

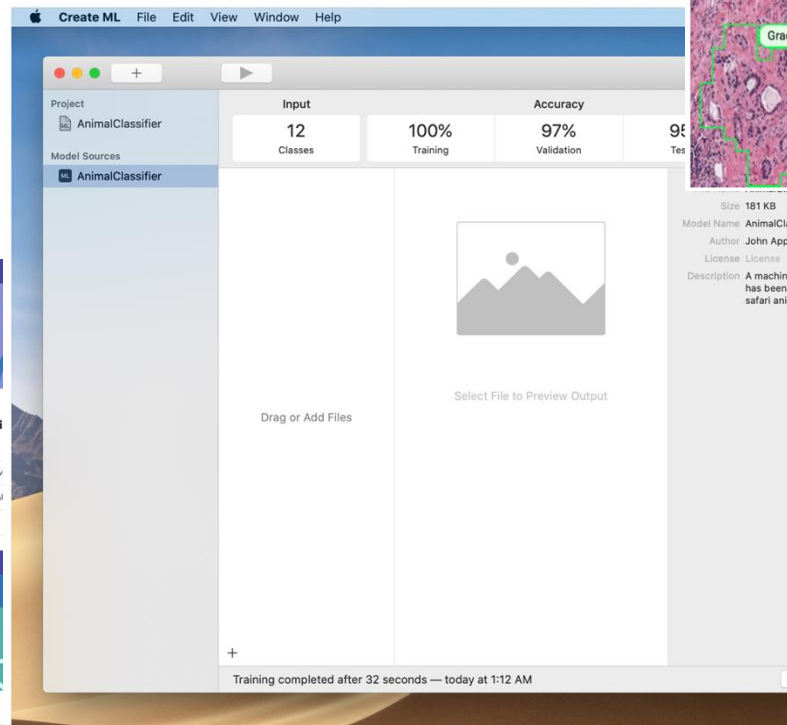
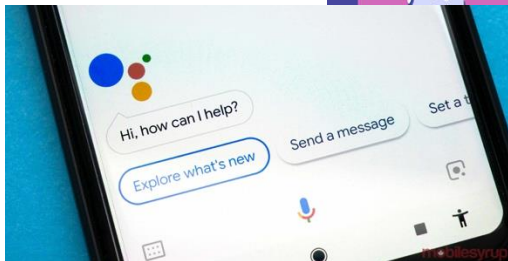
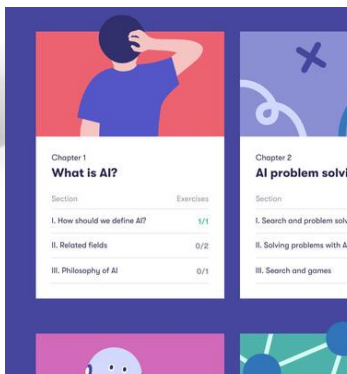
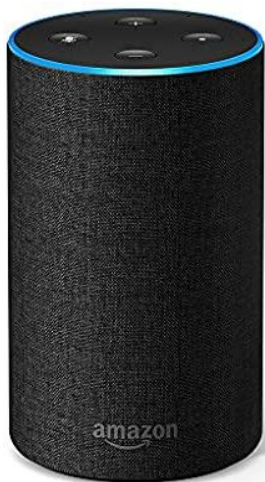
Interacting with AI

