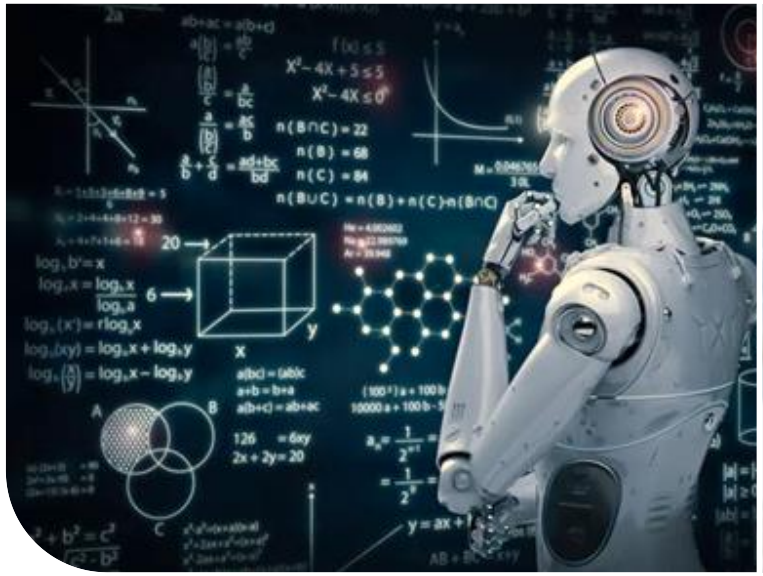
UNIVERSITY OF PASSAU

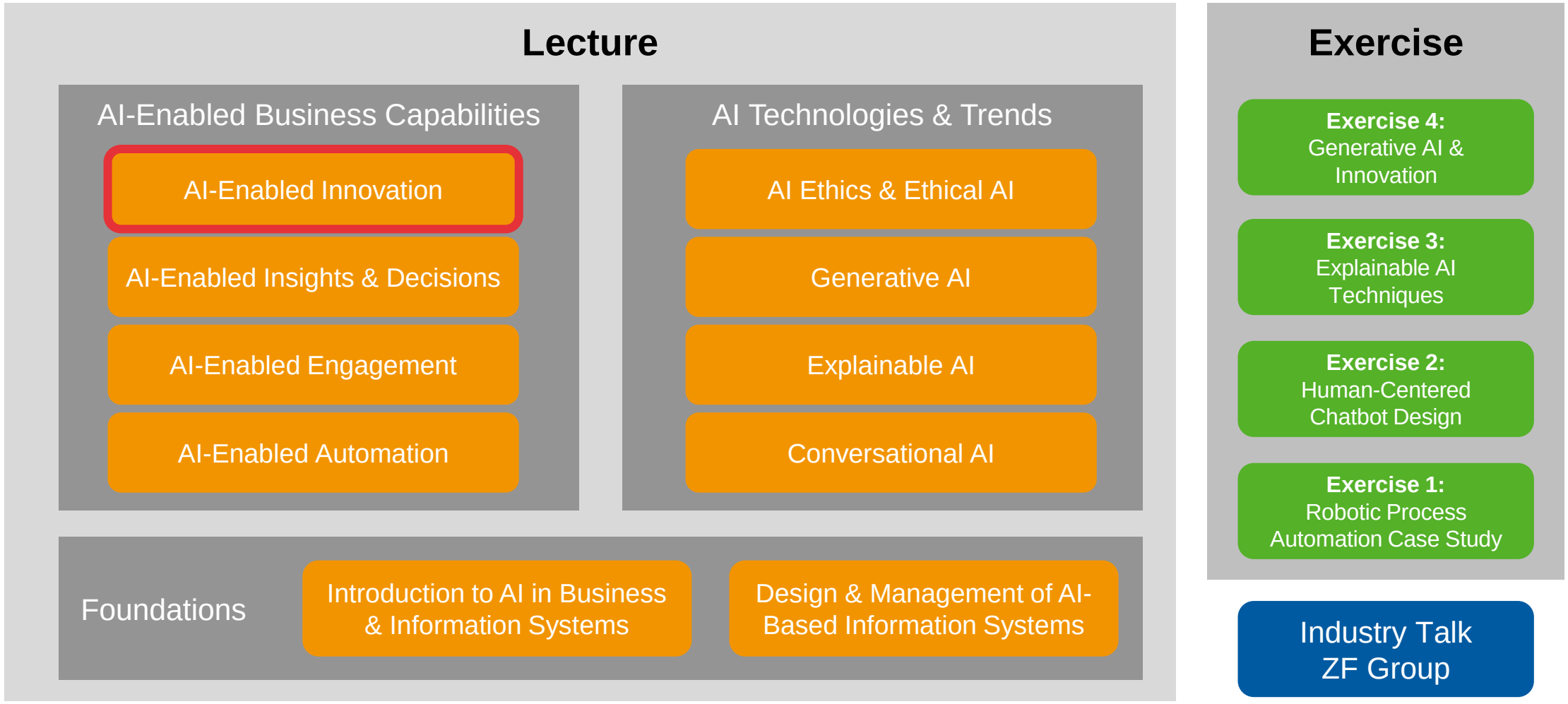
AI-Based Business Information Systems

AI-Enabled Innovation



Prof. Dr. Ulrich Gnewuch

Course Organization



Schedule

Calendar Week	Lecture	Group Exercise
42	Welcome + (1) Introduction to AI in Business & IS	
43	(2) Design & Management of AI-Based IS	Team Introductions + Exercise 1: Intro
44	(3) AI-Enabled Automation	Exercise 1: Work Session + Q&A
45		Exercise 1: Presentations
46		Exercise 2: Intro
47		Exercise 2: Work Session + Q&A
48		Exercise 2: Presentations
49	(8) Explainable AI	Exercise 3: Intro
50	(9) AI-Enabled Innovation	Exercise 3: Work Session + Q&A
51	*- No Lecture (Conference Visit) -*	Exercise 3: Work Session + Q&A #2
52 – 1	*- Winter Break -*	*- Winter Break -*
2	(10) Generative AI	Exercise 3: Presentations
3	(11) AI Ethics & Ethical AI	Exercise 4: Intro
4	Industry Talk ZF - Dr. Alexander Keller	Exercise 4: Work Session + Q&A
5	Summary + Q&A	Exercise 4: Presentations
6	*(Individual exam preparation)*	*(Individual exam preparation)*

Since I will be attending the ICIS 2024 conference, there will be no lecture next week.

