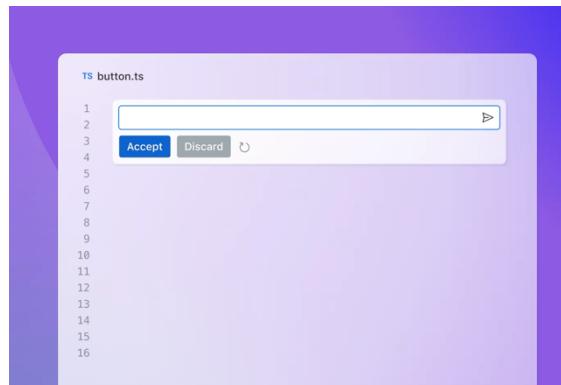
Shneiderman, B. (2007). Creativity support tools: accelerating discovery and innovation. Commun. ACM, 50, 20-32.

# AI + CREATIVITY = DISRUPTION



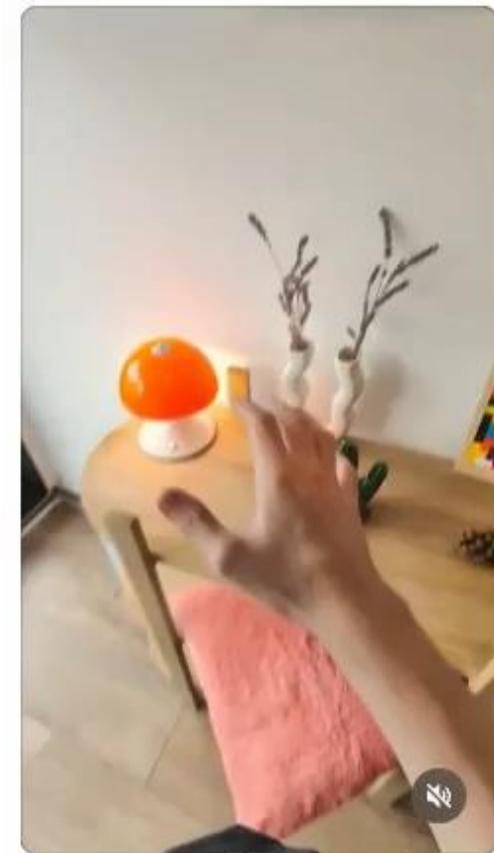
Untitled

+ :: Press 'space' for AI, '/' for commands...



We, the undersigned members of the artist and songwriting communities, call on AI developers, technology companies, platforms and digital music services to cease the use of artificial intelligence (AI) to infringe upon and devalue the rights of human artists.

Make no mistake: we believe that, when used responsibly, AI has enormous potential to advance human creativity and in a manner that enables the development and



## ***How A.I. Tools Could Change India's Elections***

Avatars are addressing voters by name, in whichever of India's many languages they speak. Experts see potential for misuse in a country already rife with disinformation.