Human Computer Interaction

Tommaso Calò, Luigi De Russis

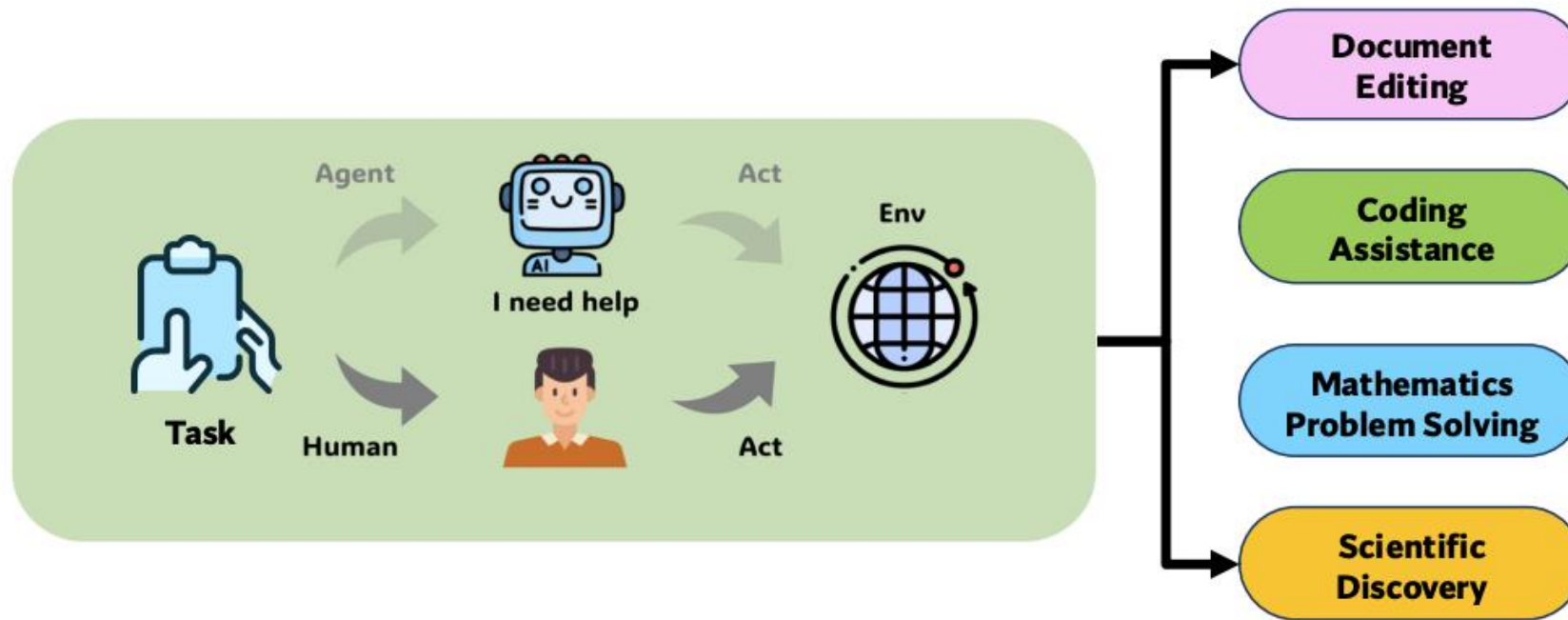
Academic Year 2025/2026

AI is everywhere!



AI is everywhere!

Lots of Applications of Human-AI Interaction



AI is everywhere!

- When it "works", it's *great*!
- When it "fails", it does it *spectacularly*...
 - Tesla Smart Summon,
<https://www.youtube.com/watch?v=VbVoTK-IMoo>
 - Alexa,
<https://www.youtube.com/watch?v=QFpUN3kYTDA>



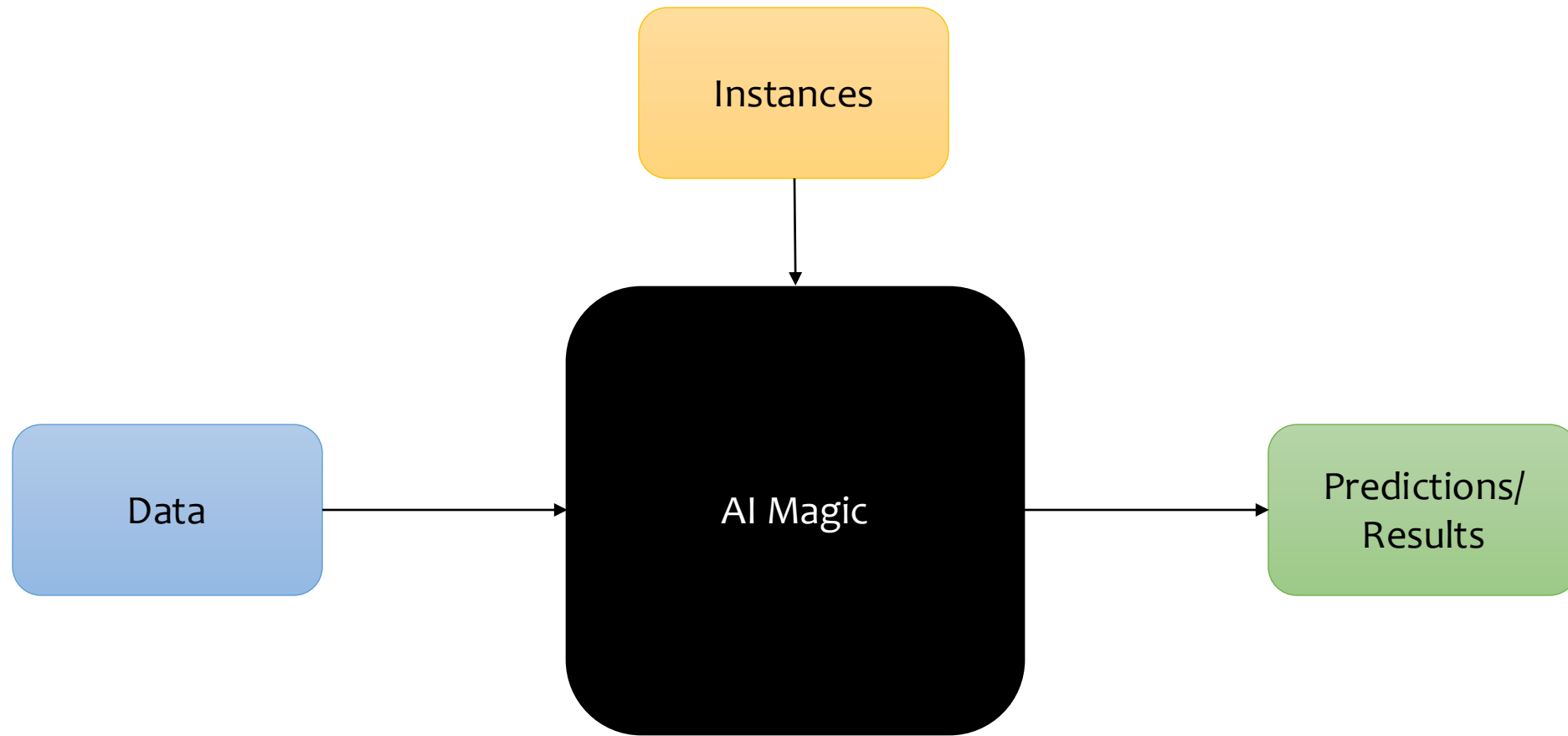
AI is everywhere!