Industry Talk – ZF Group

ZF GROUP

“AI & Data Analytics in Manufacturing at ZF”

Tuesday, January 21st, 12:00 – 14:00
Room: (HK 16) SR 006

Dr. Alexander Keller
Team Lead Data Analytics @ ZF Group

UNIVERSITY OF PASSAU

Allianz

"Using Conversational AI and LLMs in Customer Service at Allianz Germany"

Thursday, January 23rd, 14:00 – 16:00
Room: (HK 14b) SR 008

Dr. Peyman Toreini
Human-Centered AI Specialist

Daniel Faisst
Product Owner for Conversational AI

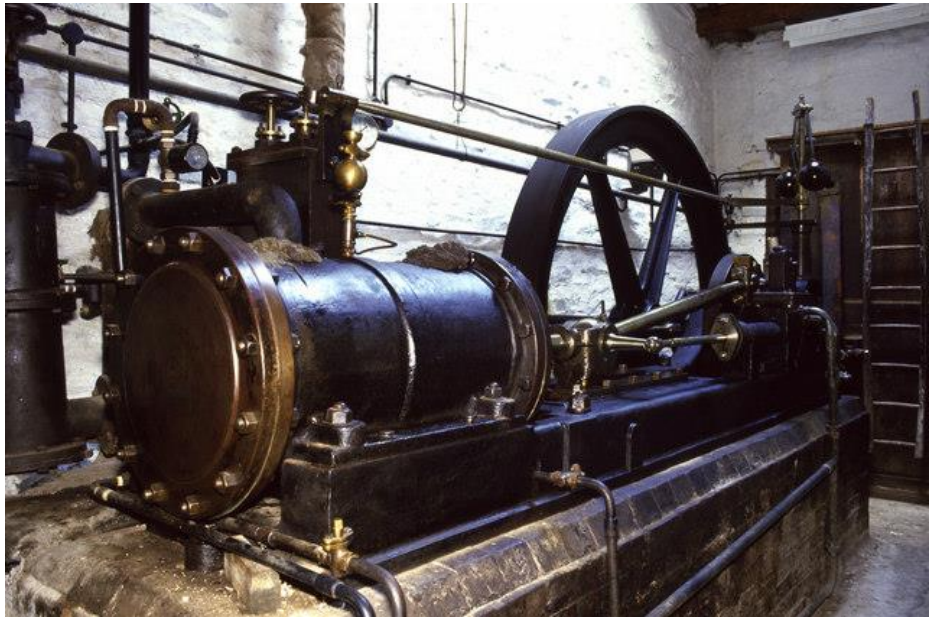
RECAP FROM LAST LECTURE:

- Who are typical XAI stakeholders?
- What are key differences between intrinsic and post-hoc explainability?
- What are some of the challenges and limitations of current XAI approaches?

Learning Goals

- Define the concept of (digital) innovation and distinguish between different types of innovation
- Explain the steps of the innovation process and describe how and where AI can be used in this process
- Identify and discuss key challenges associated with the use of AI in innovation

The Importance of Innovation



Steam Engines (1800s)

Smartphones (2000s)

Innovation is an essential driver of economic progress that benefits consumers, businesses, and the economy as a whole.

https://www.ecb.europa.eu/ecb-and-you/explainers/tell-me-more/html/growth.en.html

AI Is Becoming One of Humanity's Greatest Inventions

Top 10: AI Innovations

The Many, Many Ways AI Spurs Innovation

The Impact of Artificial Intelligence on Innovation

AI will not replace innovators but innovators who use AI will replace those who don't.

AI is reinventing the way we invent

AI & Innovation

AI Is Beco … Humanity

→ AI is an innovation

…ovations

The M… Spurs …innovation

→ AI accelerates innovation

The Impact of Artificial … nnovation

AI will not … who use A… will replace those who don't

→ AI reshapes the innovation process

AI is reinventing the … nvent

Innovation Types & Process

Definition: Innovation

Innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption.

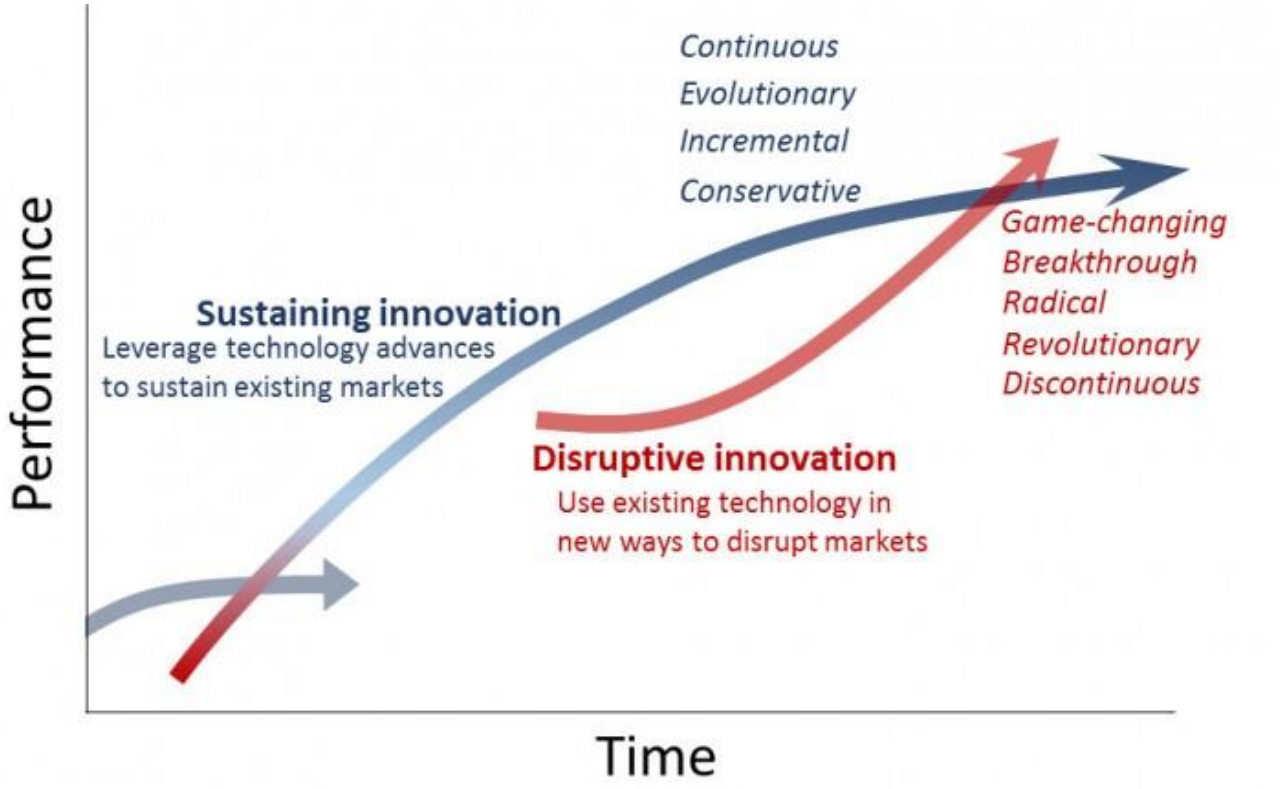
- A new idea can be a combination of old ideas
- The perception matters, not whether an idea is “objectively” new!

