

Workshop: Augmenting Research Workflows with LLMs

Slack channel

- [Slack channel for the workshop](#)



Agenda

1. What are the LLM Tangibles?
2. Cool LLM-based UI Patterns
3. Level 0: Prompting Techniques for Better Research Workflows
4. Level 1: Pydantic & Data Structures for Research Primitives
5. Level 2: Agentic Workflows with LLMs for Research
6. Concluding thoughts

What are the LLM Tangibles?

Augmenting Human Intellect: A Conceptual Framework

SRI Summary Report AFOSR-3223

By Douglas C. Engelbart
October 1962

Prepared for: Director of Information Sciences, Air Force Office of Scientific Research, Washington DC,
Contract AF 49(638)-1024 • SRI Project No. 3578 (AUGMENT,3906,)

Available Here: [permalink](#) | [HyperScope\(?\)](#) | [eReader*](#) | [Printer-Friendly PDF*](#) (*scanned original)
See also our [Field Guide](#) to 'Augmenting Human Intellect'

Augmentation = Enhancing Capability Through Tools

Augmenting Human Intellect: A Conceptual Framework - 1962 (AUGMENT,3906.) - Doug Engelbart Institute

By "augmenting human intellect" we mean increasing the capability of a ~~man~~ ^{person} to approach a complex problem situation, to gain comprehension to suit ~~his~~ particular needs, and to derive solutions to problems. Increased capability in this respect is taken to mean a mixture of the following: more-rapid comprehension, better comprehension, the possibility of gaining a useful degree of comprehension in a situation that previously was too complex, speedier solutions, better solutions, and the possibility of finding solutions to problems that before seemed insoluble. And by "complex situations" we include the professional problems of diplomats, executives, social scientists, life scientists, physical scientists, attorneys, designers—whether the problem situation exists for twenty minutes or twenty years. We do not speak of isolated clever tricks that help in particular situations. We refer to a way of life in an integrated domain where hunches, cut-and-try, intangibles, and the human "feel for a situation" usefully co-exist with powerful concepts, streamlined terminology and notation, sophisticated methods, and high-powered electronic aids.

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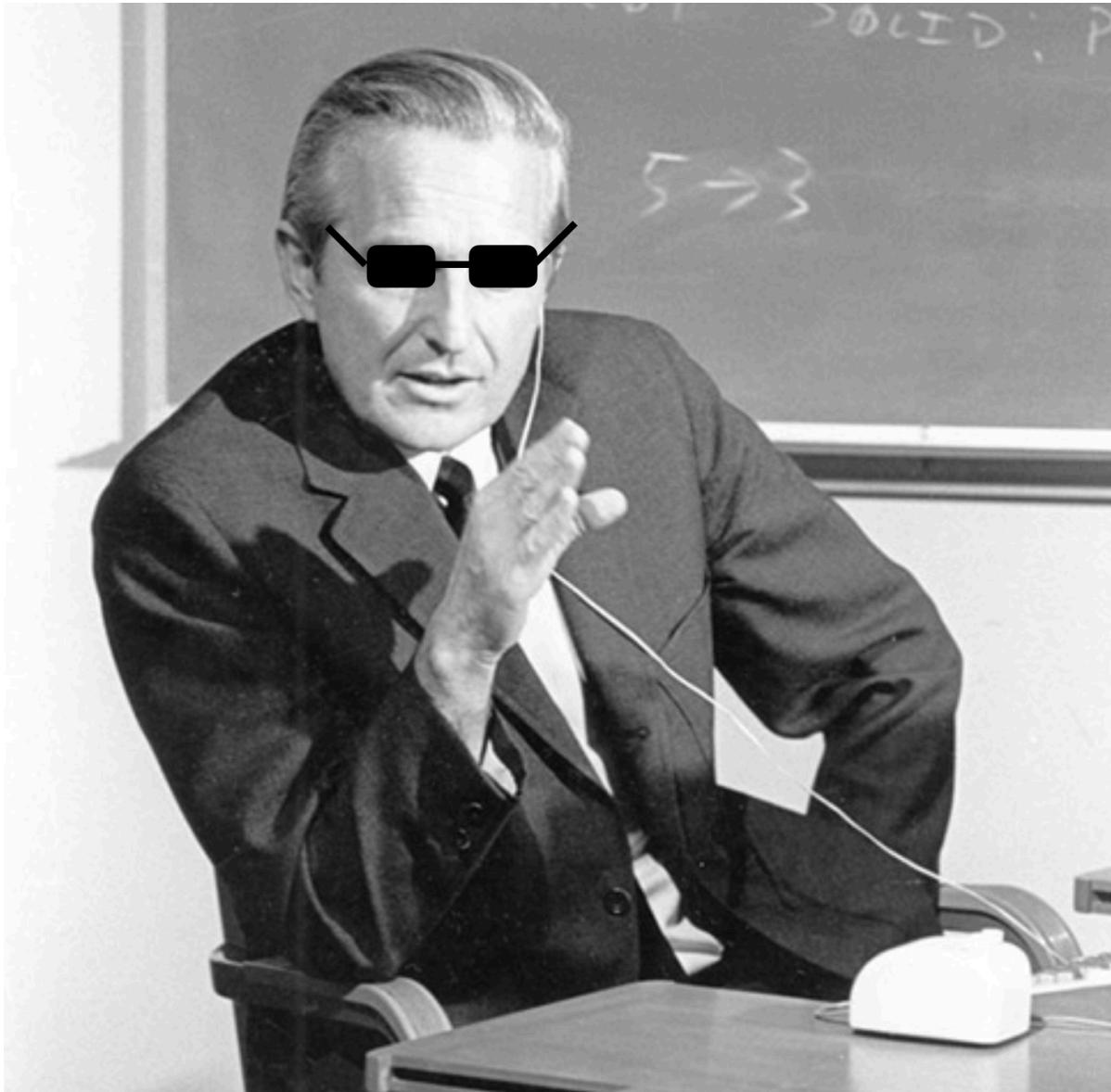
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LLM Tangibles?