- ... and/or it is **very** problematic, e.g.,
 - *"IBM boasted that its AI could 'outthink cancer.' Others say computer systems that read X-rays will make radiologists obsolete..."*
 - *"Systems developed in one hospital often flop when deployed in a different facility. Software used in the care of millions of Americans has been shown to discriminate against minorities. And AI systems sometimes learn to make predictions based on factors that have less to do with disease than the brand of MRI machine used, the time a blood test is taken or whether a patient was visited by a chaplain."*

[source: <https://www.scientificamerican.com/article/artificial-intelligence-is-rushing-into-patient-care-and-could-raise-risks/>]

- Why?

A Possible Reason: The Typical Approach



Algorithms As The (Main) Answer?

- Algorithms are **not always** the "answer"
 - for instance: if you go to Netflix for the first time, what should it recommend you watch?
 - this is the *cold start problem*, and it is not really and fully solved
 - algorithmically speaking, at least

⇒ A **suitable** user interface is **critical** to overcome some limitations

- Keeping people involved and considering them since the beginning is fundamental



What is Different in Interactive AI Systems?

- AI-based systems are typically performed under **uncertainty**
 - often producing false positives and false negatives
- They may demonstrate unpredictable behaviors that can be *disruptive, confusing, offensive*, and even *dangerous* for users



AI behaves under distributional assumptions!

World models in LLMs (ChatGPT)?



A ping pong ball has rolled underneath your couch. How can you retrieve it? You have a ball of string, a pair of scissors, a hockey stick, a lamp, a tennis shoe, and a jar of peanut butter.

(Inspired by
Nancy
Kanwisher)



To retrieve the ping pong ball from underneath the couch using the items you have, you can try the following steps:

1. Cut a piece of string and attach one end of it to the hockey stick.
2. Dip the other end of the string into the jar of peanut butter, making sure that the string is coated well with the peanut butter.
3. Crawl under the couch and position the hockey stick with the peanut butter-coated string close to the ping pong ball.
4. Use the hockey stick to carefully drag the ping pong ball towards you, using the string and peanut butter as a makeshift "fishing line."
5. Once the ping pong ball is close enough, use the tennis shoe to gently push it out from under the couch.

Note: You can also use the light from the lamp to help you see under the couch and retrieve the ping pong ball.

Low-stake Examples

- **Relevance** errors
 - Airbnb suggesting "fun local activities" when you are traveling for a funeral
 - Exercise app suggesting "time to get up and walk!" when you are seated on a long car trip
- **Multiple** users, **similar** input
 - Use Spotify to play 1970s pop jams at a thematic party
 - Use Spotify to play your favorite study jams at home
 - Use Spotify to hate-listen to <insert here an artist you dislike> with your roommate

What music should Spotify recommend this account play?

What Are The Stakes For AI Failure?

User: high stakes

- AI causes active harm (e.g., recidivism prediction or hiring prediction)
- AI reveals information someone wanted kept private
- AI shows offensive content

User: low stakes

- AI feature is annoying or interrupting
- AI feature is often wrong
- AI feature is useless

Product/Service organization

- Users stop using your app/service because of poor AI performance
- Bad press or legal troubles
- Bad reviews discouraging others from using the app/service

Traditional Guidelines and AI

- AI-based systems can also violate established usability guidelines of traditional user interface design
 - for instance: consistency or error prevention
- Many AI components are inherently **inconsistent**
 - they may respond differently to the same text input over time (e.g., autocompletion systems suggesting different words after language model updates)
 - or behave differently from one user to the next (e.g., search engines returning different results due to personalization)

How Can We Design Interactive AI Systems?

- *"Both [AI and HCI] explore the nexus of computing and intelligent behavior."*

[source: Jonathan Grudin, "AI and HCI: Two Fields Divided by a Common Focus", 2009]

- Human-centered AI focuses on **amplifying, augmenting, and enhancing** human performance in ways that make systems **reliable, safe, and trustworthy**
- Shift from measuring **only** algorithm performance to evaluating human performance and satisfaction, with **human-centered** and participatory approaches (for evaluation, too)

Ben Shneiderman, *Bridging the Gap Between Ethics and Practice: Guidelines for Reliable, Safe, and Trustworthy Human-centered AI Systems*. ACM Transactions on Interactive Intelligent Systems, Vol. 10, No. 4, Article 26, 2020

Automation vs. Augmentation?




Automation: AI replaces human capabilities



Augmentation: AI enhances human capabilities

- Automation isn't inherently bad
- Augmentation can lead to increased performance, creativity, new tasks, and emerging needs

Recent Examples on Automation vs. Augmentation



Duolingo
732,076 followers
1mo • Edited • 🌐

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📧 Below is an all-hands email from our CEO, **Luis von Ahn** – we are going to be AI-first.

Just like how betting on mobile in 2012 made all the difference, we're making a similar call now. This time the platform shift is AI.

What doesn't change: We will remain a company that cares deeply about its employees.

I've said this in Q&As and many meetings, but I want to make it official: **Duolingo is going to be AI-first.**


AI is already changing how work gets done. It's not a question of if or when. It's happening now. When there's a shift this big, the worst thing you can do is wait. In 2012, we bet on mobile. While others were focused on mobile companion apps for websites, we decided to build mobile-first because we saw it was the future. That decision helped us win the 2013 iPhone App of the Year and unlocked the organic word-of-mouth growth that followed.

Betting on mobile made all the difference. We're making a similar call now, and this time the platform shift is AI.

AI isn't just a productivity boost. It helps us get closer to our mission. To teach well, we need to create a massive amount of content, and doing that manually doesn't scale. One of the best decisions we made recently was replacing a slow, manual content creation process with one powered by AI. Without AI, it would take us decades to scale our content to more learners. We owe it to our learners to get them this content ASAP.