Rogers 2003

Disruptive vs. Sustaining Innovation

- **Disruptive** innovations significantly alter and improve a product or service in ways that the market did not expect

- **Sustaining** innovation seeks to improve existing products or services



https://www2.deloitte.com/il/en/pages/innovation/article/disruptive_vs_sustaining.html

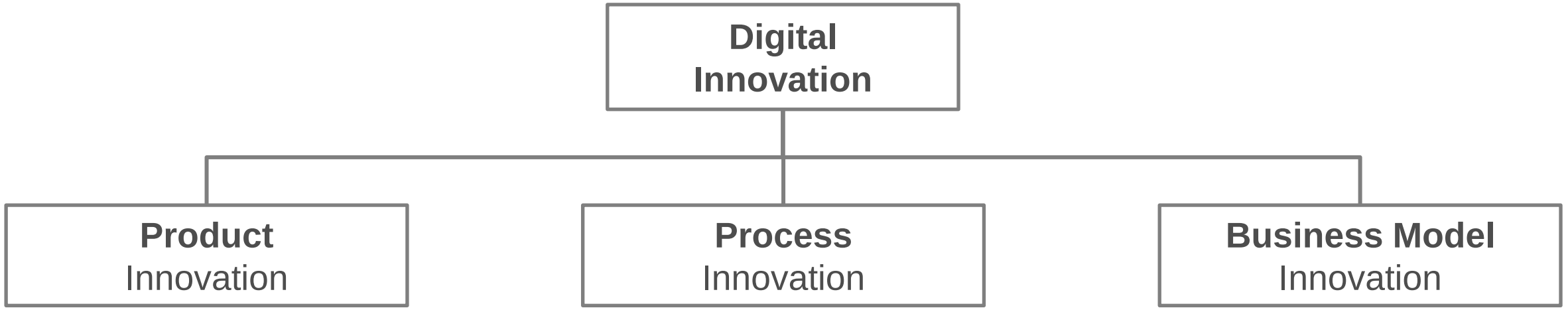
Definition: Digital Innovation

Digital innovation is a product, process, or business model that is perceived as new, requires significant changes on the part of adopters, and is embodied in or enabled by information technology.

- In digital innovation, IT plays the key role
  - This not only includes AI technology but also other types of technology (e.g., cloud infrastructure technology, database technology)
- The perception of a digital innovation being “new” is also a matter of perspective:
  - For example, a small company might view adopting a CRM system as innovative, while larger companies may consider it a standard practice

Fichman et al. 2014; Nambisan et al. 2017

Types of Digital Innovation



Digital product innovations are significantly **new products or services** that are either embodied in IT or enabled by IT.

Digital process innovations are significantly **new ways of doing things in an organizational setting** that are embodied in or enabled by IT.

Digital business model innovations are significantly **new ways of creating and capturing business value** that is embodied in or enabled by IT.

Fichman et al. 2014

Types of Innovation

Which innovation type best describes …

- … the introduction of a new chatbot for automating customer service?
- … the development of a new car that drives autonomously?
- … the integration of a new recommendation system on a shopping website?

Digital Product Innovation: Examples

- New enterprise platforms (e.g., ERP, CRM)
- New consumer products (e.g., smartphones)
- Existing products substantially enhanced by the addition of digital technology (e.g., connected car services)
- …

Fichman et al. 2014

Digital Process Innovation: Example

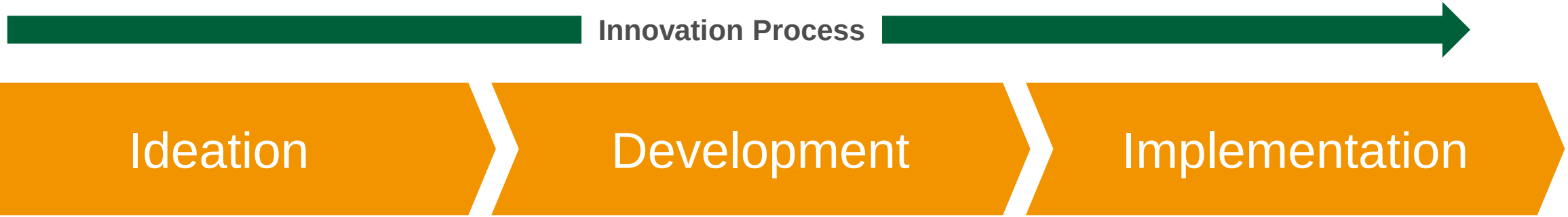
- Improve process execution and fix inefficiency using process mining software (e.g., Celonis)

https://www.youtube.com/watch?v=yuP-LwunbbY

Digital Business Model Innovation: Example

- Online platform business models, including:
  - Airbnb
  - Uber
  - Alibaba
  - Amazon
  - …

Innovation Process & Key Activities



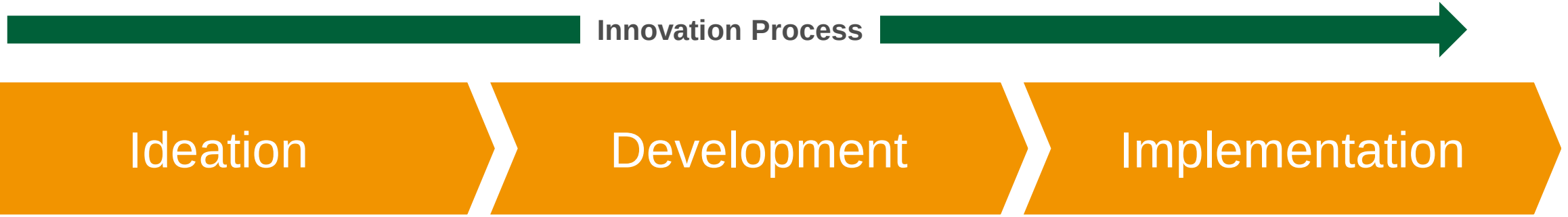
- Market analysis
- Trend analysis
- Idea generation
- Idea evaluation
- Idea selection
- …

- Proof-of-concept
- Prototype development
- Business case
- Testing
- …

- Go-live
- Production
- Marketing
- Market launch
- …

Kohli & Melville 2019; Fichman et al. 2014

Innovation Process & Key Activities



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Creativity is essential for innovation by deriving the ideas that are later implemented!

Kohli & Melville 2019; Fichman et al. 2014

Creativity

Creativity is the capacity to produce something – either abstract or physical – that is (1) new and (2) valuable.