What are the LLM 'tangibles' we should learn?

First, some cool LLM-based UI Patterns

Elicit Tables UI

Accelerated Interdisciplinary Skill Acquisition

How to speed up skill acquisition across subjects and fields?

Summary of top 4 papers

Research has identified several factors that can speed up skill acquisition across different fields. [Verniani \(2024\)](#) found that personalization, subtask independence, and algorithm responsiveness in virtual reality training can enhance skill acquisition. [Hoffman \(2013\)](#) suggested that accelerated learning can be achieved through the use of technologies such as virtual training, cross-training, and training for resilience and adaptivity. [Tenison \(2016\)](#) proposed a model of skill acquisition that involves three distinct learning states, each showing speedup with practice. [Cundey \(1978\)](#) highlighted the role of mental activity in skill acquisition and the potential for psychological approaches to facilitate this process. These findings collectively suggest that a combination of personalized, responsive, and technology-enhanced training, along with an understanding of the distinct phases of skill acquisition, can help speed up skill acquisition across subjects and fields.

Sort: Most relevant	Filters	Export as	UPGRADE	8	Manage Columns
<input type="checkbox"/> Paper	Abstract summary		Main findings		Manage Columns
<input type="checkbox"/> Features of adaptive training algorithms for improved complex skill acquisition 🕒 Alessandro Verniani +6 Frontiers in Virtual Reality 2024 - 0 citations DOI	Highly responsive algorithms may lead to faster learning progressions and higher skill acquisition for some subjects.		Personalization leads to faster skill acquisition, independence in difficulty adjustments enhances skill acquisition, and skill transfer may require high responsiveness or a standardized progression.	Search or create a column Describe what kind of data you want to extract e.g. Limitations, Survival time	CURRENT COLUMNS Main findings
<input type="checkbox"/> Accelerated Expertise: Training for High Proficiency in a Complex World 🕒 R. Hoffman +5 2013 - 149 citations	Accelerated learning methods leverage technologies and capabilities including virtual training, cross-training, training across strategic and tactical levels, and training for resilience and adaptivity.		The abstract discusses the importance of speed in acquiring knowledge and skills, the potential advantages of accelerated training regimens, and the use of technologies for accelerating learning.	ADD COLUMNS + Summary + Methodology + Intervention + Outcome measured + Limitations + Intervention effects	Show more
<input type="checkbox"/> Modeling the distinct phases of skill acquisition. 🕒 Caitlin Tenison +1 Journal of Experimental Psychology. Learning, Memory and Cognition 2016 - 69 citations DOI	The major speedups are produced by transitions between learning states.		The study identified 3 distinct learning states in skill acquisition through practice, with major speedups occurring during transitions between these states, aligning with the 3 phases of skill acquisition proposed by Fitts and Posner (1967).		
<input type="checkbox"/> Psychological approaches to skill acquisition 🕒 B. Cundey 1978 - 2 citations DOI	Psychological approaches have led to increased understanding of the processes involved in the acquisition and performance of skilled behavior.		The main finding is that psychological approaches have improved the understanding of the processes involved in the acquisition and performance of skilled behavior.		
<input type="checkbox"/> The acquisition of skilled motor performance: fast and slow experience-driven changes in primary motor cortex.	A few minutes of daily practice on a sequence induced large incremental performance gains over a few weeks of		- Skill learning involves discrete changes in neural representations driven by experience.		