Share full article



25

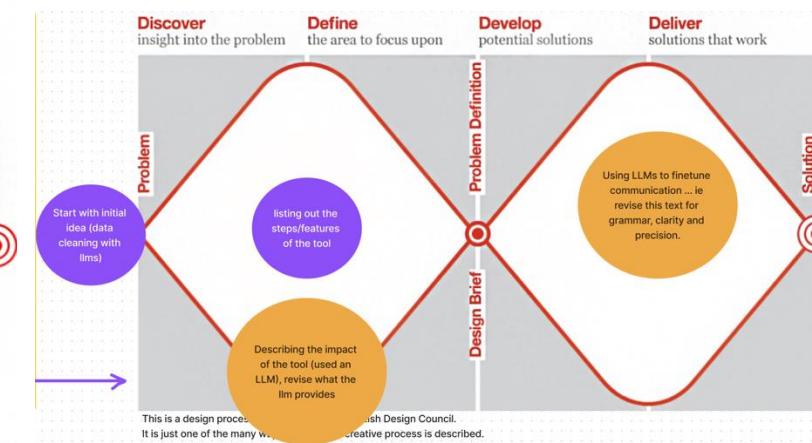
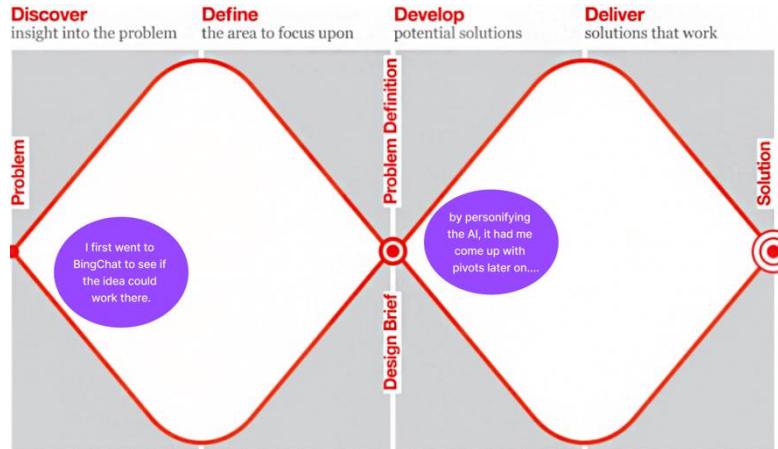
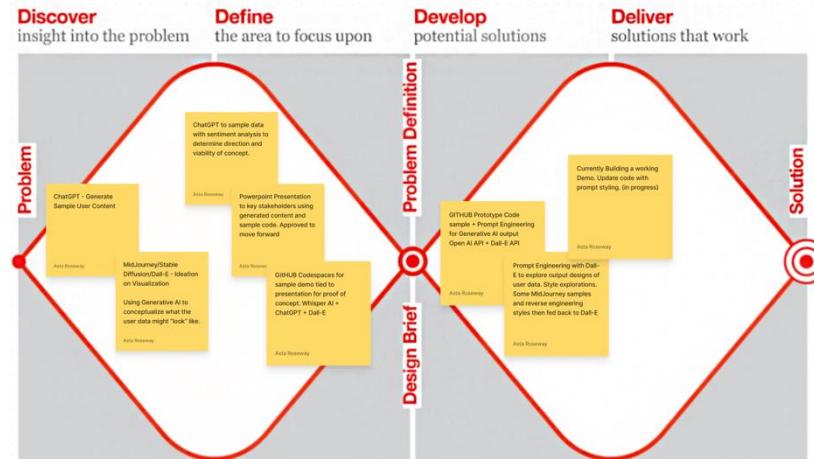
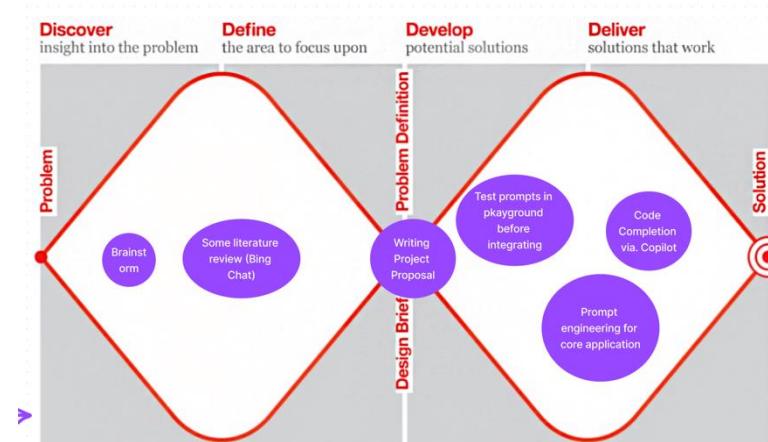
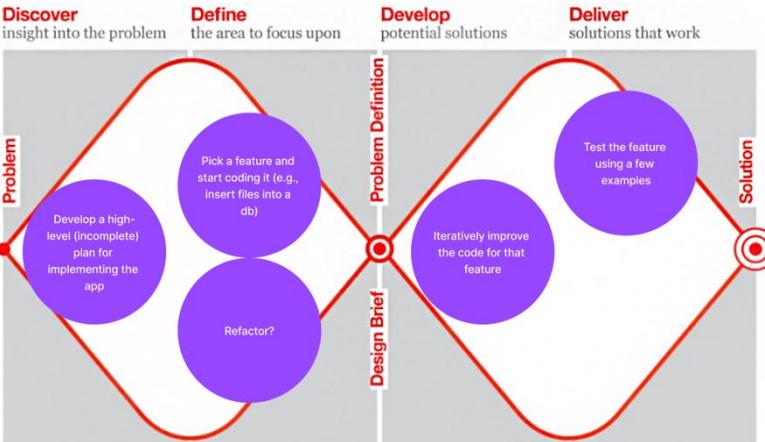
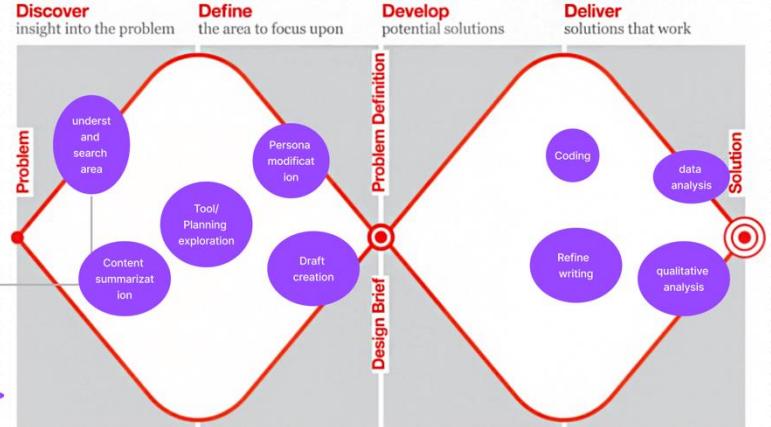
578