- We do not know precisely how human creativity works
- While we tend to think that ideas come “out of the blue”, knowledge is usually an important requirement for creativity (e.g., knowledge of certain technologies or markets)
- There are many techniques (e.g., brainstorming) and tools (e.g., digital mind maps) to foster creativity

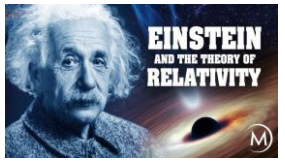
Kaufman & Beghetto 2009

Four-C Model of Creativity

- The Four-C model distinguishes between four levels of creativity:

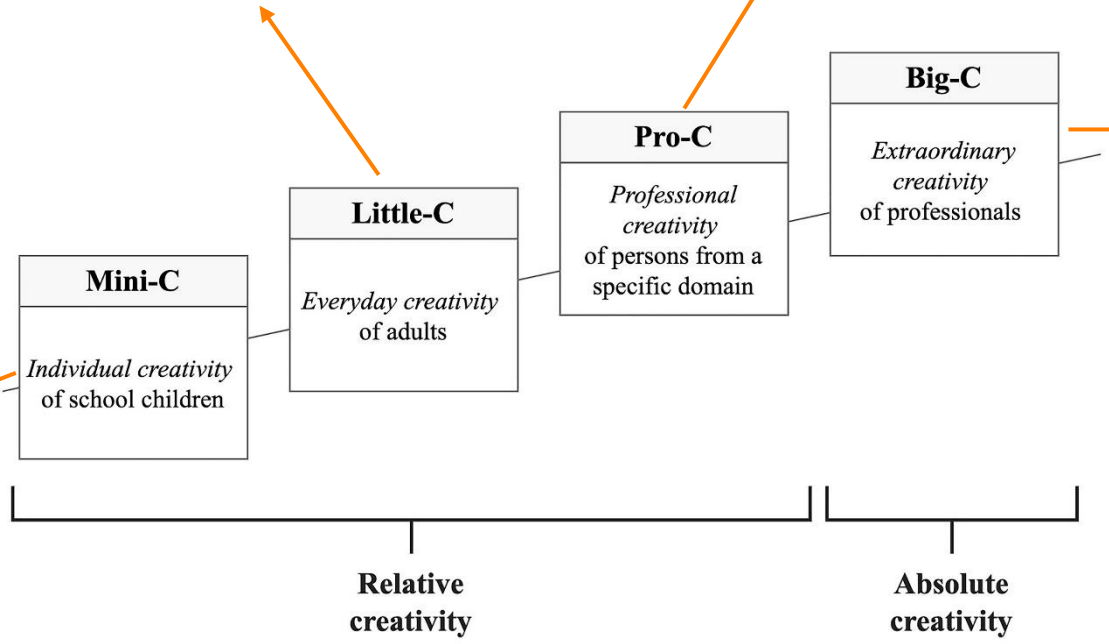
Regular people's everyday creative actions and contributions

Creative efforts of experts that other professionals in that domain recognize



Ground-breaking discoveries and enhancements

Novel and personally meaningful interpretation of experiences, actions, and events



Kaufman & Beghetto 2009

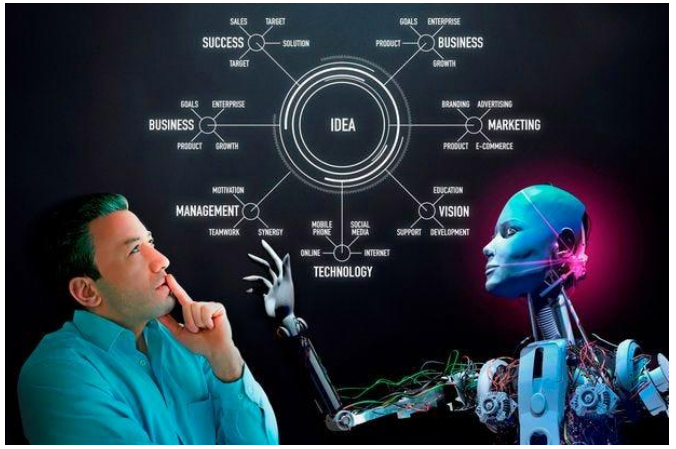
AI-Enabled Innovation

AI-Enabled Innovation

AI-enabled innovation refers to the use of AI to generate, evaluate, refine, and implement ideas for new or altered products, processes, or business models.

- AI technologies and algorithms (e.g., deep learning) can facilitate the creative interpretation of data and support decision-making within the innovation process (e.g., evaluating and selecting ideas)

- Although AI technologies may not yet be able to independently develop entire solutions (e.g., new products), they can point humans toward the most promising avenues for innovation

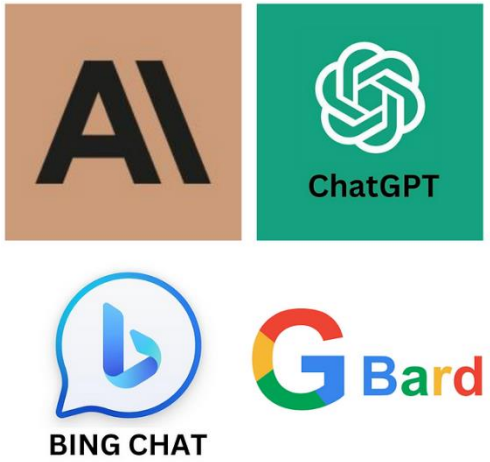


Benbya et al. 2021; Wu et al. 2020

Generative AI's Impact on Innovation

- Generative AI has a transformative impact on innovation across all industries

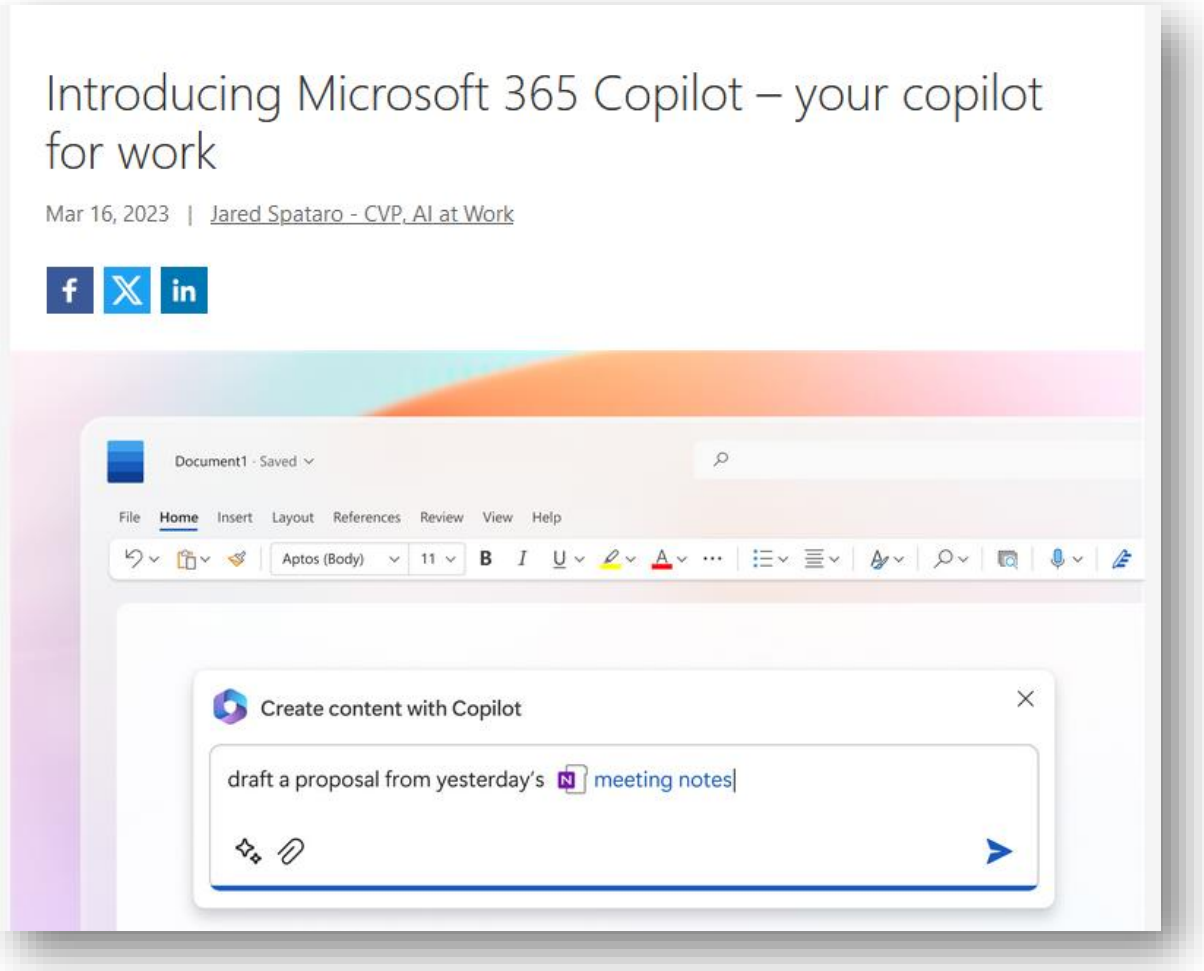
- For example, through the use of generative AI models, businesses can now generate unlimited new ideas and concepts that are often indistinguishable from human creative output