Semantic Zoom

Amelia Wattenberger = Freaking awesome



Peter Pan

Chapter I.

PETER BREAKS THROUGH

All children, except one, grow up. They soon know that they will grow up, and the way Wendy knew was this. One day when she was two years old she was playing in a garden, and she plucked another flower and ran with it to her mother. I suppose she must have looked rather delightful, for Mrs. Darling put her hand to her heart and cried, "Oh, why can't you remain like this for ever!" This was all that passed between them on the subject, but henceforth Wendy knew that she must grow up. You always know after you are two. Two is the beginning of the end.

Of course they lived at 14, and until Wendy came her mother was the chief one. She was a lovely lady, with a romantic mind and such a sweet mocking mouth. Her romantic mind was like the tiny boxes, one within the other, that come from the puzzling East, however many you discover there is always one more; and her sweet mocking mouth had one kiss on it that Wendy could never get, though there it was, perfectly conspicuous in the right-hand corner.

The way Mr. Darling won her was this: the many gentlemen who had been boys when she was a girl discovered simultaneously that they loved her, and they all ran to her house to propose to her except Mr. Darling, who took a cab and nipped in first, and so he got her. He got all of her, except the innermost box and the kiss. He never knew about the box, and in time he gave up trying for the kiss. Wendy thought Naggs could have got it, but I can picture him trying, and then going off in a passion, slaming the door.

Mr. Darling used to boast to Wendy that her mother not only loved him but respected him. He was one of those deep ones who know about stocks and shares. Of course no one really knows, but he quite seemed to know, and he often said stocks were up and shares were down in a way that would have made any woman respect him.

Mrs. Darling was married in white, and at first she kept the books perfectly, almost gleefully, as if it were a game, not so much as a Brussels sprout was missing; but by and whole cauliflower dropped out, and instead of them there were pictures of babies without faces. She drew them when she should have been totting up. They were Mrs. Darling's guesses.

Wendy came first, then John, then Michael.

For a week or two after Wendy came it was doubtful whether they would be able to keep her, as she was another mouth to feed. Mr. Darling was frightfully proud of her, but he was very honourable, and he sat on the edge of Mrs. Darling's bed, holding her hand and calculating expenses, while she looked at him imploringly. She wanted to risk it, come what might, but that was not his way; his way was with a pencil and a piece of paper, and if she confused him with suggestions he had to begin at the beginning again.

"Now don't interrupt," he would beg of her.

"I have one pound seventeen here, and two and six at the office; I can cut off my coffee at the office, say ten shillings, making two nine and six, with your eighteen and three makes three nine seven, with five naught caught in my cheque-book makes eight nine seven—who is that moving?—eight nine seven, dot and carry seven—don't speak, my own—and the pound you lent to that man who came to the door—quiet, child—dot and carry child—there, you've done it!—did I say nine nine seven? yes, I said nine nine seven; the question is, can we try it for a year on nine nine seven?"

"Of course we can, George," she cried. But she was prejudiced in Wendy's favour, and he was really the grander character of the two.

"Remember mumps," he warned her almost threateningly, and off he went again. "Mumps one pound, that is what I have put down, but I

Climbing the Ladder of Abstraction: Amelia Wattenberger

Semantic Zoom

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The screenshot shows a digital reading interface for the book "Peter Pan". At the top, there's a navigation bar with the PenPal logo, a user icon, the email address "wattenberger@gmail.com", and a "Logout" button. Below the title "Peter Pan" is a section header "Chapter 1. Peter Breaks Through". The main content area contains several paragraphs of text from the story. A vertical sidebar on the right side displays a zoomed-in view of the text, showing a magnified portion of the first few lines. At the bottom of the page, there's a footer note: "Wendy came first, then John, then Michael".