18

66



# MAPPING OPPORTUNITIES FOR AUGMENTED IDEATION

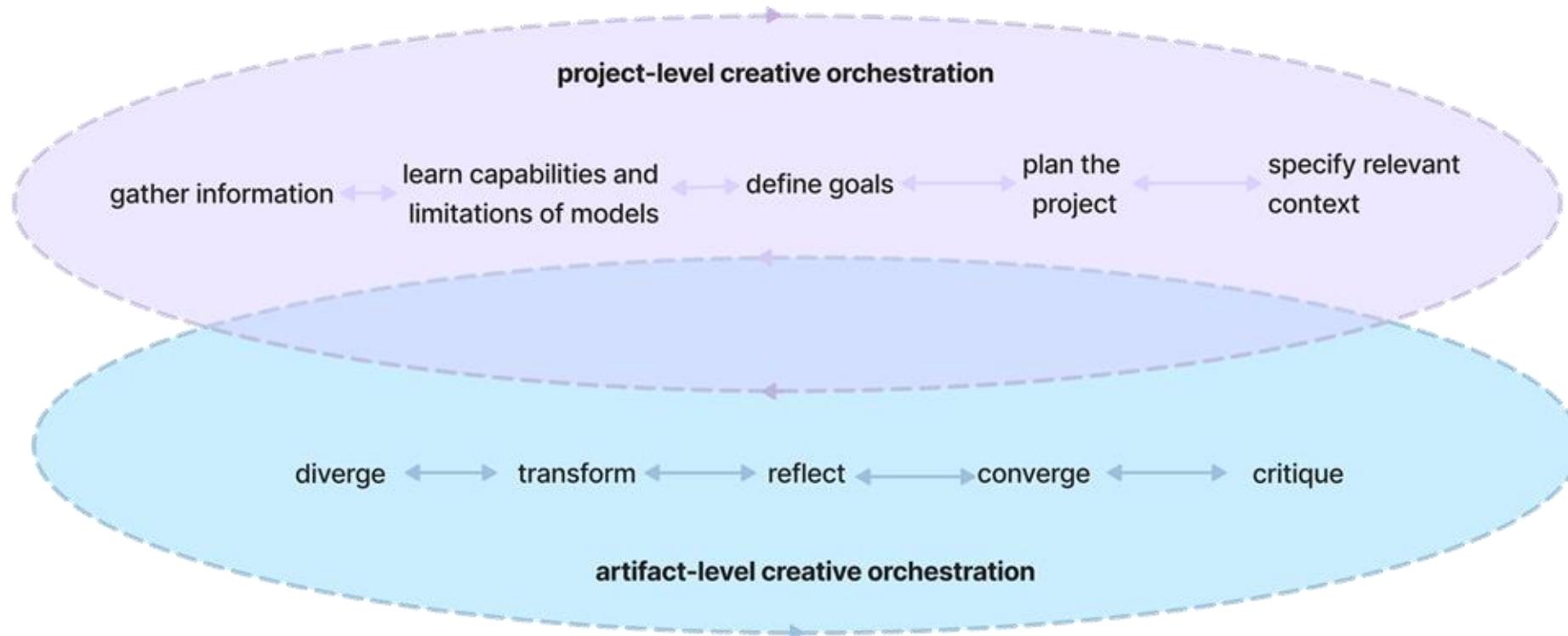


# MAPPING OPPORTUNITIES FOR AUGMENTED IDEATION



# OPPORTUNITIES FOR AUGMENTED IDEATION

## Orchestration Loops



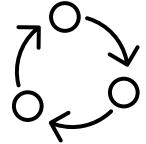
# OPPORTUNITIES FOR AUGMENTED IDEATION

## OBSERVED CHALLENGES

- Articulating creative goals
- Information and context loss (fragmented ecosystem)
- Checking alignment of goals with GenAI outputs

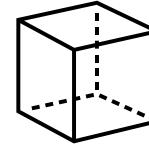
# OPPORTUNITIES FOR AUGMENTED IDEATION

## PROCESS



- Goal formulation
- Task decomposition
- Context specification
- Focus regulation

## ARTIFACTS



- Divergence
- Reflection
- Convergence
- Analysis / Critique
- Communication

# DESIGN PRIORITIES TO CONSIDER

Until we find better ones...

- Protect focus
- Provide agency for flow
- Augment AND protect thinking
- Provide rich ways to specify context and intent
- Have in-the flow orchestration operations
- Embrace technical limitations



## My Workbook

home

[+ Add page](#)

## My Context

- me
- Instructions - Project and Deliverables
- Personal\_Fitness\_Tracker

[Add new... ▾](#)

## Project Roadmap.

### Project Goals

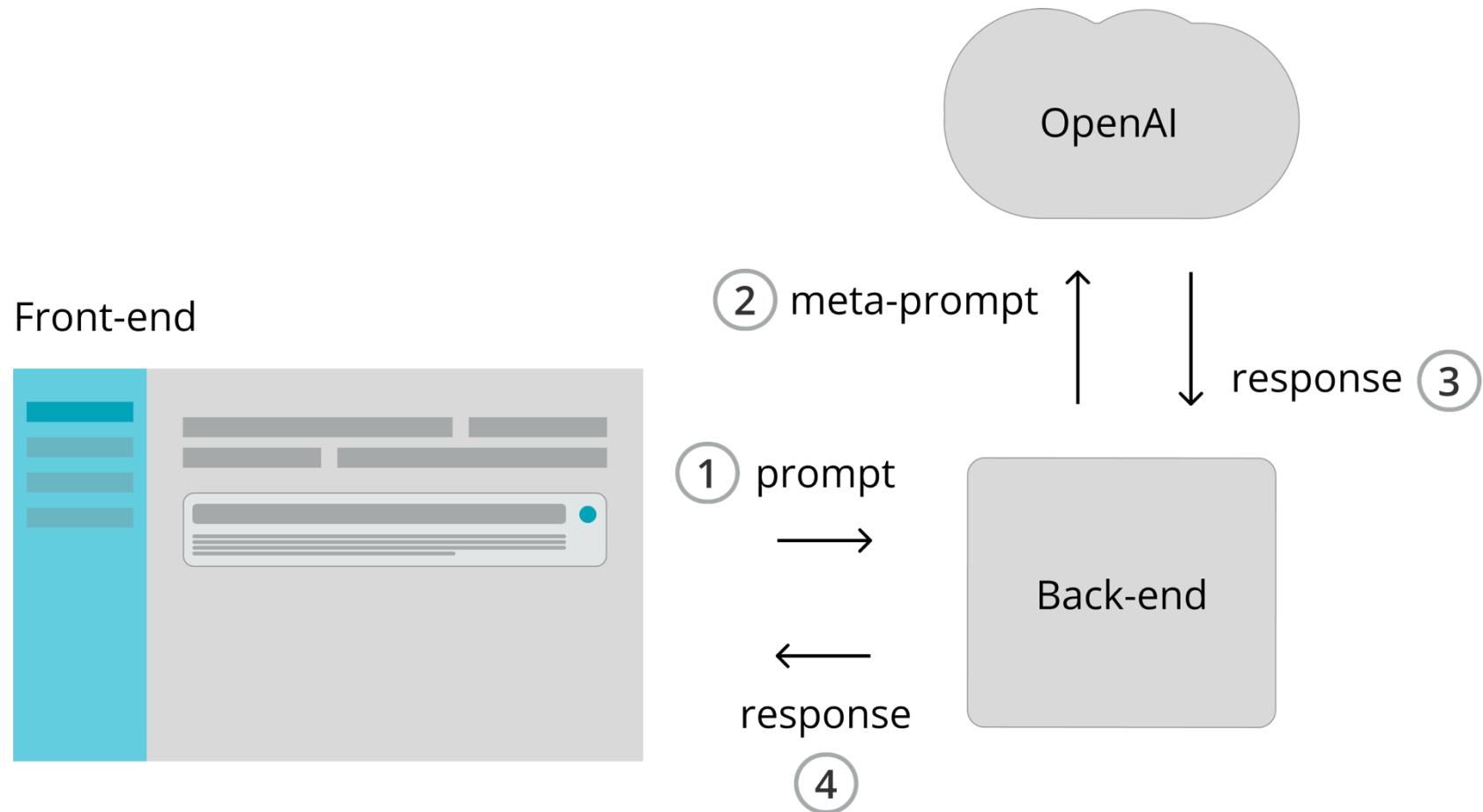
Describe your project goals and objectives