→ Generative AI Lecture

Holmström & Carroll 2024

AI-Enabled Product Innovation: Example

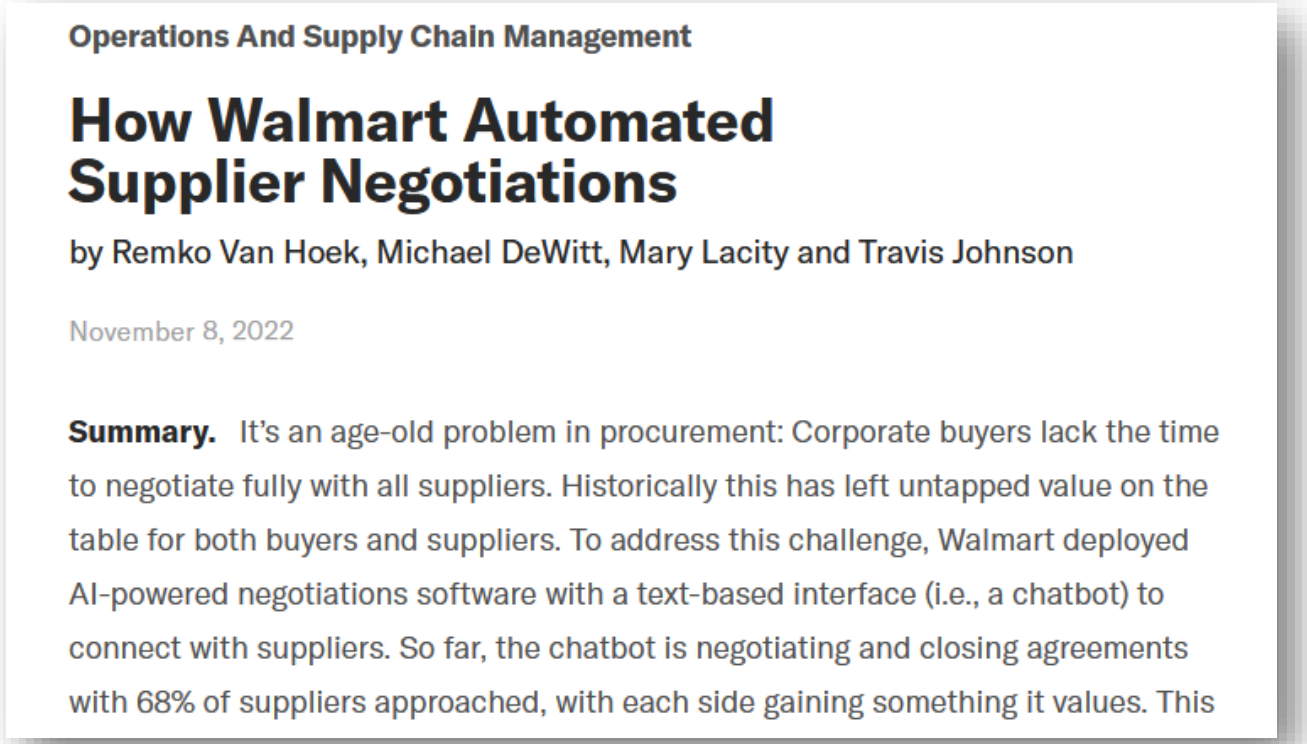


Copilot

OpenAI

https://blogs.microsoft.com/blog/2023/03/16/introducing-microsoft-365-copilot-your-copilot-for-work/

AI-Enabled Process Innovation: Example



Operations And Supply Chain Management

How Walmart Automated Supplier Negotiations

by Remko Van Hoek, Michael DeWitt, Mary Lacity and Travis Johnson

November 8, 2022

Summary. It's an age-old problem in procurement: Corporate buyers lack the time to negotiate fully with all suppliers. Historically this has left untapped value on the table for both buyers and suppliers. To address this challenge, Walmart deployed AI-powered negotiations software with a text-based interface (i.e., a chatbot) to connect with suppliers. So far, the chatbot is negotiating and closing agreements with 68% of suppliers approached, with each side gaining something it values. This

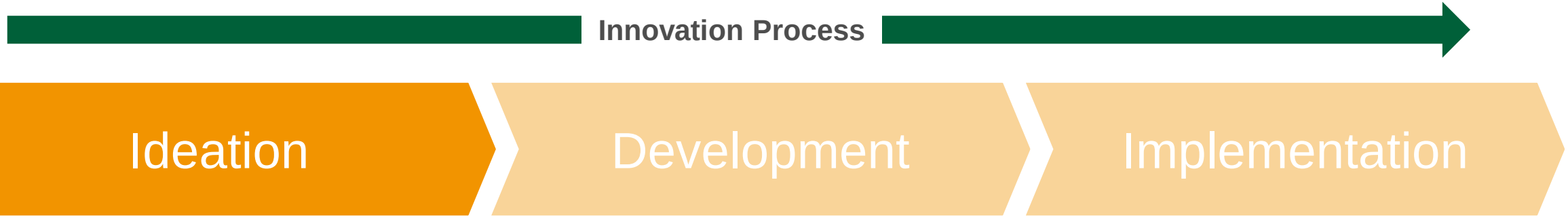
https://hbr.org/2022/11/how-walmart-automated-supplier-negotiations