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The screenshot shows a digital writing interface with the following elements:

- Header:** PenPal
- User Information:** wattenberger@gmail.com Logout
- Title:** Peter Pan
- Section Header:** Chapter 1. Peter Breaks Through
- Text Content:**
 - Wendy realizes she must grow up after her mother expresses a desire for her to stay young forever.
 - Wendy's mother, a lovely and romantic woman, had a sweet mocking mouth but withheld a kiss from Wendy.
 - Mr. Darling won her by being the first to propose, but he never received her innermost box or a kiss, and eventually gave up trying.
 - Mr. Darling boasted his knowledge of stocks and shares to win Wendy's mother's love and respect.
 - Mrs. Darling began neglecting her bookkeeping, replacing calculations with drawings of faceless babies.
 - Wendy came first, then John, then Michael.
 - Wendy's arrival caused financial concerns for the family, leading Mr. Darling to carefully consider their expenses with Mrs. Darling's support.
 - "Now don't interrupt," he would beg of her.
 - The speaker is trying to figure out if they can live on nine nine seven for a year.
 - She favored Wendy but recognized George's grander character.
 - He warned her about the cost of various illnesses, and she successfully negotiated lower prices for them.
 - John and Michael were able to attend Miss Fulsom's Kindergarten school with their nurse despite some challenges.
 - Mrs. Darling loved to have everything just so, and Mr. Darling had a passion for being exactly like his neighbours; so, of course, they had a nurse. As they were poor, owing to the amount of milk the children drank, this nurse was a prim Newfoundland dog, called Nana,

Climbing the Ladder of Abstraction: Amelia Wattenberger

Latent Space Style Exploration of Ideas with Luminate

The screenshot displays the Luminate application interface. On the left, a sidebar contains a title input field ("Click here to write down the title") and a yellow-highlighted area with the following text:

A man sits on a crowded subway train, his face expressionless as he stares into space. Suddenly, a voice booms inside his head.

Narrator: "And here we have our protagonist, trapped in the mundane routine of daily life. Little does he know, I control every thought and action."

The man's eyes widen in horror as the narrator continues to narrate his every move.

Narrator: "He tries to ignore me, but I am always there. Like a pesky fly buzzing around his brain."

The man starts to sing along with the narrator's words, breaking into a deadpan musical number spoof.

At the bottom of this sidebar are two buttons: "Ask AI for ideas" and "leave me alone? This constant".

The main workspace is a large area containing a scatter plot of numerous small gray dots, representing data points in a latent space. Above the plot is a search bar labeled "Search for nodes using keywords" and several filter buttons: "Tone", "Setting", "Style", and "Humor".

At the bottom right of the workspace is a button labeled "Select a Dimension".

Latent Space Style Exploration of Ideas with Luminate

The screenshot shows the Luminate application interface. On the left, there is a sidebar with a yellow background containing several text snippets:

- A man sits on a crowded subway train, his face expressionless as he stares into space. Suddenly, a voice booms inside his head.
- Narrator: "And here we have our protagonist, trapped in the mundane routine of daily life. Little does he know, I control every thought and action."
- The man's eyes widen in horror as the narrator continues to narrate his every move.
- Narrator: "He tries to ignore me, but I am always there. Like a pesky fly buzzing around his brain."
- The man starts to sing along with the narrator's words, breaking into a deadpan musical number spoof.

Below these snippets are two buttons: "Ask AI for ideas" and "leave me alone? This constant".

The main area of the interface is a network graph titled "Search for nodes using keywords". The graph consists of numerous light blue rounded rectangles representing different nodes, such as "Inner Voices Torment Man", "Unwanted Narrator", "Inner Critic at Grocery Store", "Sarcastic Narrator' Sketch", "Annoying Narrator on Subway Train", "Park Bench Narrator", "Tormented by InSubway Musical Sketch", "Inner Voice Sketches", "Inner Narrator Sketch", "Voices in Head", "Narrator Voice! Grocery Shopping Sketch", "Tormenting Narrator in Grocery Store", "Annoying Subway Narrator", "Mundane Narration", "Inner Narrator Sketches", "Narrator Torment", "Inner Voice Struggles", "Inner Narrator Struggles", and "Sarcastic Narrator Sketch". These nodes are interconnected by a complex web of thin lines.

At the top of the main area, there is a toolbar with icons for search, bookmark, tone, setting, style, and humor, along with a "Select a Dimension" button.

Built on top of atomic usage of AI

Level 0: Prompting Techniques for Better Research Workflows

Level 1: Research Primitives with Pydantic for Efficient LLM-based Research

Researcher controlled semantic data structures?

Level 2: Agentic Workflows with LLMs for Research

Practical Usage Patterns for Agentic Workflows

Patterns for Working with Agents

1. Iterative (mini) Research Reports (e.g GPT-Researcher)

- [] What we want ultimately is useful and reliable transformations that help us get to where we need to go
- [] How can we make incoherence evident without the disguise of hallucination?

References

- <https://arxiv.org/pdf/2310.10808v1>
- https://www.youtube.com/watch?v=PAy_GHUAICw
- [LLMs as Zero-Shot Hypothesis Proposers](#)
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