[execute goal](#)

# Amethyst

## A Creative Process-Centric Notebook That Leverages Large Language Models

# A PEEK UNDER THE HOOD



# DID IT WORK?

From an Amethyst vs the Internet (circa 2023) study...

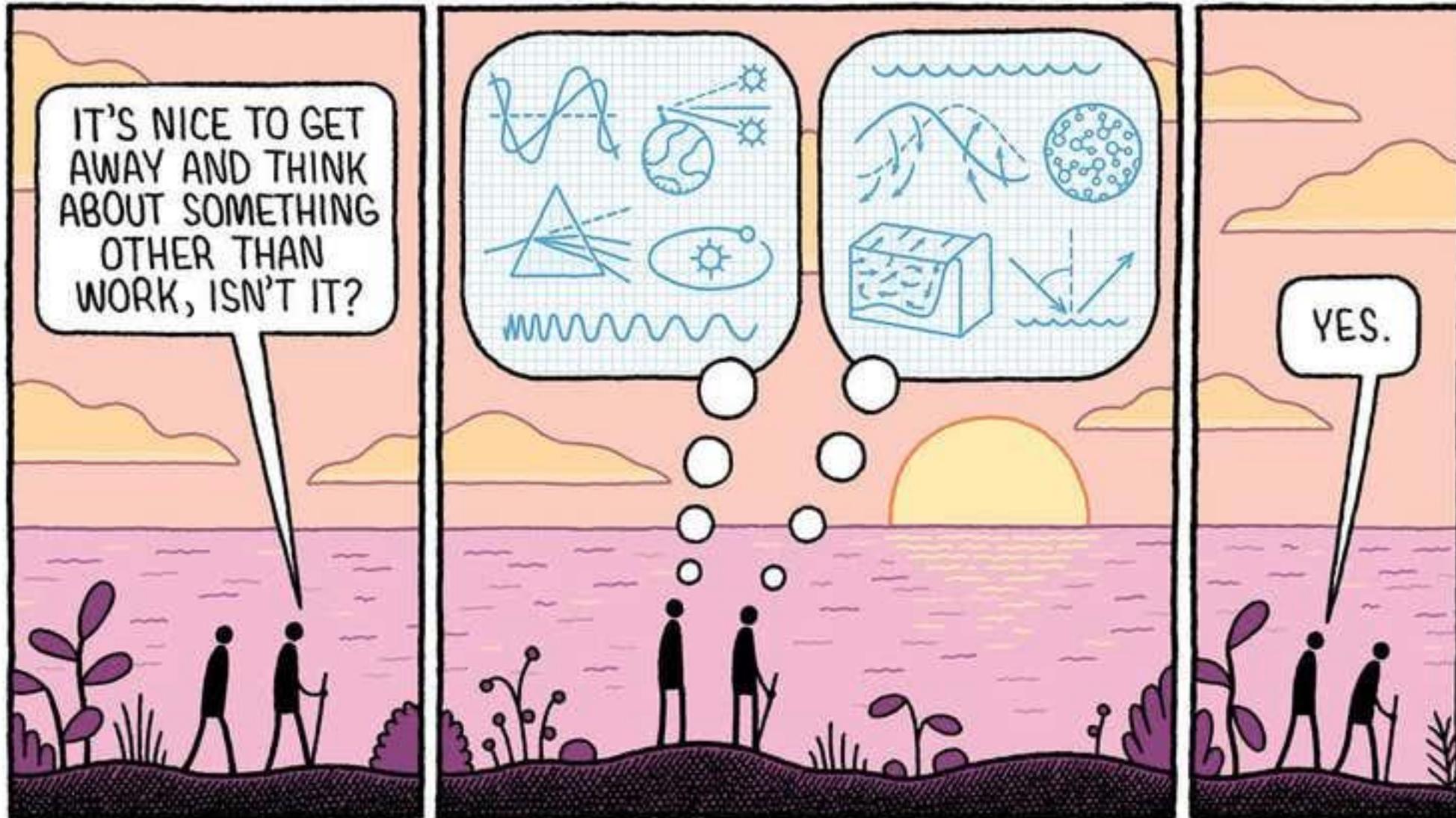
- Amethyst preferred, with more, better ideas  
(Novelty, Feasibility, and Value)
- Amethyst more helpful in articulating goals and managing tasks
- Amethyst modulated more empathic outputs
- "Ask Amethyst" was most used operation (\*)

# ACTIVITIES

## # Ideation / Creativity

- Help a person define a SMART creative goal
- Given an 'idea brief', generate n ideas
- Given n ideas, reflect & convergence to reduce them to  $m < n$
- Implement a creativity operation
  - Find gaps in an idea
  - Constructive Critique
  - ...
- Given an idea, package as a story/presentation for audience X