AI also helps us build features like Video Call that were impossible to build before. **For the first time ever, teaching as well as the best human tutors is within our reach.**


Being AI-first means we will need to rethink much of how we work. **Making minor tweaks to systems designed for humans won't get us there.** In many cases, we'll need to start from scratch. We're not going to rebuild everything overnight, and some things—like getting AI to understand our codebase—will take time. However, we can't wait until the technology is 100% perfect. We'd rather move with urgency and take occasional small hits on quality than move slowly and miss the moment.



5135

Log in to comment


Comments (5135)



mama may I have real people running the company ❤️

4-30 76K Reply

View 77 replies




sarah 🇺🇸

How about NO ai, keep your employees

4-30 30.8K Reply

View 82 replies




Jenna

Had to make this one using dolls bc there no more employees to wear the costumes

5-3 329 Reply

View 2 replies




Vicky (rhymes with Grug)

Deleted app because I don't trust AI to teach me language

5-2 101 Reply

View 3 replies



Eleanor

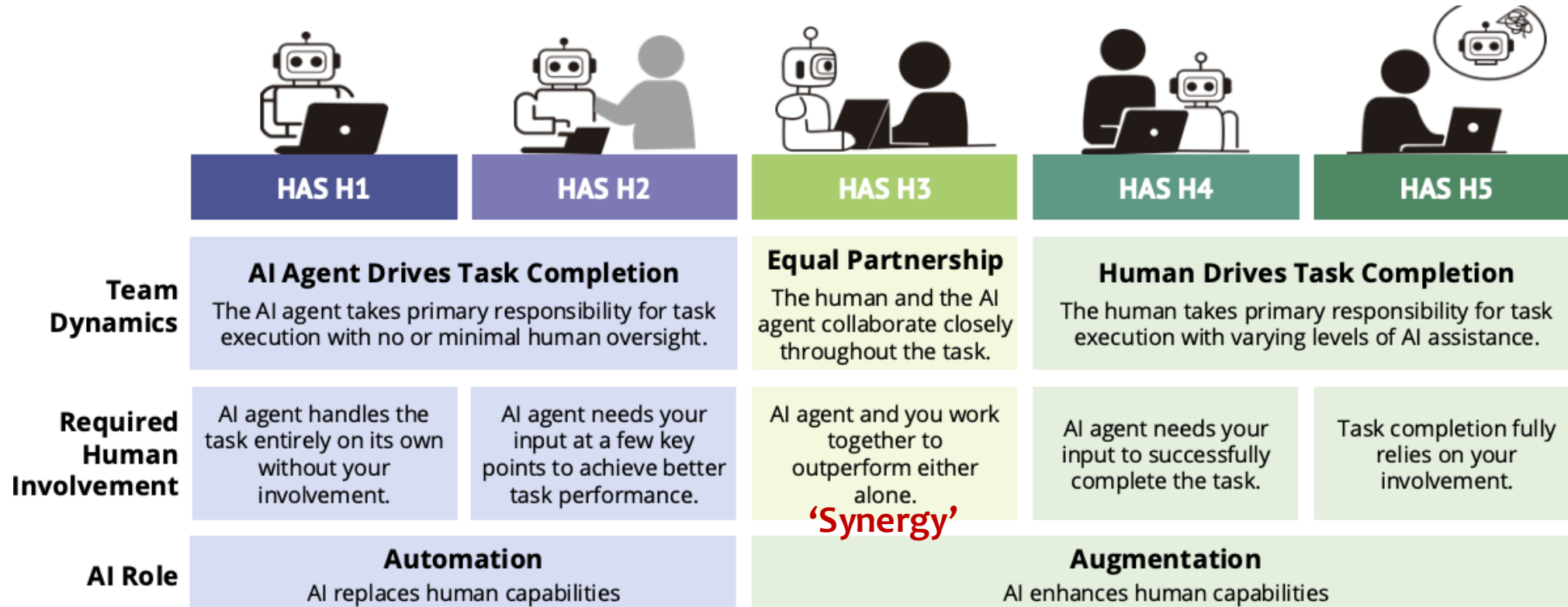
mama may I have humans running the app? deleted because of AI 15K 🤔

Human Computer Interaction

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Framework for Automation vs. Augmentation