AI-Enabled Business Model Innovation: Example

Waymo’s Driverless Taxi Services

https://www.businessinsider.com/waymo-self-driving-robotaxi-cars-without-drivers-amazing-tech-review-2024-4

AI in the Innovation Process: Ideation



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Kohli & Melville 2019; Fichman et al. 2014

Customer Feedback Analysis with AI

- Customer feedback in online reviews, social media comments, etc. provides a valuable source of information about unmet needs, changing preferences, and current pain points
- This information can inspire new features, products, and even business models

- Natural language processing (NLP) techniques can be used to analyze the vast amounts of unstructured data and extract insights:
  - For example, if a software company notices that many reviews request “mobile compatibility”, it may prioritize the development of a native mobile app

Natural language processing
(e.g., topic modeling, sentiment analysis, …)

Feature requests, bugs, new products or business model ideas, …

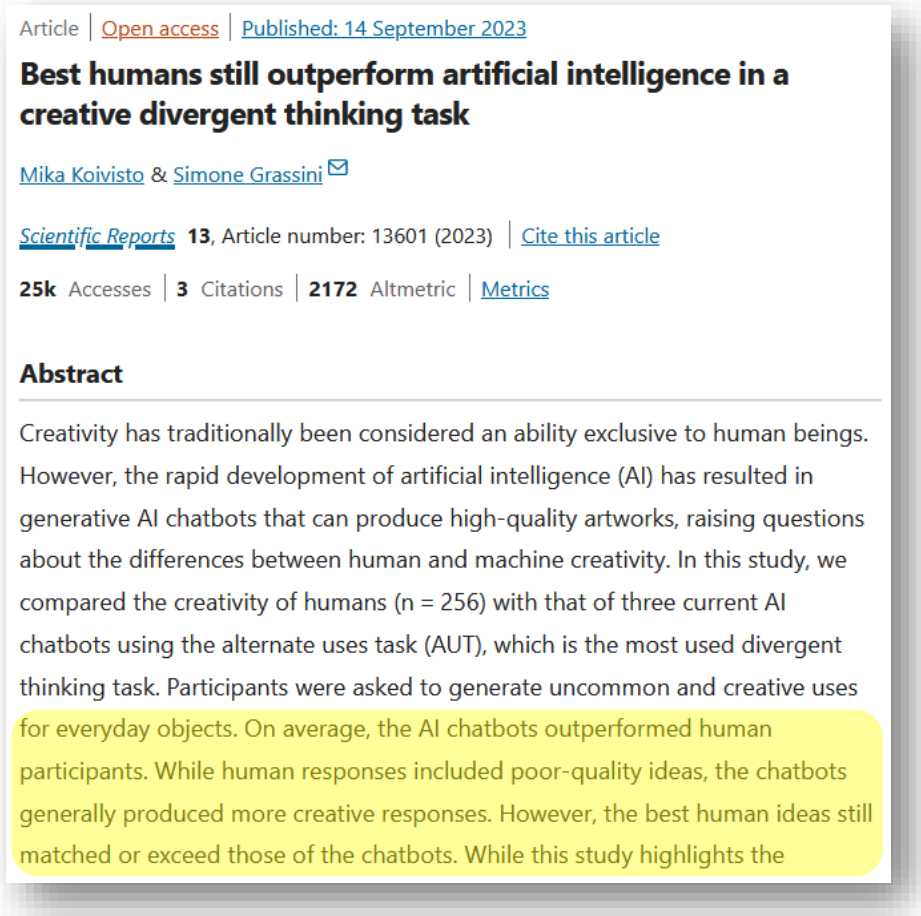
Automated Market & User Research

- Market and user research is costly and time-consuming
- AI-generated personas can replace human participants in surveys, interviews, and market research studies

Example: Synthetic Users

https://www.youtube.com/watch?v=48EekUpkfcY

Idea Generation: Human vs. AI Creativity Debate



Article | Open access | Published: 14 September 2023

Best humans still outperform artificial intelligence in a creative divergent thinking task

Mika Koivisto & Simone Grassini

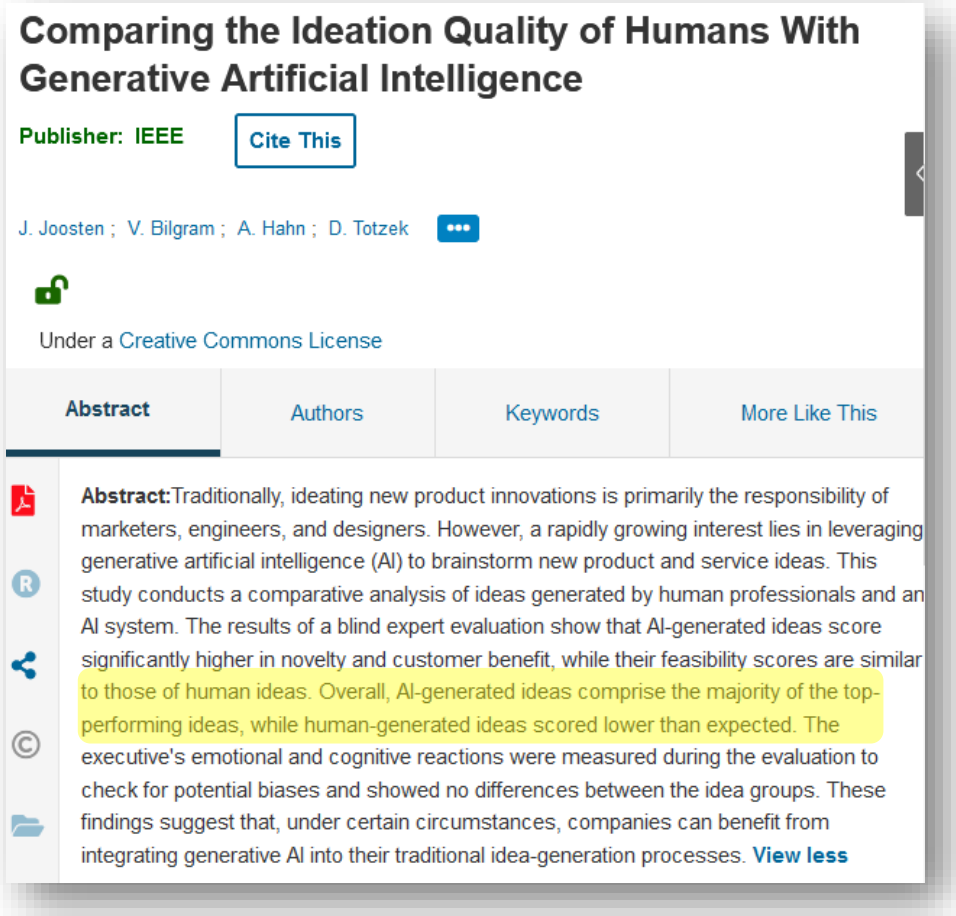
Scientific Reports **13**, Article number: 13601 (2023) | Cite this article