# SCIENTISTS ON HOLIDAY

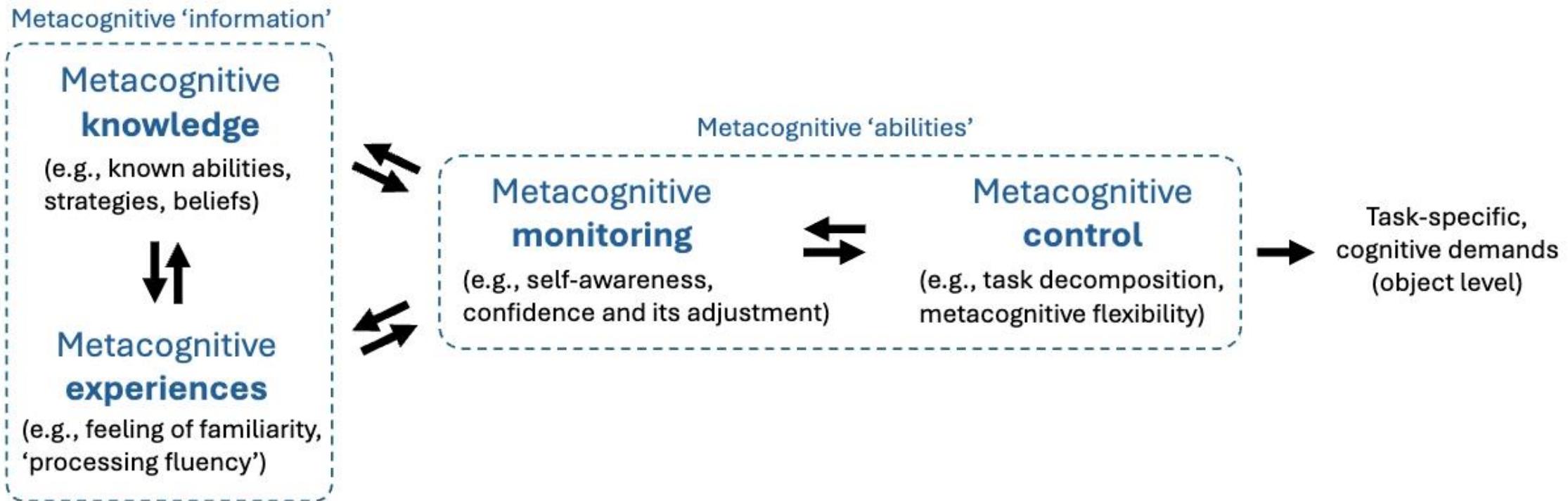


TOM GAULD for NEW SCIENTIST

# METACOGNITION

# METACOGNITION

## (a primer)



# METACOGNITIVE DEMANDS \*

(and support opportunities)

- Prompting
  - (set goals, task decomposition, ...)
- Evaluating Prompts and their Output
  - (reflect, assess confidence, gulf of evaluation)
- How and when to use GenAI (Strategy)
  - (strategy selection, resource allocation)

(\*) how does it align with challenges and opportunities in Ideation Section?

# REDUCING METACOGNITIVE DEMANDS

(a starter list)

- GenAI Explainability  
(transparency, close gulf of evaluation)
- User Agency / UX customizability  
("the path you know")
- Metacognition Literacy  
(cognition awareness, regulation strategies)

# ACTIVITIES

## # Metacognition

- Help evaluate the quality / alignment of GenAI outputs
- Generate output using progressive disclosure principles
- Using a text adventure game metaphor, given a task goal and a series of steps, use GenAI to suggest what a user should do next.
- ...

THE HILLS

HEY,  
FRANK.

WHAT?

NEVER MIND, YOU  
HAD SOMETHING ON  
YOUR HEAD, BUT IT'S  
GONE NOW.

TOM GAULD

SO...?

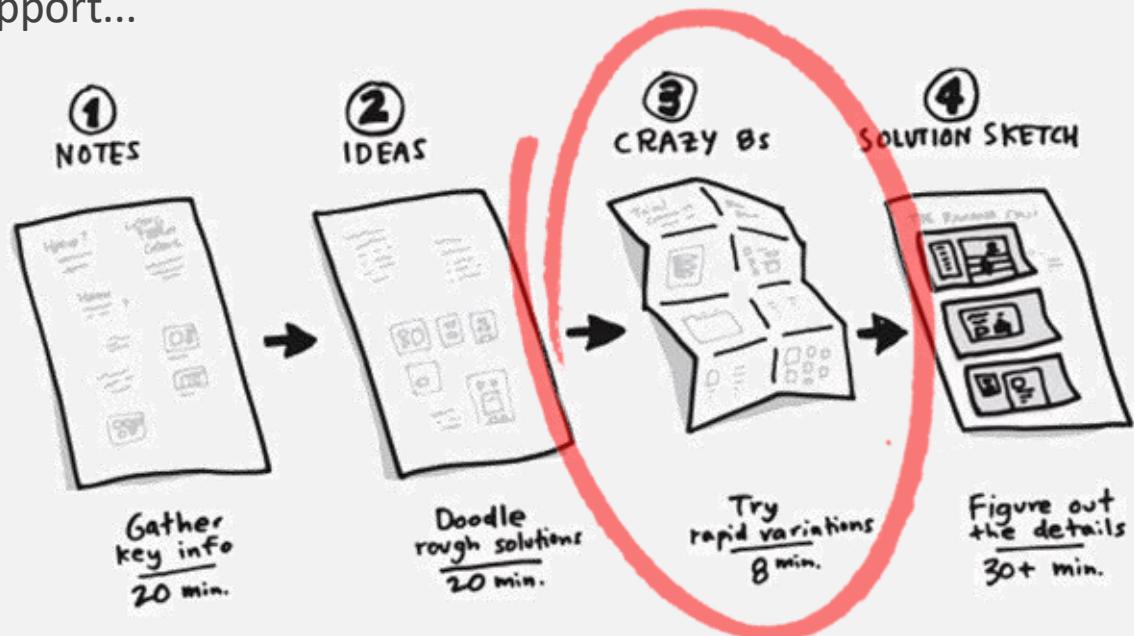
## TAKEAWAYS...