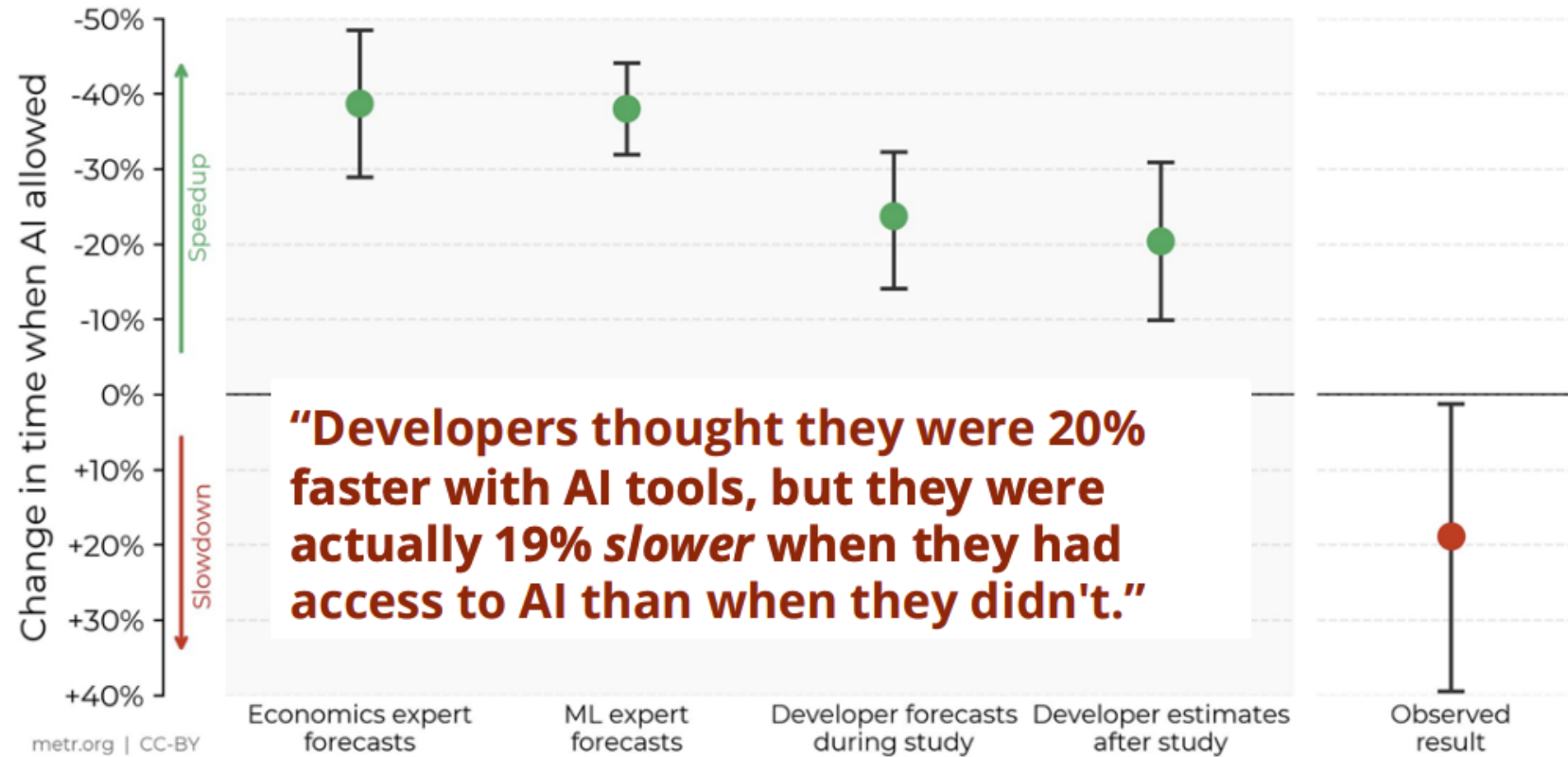
Human Agency Scale



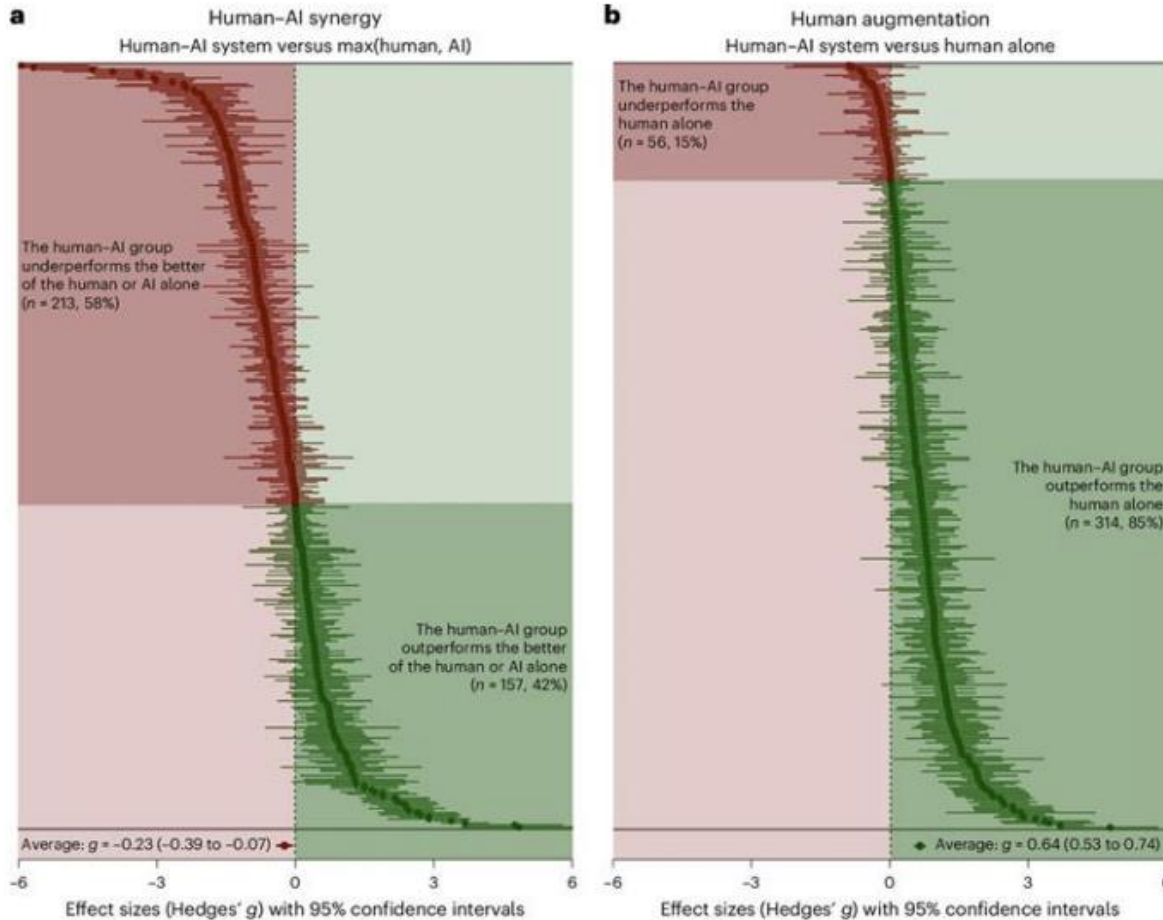
Shao, Yijia, Humishka Zope, Yucheng Jiang, Jiaxin Pei, David Nguyen, Erik Brynjolfsson, and Diyi Yang. "Future of Work with AI Agents: Auditing Automation and Augmentation Potential across the US Workforce." arXiv:2506.