25k Accesses | **3** Citations | **2172** Altmetric | Metrics

Abstract

Creativity has traditionally been considered an ability exclusive to human beings. However, the rapid development of artificial intelligence (AI) has resulted in generative AI chatbots that can produce high-quality artworks, raising questions about the differences between human and machine creativity. In this study, we compared the creativity of humans (n = 256) with that of three current AI chatbots using the alternate uses task (AUT), which is the most used divergent thinking task. Participants were asked to generate uncommon and creative uses for everyday objects. On average, the AI chatbots outperformed human participants. While human responses included poor-quality ideas, the chatbots generally produced more creative responses. However, the best human ideas still matched or exceed those of the chatbots. While this study highlights the

https://www.nature.com/articles/s41598-023-40858-3



Comparing the Ideation Quality of Humans With Generative Artificial Intelligence

Publisher: IEEE | Cite This

J. Joosten ; V. Bilgram ; A. Hahn ; D. Totzek

Under a Creative Commons License

Abstract | Authors | Keywords | More Like This

Abstract: Traditionally, ideating new product innovations is primarily the responsibility of marketers, engineers, and designers. However, a rapidly growing interest lies in leveraging generative artificial intelligence (AI) to brainstorm new product and service ideas. This study conducts a comparative analysis of ideas generated by human professionals and an AI system. The results of a blind expert evaluation show that AI-generated ideas score significantly higher in novelty and customer benefit, while their feasibility scores are similar to those of human ideas. Overall, AI-generated ideas comprise the majority of the top-performing ideas, while human-generated ideas scored lower than expected. The executive's emotional and cognitive reactions were measured during the evaluation to check for potential biases and showed no differences between the idea groups. These findings suggest that, under certain circumstances, companies can benefit from integrating generative AI into their traditional idea-generation processes. **View less**

https://ieeexplore.ieee.org/document/10398283

Idea Generation: Human-AI Co-Creation

Establishing the importance of co-creation and self-efficacy in creative collaboration with artificial intelligence

Jack McGuire, David De Cremer & Tim Van de Cruys

Scientific Reports **14**, Article number: 18525 (2024) | Cite this article

3865 Accesses | **1** Altmetric | Metrics

Abstract

The emergence of generative AI technologies has led to an increasing number of people collaborating with AI to produce creative works. Across two experimental studies, in which we carefully designed and programmed state-of-the-art human–AI interfaces, we examine how the design of generative AI systems influences human creativity (poetry writing). First, we find that people were most creative when writing a poem on their own, compared to first receiving a poem generated by an AI system and using sophisticated tools to edit it (Study 1). Following this, we demonstrate that this creativity deficit dissipates when people co-create with—not edit—AI and establish creative self-efficacy as an important mechanism in this process (Study 2). Thus, our findings indicate that people must occupy the role of a co-creator, not an editor, to reap the benefits of generative AI in the production of creative works.

https://www.nature.com/articles/s41598-024-69423-2

How Generative AI Can Augment Human Creativity

Use it to promote divergent thinking. by Tojin T. Eapen, Daniel J. Finkenstadt, Josh Folk, and Lokesh Venkataswamy

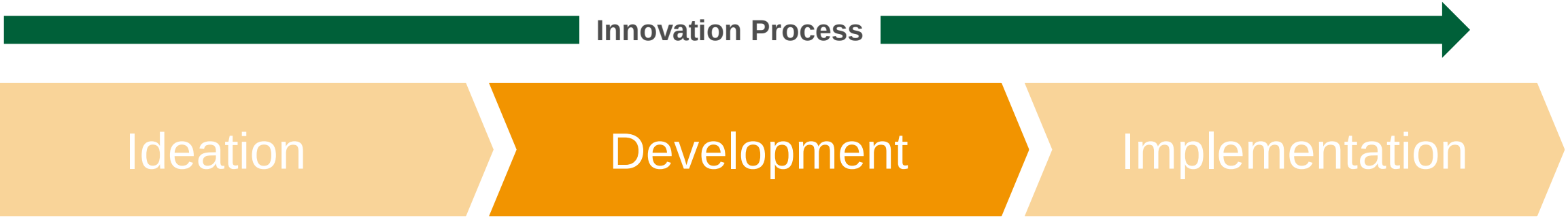
From the Magazine (July–August 2023)

AI & MACHINE LEARNING

There is tremendous apprehension about the potential of generative AI—technologies that can create new content such as audio, text, images, and video—to replace people in many jobs. But one of the biggest opportunities generative AI offers to businesses and governments is to augment human creativity and overcome the challenges of democratizing innovation.

https://hbr.org/2023/07/how-generative-ai-can-augment-human-creativity

AI in the Innovation Process: Development



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Kohli & Melville 2019; Fichman et al. 2014

AI-Moderated Prototype Testing

- Designers and developers need to continuously test their products to identify potential usability issues and improve the user experience
- Running moderated usability testing sessions regularly requires a lot of time and resources
- AI-moderated prototype testing makes it easier and faster to get actionable feedback and user insights

wondering

maze

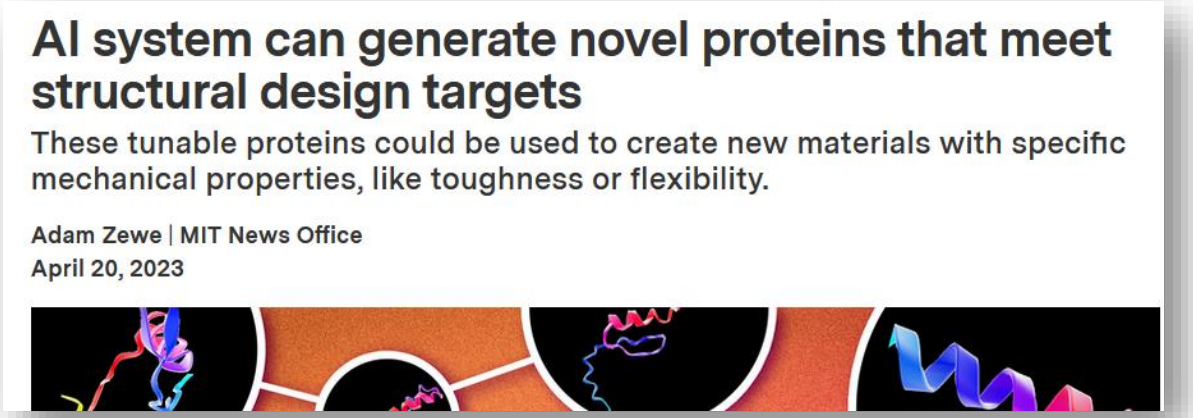
+

Figma

https://wondering.com/blog/meet-ai-moderated-prototype-testing
https://maze.co/integrations/figma/