- Distributed Cognition, Extended Mind, Metacognition:  
useful to frame how to augment thinking with AI.
- Sensemaking and Ideation: rich cognitive processes  
with lots of augmentation opportunities with LLMs.
- Creativity: is a full-stack activity.
- Augmentations: do not be perfect, be useful.
- Augmenting thinking is (also) a design problem.

# ACTIVITIES

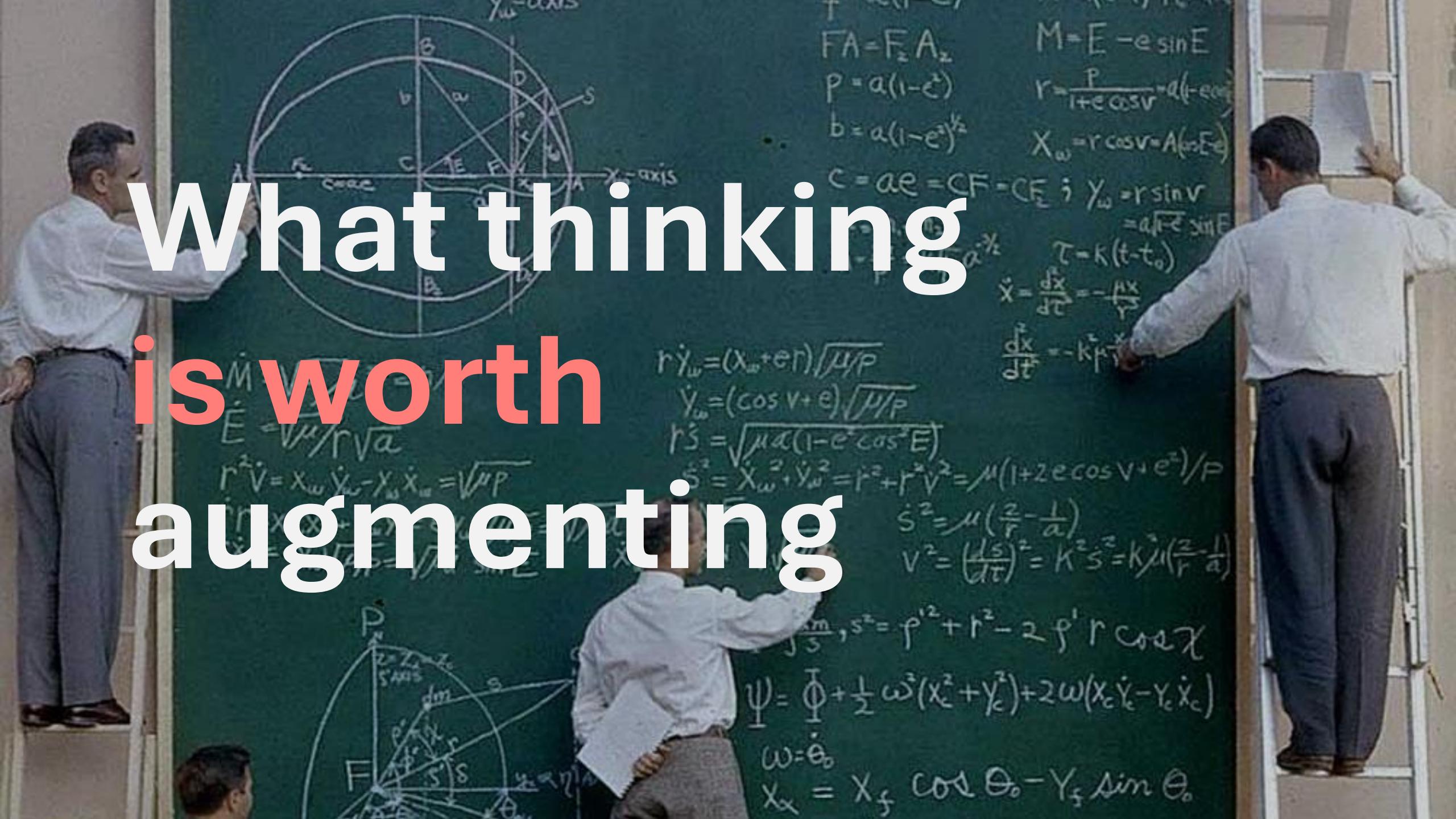
## # Design!

- Use 'design sprint' techniques to sketch design solutions augmented sensemaking, ideation, metacognition support...