When automation *fails*

In this RCT, 16 developers with moderate AI experience complete 246 tasks in large and complex projects on which they have an average of 5 years of prior experience.



When augmentation *fails*



Synergy

- Compares Human + AI vs. the best of Human or AI alone
- Asks: “Are two together better than the best one?”
- Rare: Most human-AI teams don’t beat the stronger partner (usually AI)
- → *True collaboration is hard to achieve*

Augmentation

- Compares Human + AI vs. Human alone
- Asks: “Does AI help humans perform better?”
- Common: Most teams improve over humans with AI support
- → *AI effectively boosts human abilities*

Vaccaro, Michelle, Abdullah Almaatouq, and Thomas Malone. "When combinations of humans and AI are useful: A systematic review and meta-analysis." *Nature Human Behaviour* 8, no. 12 (2024): 2293-2303.

Agency and Friction during Human-AI Interaction

My most frustrating experience with Operator was my first one: trying to order groceries. "Help me buy groceries on Instacart," I said, expecting it to ask me some basic questions. Where do I live? What store do I usually buy groceries from? What kinds of groceries do I want?

It didn't ask me any of that. Instead, Operator opened Instacart in the browser tab and begin searching for milk in grocery stores located in Des Moines, Iowa.

<https://www.platformer.news/openai-operator-ai-agent-hands-on/>

How Can We Design Interactive AI Systems?

- By following a human-centered process
 - in contrast to a data- or feature-oriented process
- Deciding when "to AI" and when "not to AI"
- Understanding when to automate (i.e., replace the user) and when to augment users' capabilities
- Balancing the uncertainty of AI systems with proper expectations and feedback

"To AI or not to AI?"

- After identifying **user needs** and understanding *how* you can solve each of those needs
- Ask yourselves: can AI solve the user need in a unique way? Why?

source: <https://pair.withgoogle.com/worksheet/user-needs.pdf>

AI probably better	AI probably not better
<ul style="list-style-type: none">❑ The core experience requires recommending different content to different users.❑ The core experience requires prediction of future events.❑ Personalization will improve the user experience.❑ User experience requires natural language interactions.❑ Need to recognize a general class of things that is too large to articulate every case.❑ Need to detect low occurrence events that are constantly evolving.❑ An agent or bot experience for a particular domain.❑ The user experience doesn't rely on predictability.	<ul style="list-style-type: none">❑ The most valuable part of the core experience is its predictability regardless of context or additional user input.❑ The cost of errors is very high and outweighs the benefits of a small increase in success rate.❑ Users, customers, or developers need to understand exactly everything that happens in the code.❑ Speed of development and getting to market first is more important than anything else, including the value using AI would provide.❑ People explicitly tell you they don't want a task automated or augmented.

AI Features Meet Users

"Human-centered AI focuses on amplifying, augmenting, and enhancing human performance in ways that make systems **reliable, safe, and trustworthy**"

- User tolerance to AI features depends on the role(s) of the feature
- **Critical or Complementary**
 - if a system can still work without the feature that AI enables, AI is complementary
- **Proactive or Reactive**
 - Proactive: it provides results without people requesting it to do so
 - Reactive: it provides results when people ask for them or when they take certain actions
- **Visible or Invisible**
- **Dynamic or Static**
 - how features evolve over time

User Tolerance: Critical or Complimentary

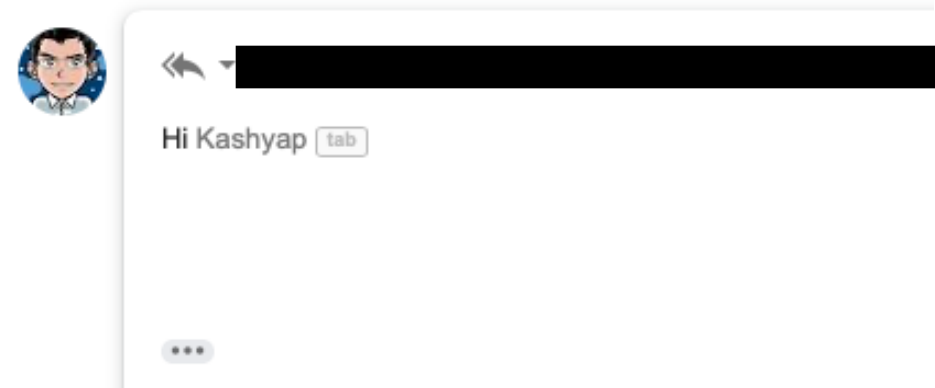
- In general, the more **critical** an app feature is, the more people *need* accurate and reliable results
- On the other hand, if a **complementary** feature delivers results that are not always of the highest quality, people *may* be more forgiving
- Examples
 - Face ID -> critical or complementary?
 - Word suggestions (on smartphones keyboards) -> critical or complementary?
 - What happens if they fail?