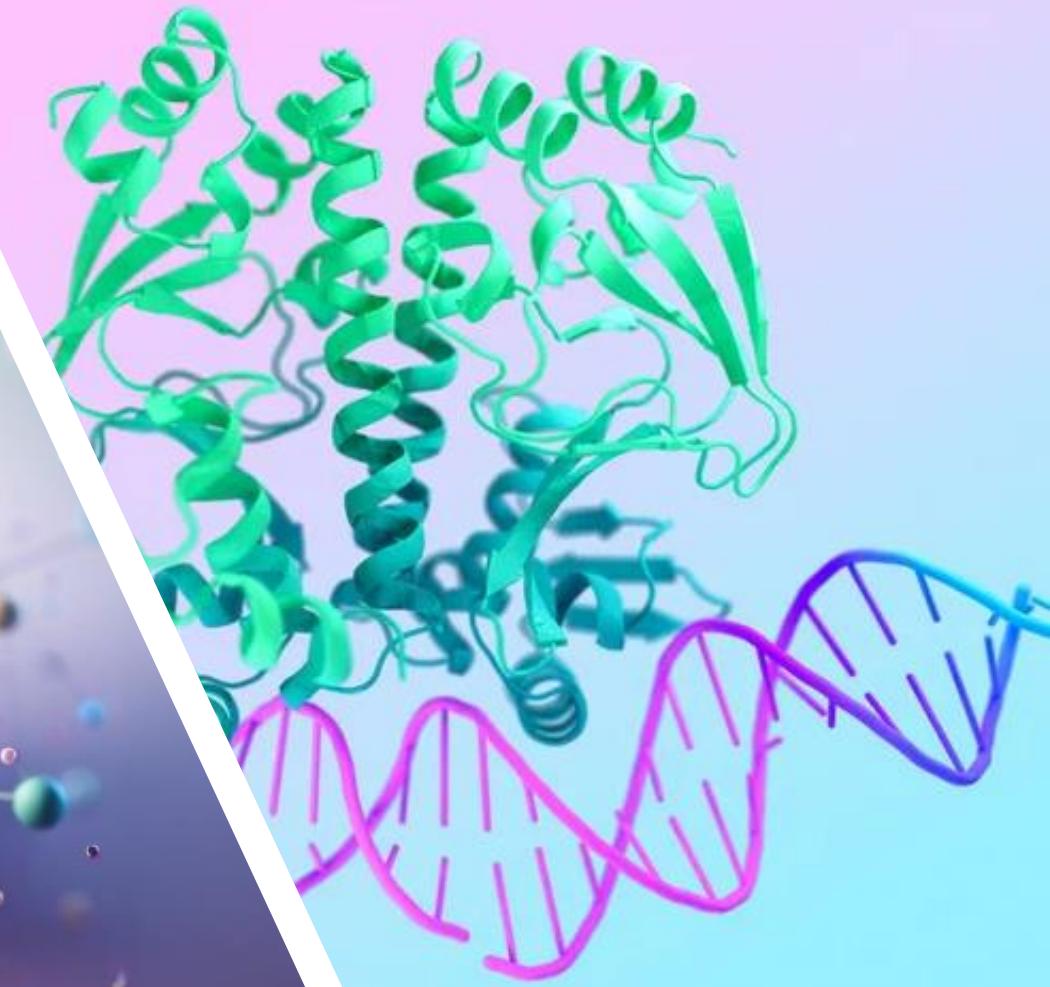


# PROVOCATIONS

# What thinking is worth augmenting



AlphaFold-3



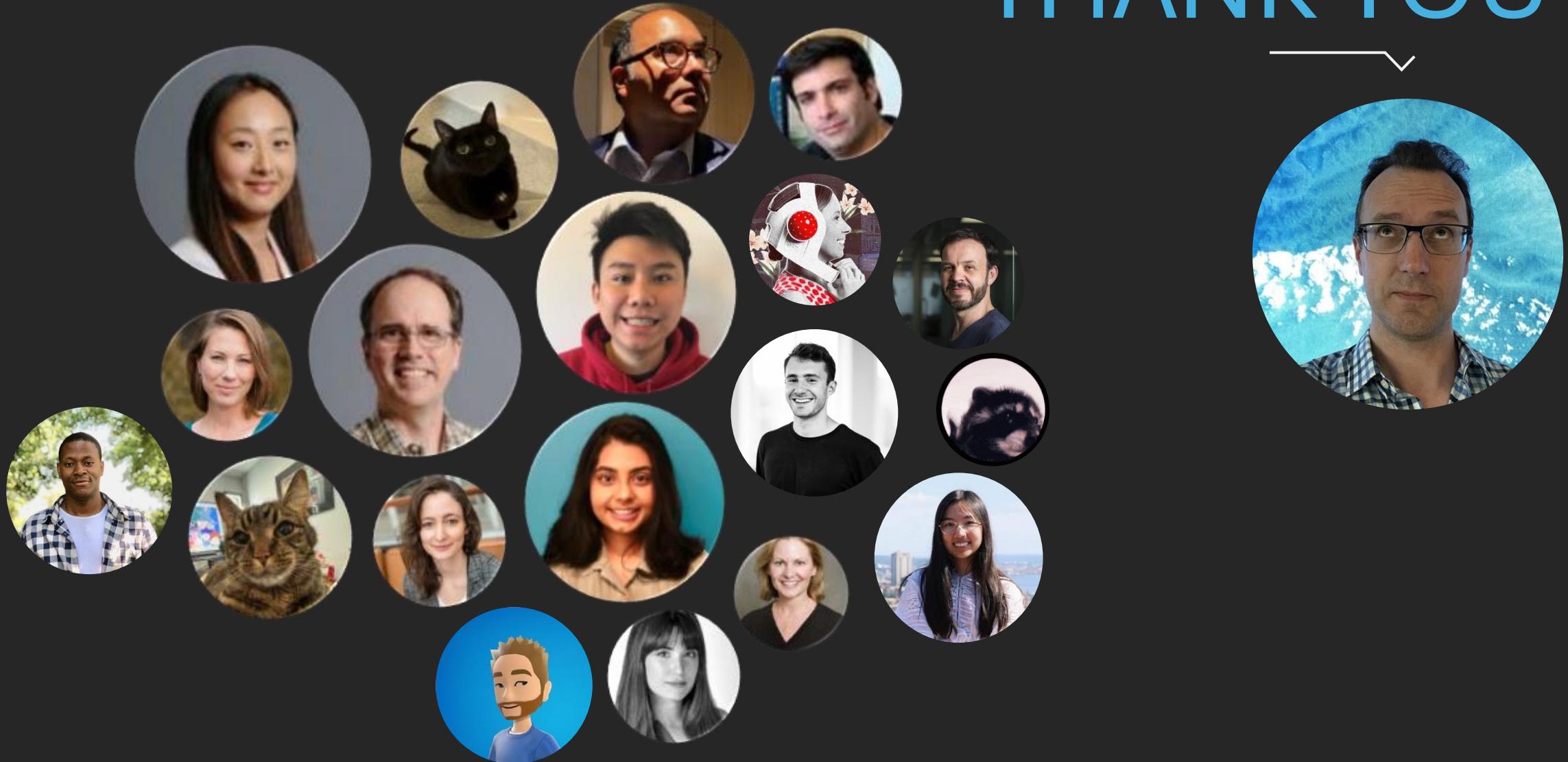
MatterGen





We are in a  
Desired Paths  
moment

# THANK YOU



# AUGMENTING IDEATION AND SENSEMAKING IN THE AGE OF LLMs

Concepts, Examples, and Opportunities from an HCI Perspective

as told by Gonzalo Ramos

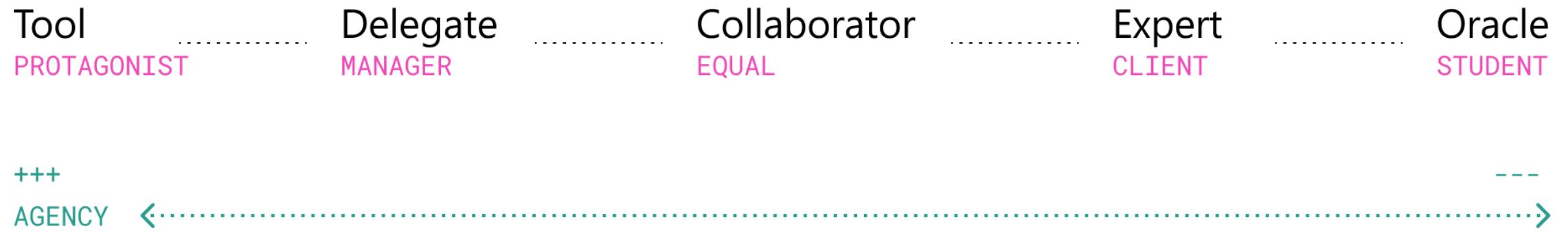
[goramos@microsoft.com](mailto:goramos@microsoft.com)

<https://www.linkedin.com/in/gonzaloramos/>

<https://www.microsoft.com/en-us/research/people/goramos/>

# EXTRAS

# About people & AI perceived roles



# The Aleph & Other Metaphors for Image Generation Models



Gonzalo A. Ramos, Rick Barraza,  
Victor Dibia, and Sharon Lo.

HCAI @ NeurIPS'22



## Metaphors as Provocations

We use metaphors to understand, explain, and tell stories about the world.

They are useful until they are not. That is OK.

The metaphors we choose as designers shape what people can do with what we create.

Metaphors suggest affordances.

## Infinite Libraries Can Help People Understand IGMs From a HCML Lens

Libraries offer relatable affordances that map well to IGMs.

The **latent space** is the library.



**Dimensions** within the space are the hallways.



**CLIP embeddings** are the librarian/index.



**Images** are books.

These provocations are a starting point to think about how we present IGMs to others, how we expect them to be used, and what affordances we include by design.