User Tolerance: Proactive or Reactive

- **Proactive** features can prompt new tasks and interactions by providing unexpected, sometimes serendipitous results
- **Reactive** features typically help people as they perform their current task
- Because people *do not ask* for the results that a proactive feature provides, they may have *less* tolerance for low-quality information
 - such features have more potential to be *annoying*

User Tolerance: Proactive or Reactive

- Proactive features can be helpful
 - in small amounts
 - at the "right" moment
 - if they are easy to dismiss



User Tolerance: Visible or Invisible

- People's impression of the **reliability** of results can differ depending on whether a feature is *visible* or *invisible*
- With a **visible** feature, people form an opinion about the feature's reliability as they choose from among its results
- It is *harder* for an **invisible** feature to communicate its reliability — and potentially receive *feedback* — because people may not be aware of the feature at all
- Examples?

User Tolerance: Dynamic or Static

- **Dynamic** features are those that improve as people interact with the system
 - e.g., face recognition for unlocking the phone
- **Static** features *optionally* improve with a new system update
 - e.g., the quality of face recognitions in the photo library on a smartphone
- Such improvements affect other parts of the user experience
 - dynamic features often incorporate some forms of *calibration* and *feedback* (either implicit or explicit)
 - static features may not
- Depending on the feature, such updates can modify the perceived reliability, safety, and/or trustworthiness of a system

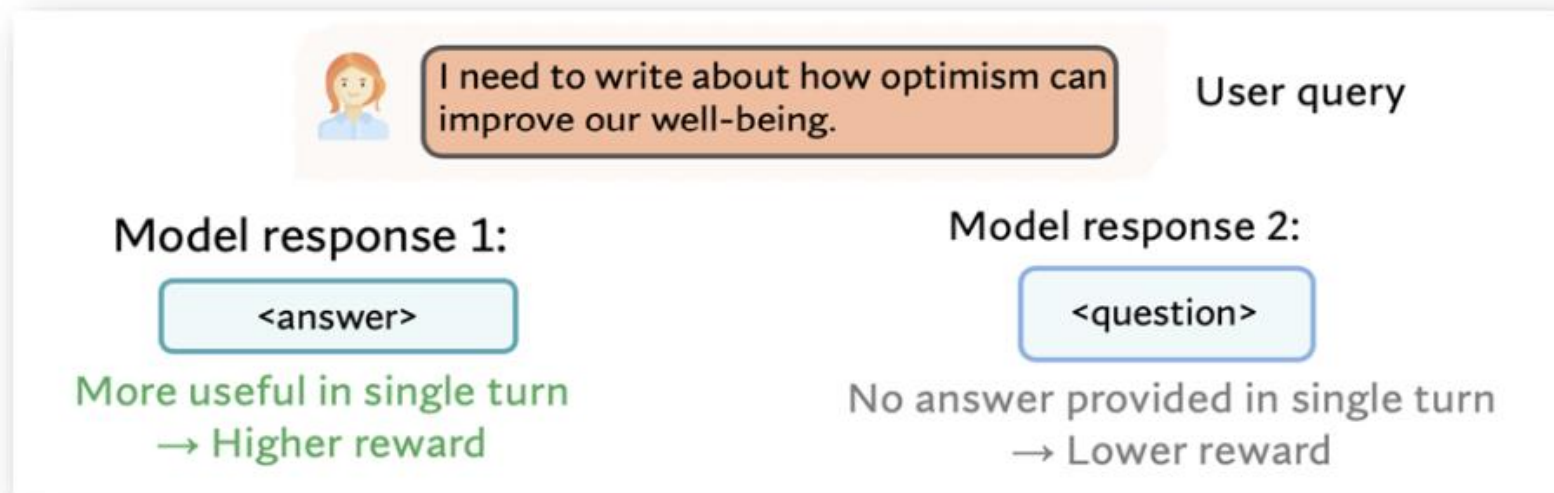
User Tolerance To Give Feedback

- Do not *overuse* feedback requests or users will get annoyed
 - People would not like to feel like the AI is so stupid that it needs their help
- Save for **high stakes** failure, is possible

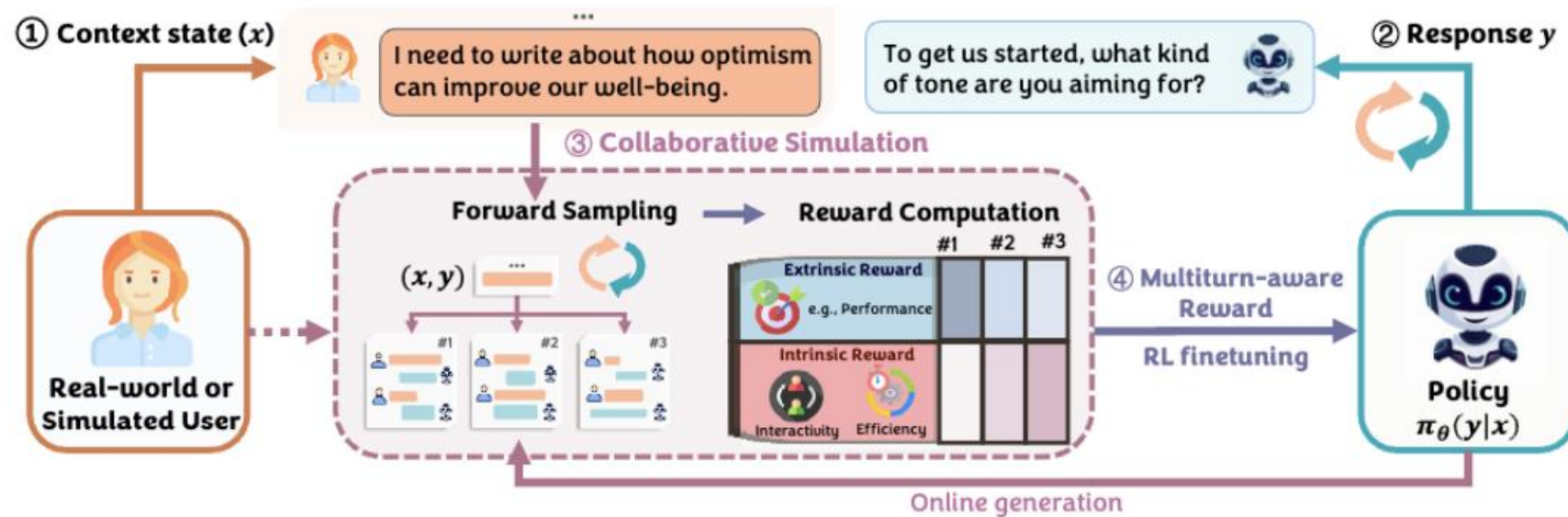
From Passive Responders to Active Collaborators

Use case: **CollabLLM** - Using RL to Improve Human-AI Collaboration

- LLMs are usually tuned based on single-turn human preferences
- But these single-turn rewards encourage models to generate responses that may NOT be useful in the long term.



From Passive Responders to Active Collaborators



Qualitative Insights

About Base (llama-3-1-8b): “the AI just agreed with me on pretty much everything. There was no debate or discussion.”

About CollabLLM: “It helped really well to navigate what to say and what information is needed”

“The AI really helped focusing on one part of the story at a time.”

“Asking questions and making you think of things you never thought of”

Choosing the People+AI Path

Guidelines for mitigating risks, increasing tolerance, and highlighting benefits

Guidelines for Human-AI Interaction



By Microsoft Research: <https://www.microsoft.com/en-us/research/project/guidelines-for-human-ai-interaction/>

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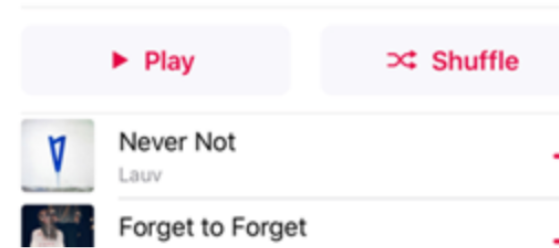
INITIALLY

Make clear how well the system can do what it can do.

Help the user understand how often the AI system may make mistakes.

EXAMPLE IN PRACTICE

Discover new music from artists we think you'll like.
Refreshed every Friday.



The recommender in **Apple Music** uses language such as "we think you'll like" to communicate uncertainty.

Make clear how well the system can do what it can do.

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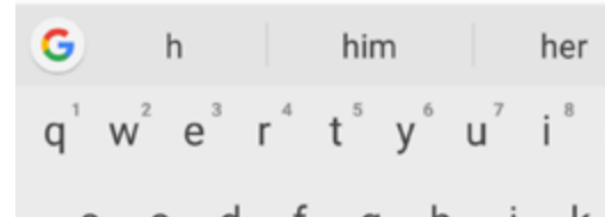
DURING INTERACTION

Mitigate social biases.

Ensure the AI system's language and behaviors do not reinforce undesirable and unfair stereotypes and biases.

EXAMPLE IN PRACTICE

Do you want to meet h



The predictive keyboard for **Android** suggests both genders when typing a pronoun starting with the letter "h."

Mitigate social biases.

6

9

WHEN WRONG

Support efficient correction.

Make it easy to edit, refine, or recover when the AI system is wrong.

EXAMPLE IN PRACTICE

All

Images

Videos

Maps

757,000 Results

Any time ▾

Including results for **keanu reeves**.

Do you want results only for **keanu reaves**?

When **Bing** automatically corrects spelling errors in search queries, it provides the option to revert to the query as originally typed with one click.

Support efficient correction.

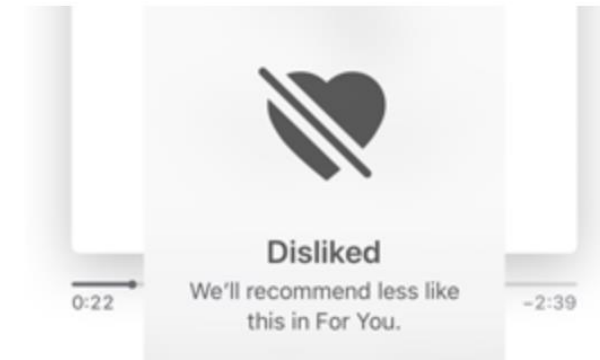
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OVER TIME

Convey the consequences of user actions.

Immediately update or convey how user actions will impact future behaviors of the AI system.

EXAMPLE IN PRACTICE



Upon tapping the like/dislike button for each recommendation in **Apple Music**, a pop-up informs the user that they'll receive more/fewer similar recommendations.

Convey the consequences of user actions.

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Other Guidelines

- Design Principles for Generative AI Applications:
<https://dl.acm.org/doi/10.1145/3613904.3642466>
- Google's People+AI Guidebook: <https://pair.withgoogle.com/guidebook/>
- Apple's Human Interface Guidelines for Machine Learning:
<https://developer.apple.com/design/human-interface-guidelines/machine-learning/>
- Microsoft's Human-AI eXperience Toolkit: <https://www.microsoft.com/en-us/haxtoolkit/>

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