## Why Infinites?

An infinite library has all the (even nonsensical) books that can exist. IGMs promise engines that can produce any image a person can imagine.

Jorge L. Borges produced stories that often provoked us to think about the infinite. "El Aleph" and "La Biblioteca de Babel" are two key readings.



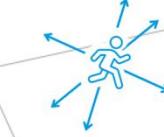
Prompt: A portrait of jorge luis borges, black and white, depth of field, photography  
Steps: 25, Sampler: Euler a, CFG scale: 7, Seed: 3533637492, Size: 512x512, Model hash: 7460a6fa

## How These Metaphors Inspire Design and Development for IGMs (a starter list)

**Interact with the librarian:** Have rich, multimodal, explainable prompts and outputs.



**Navigate and explore the hallways:** Have deliberate, semantic ways to explore the latent space. Define, refine and personalize hallways.



**Leverage and help other visitors:** As readers find books, they support the mapping of the space, as well as making, using and sharing book annotations.



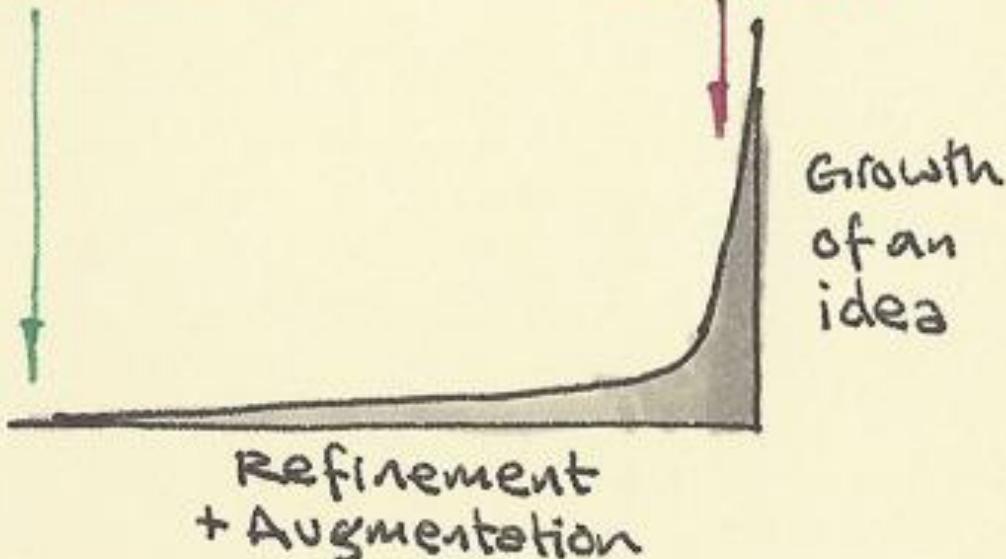
The

Bill Buxton

## LONG NOSE OF INNOVATION

INVENTION

TRACTION



The bulk of innovation is behind the wow

"A ton of small incremental work precedes what feels like a wow innovation moment. Computer mice, touchscreens, robotics, CNC machining, haptics etc. were all around for decades before they hit the big time."