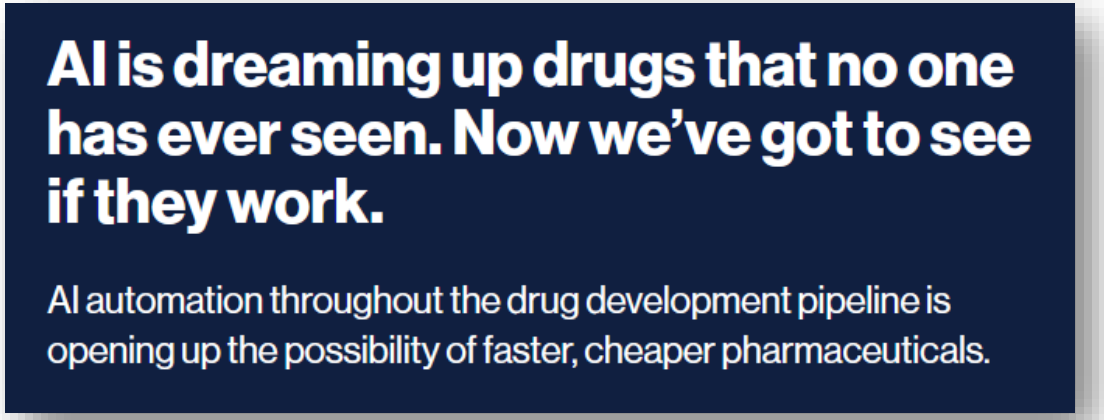
AI-Assisted Development

Chemistry (New Proteins)



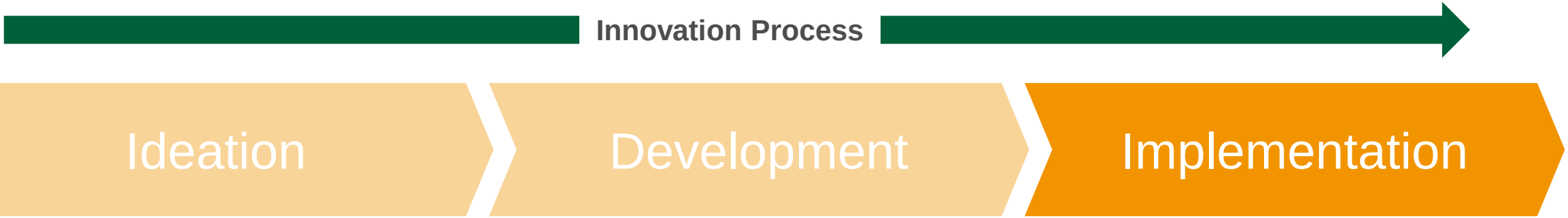
https://news.mit.edu/2023/ai-system-can-generate-novel-proteins-structural-design-0420

Medicine (New Drugs)



https://www.technologyreview.com/2023/02/15/1067904/ai-automation-drug-development/

AI in the Innovation Process: Implementation

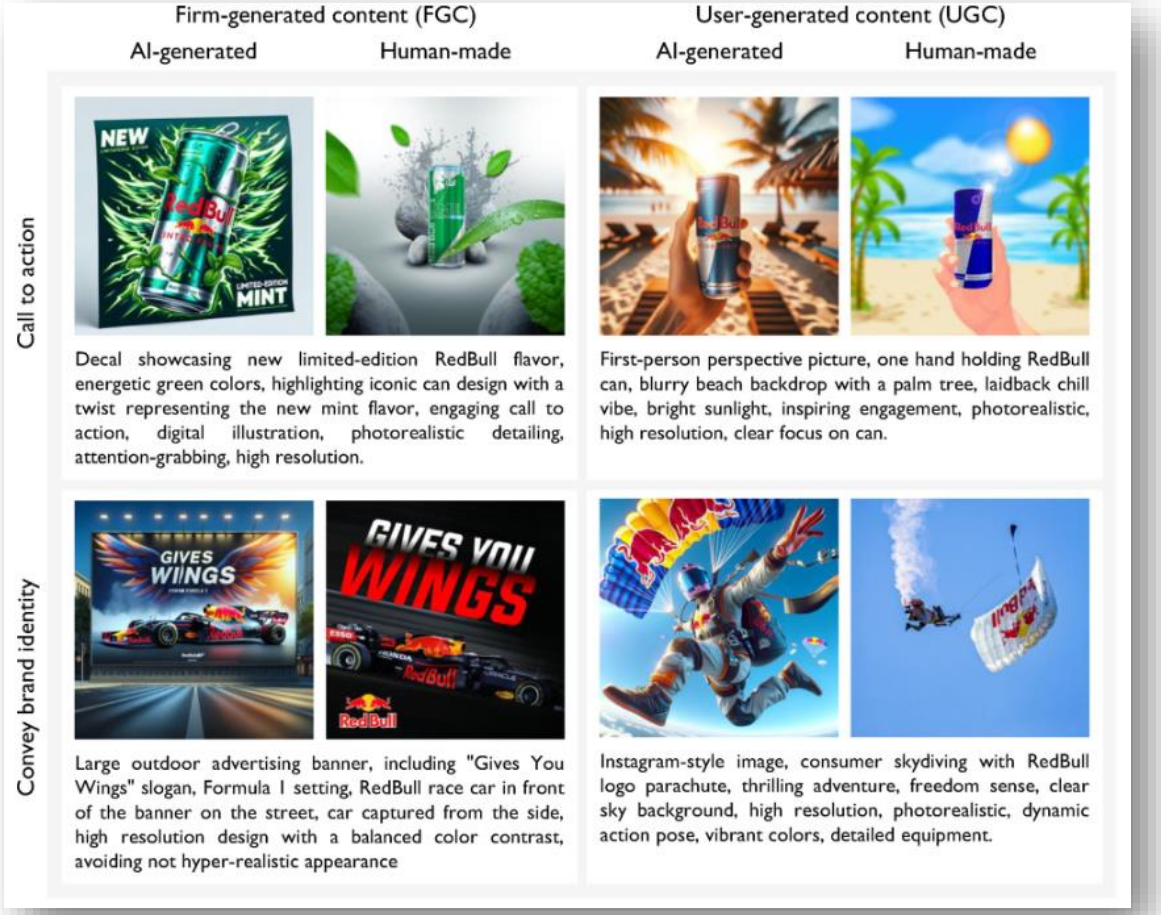


Kohli & Melville 2019; Fichman et al. 2014

AI-Generated Marketing Images

- Systematic comparison of AI-generated marketing images to human-made ones:
  - DALL-E 3, Midjourney v6, Firefly 2, Imagen 2, Imagine, Stable Diffusion XL Turbo, and Realistic Vision vs.
  - Commissioned freelancers

- **AI-generated images consistently scored higher** than human-created visuals on quality and realism
- In a real-world setting, an **AI-generated banner ad achieved a 50% higher click-through rate** than a professionally crafted stock photo



DALL-E 3 created the AI-generated images (left)

Hartmann et al. 2024

AI-Generated Marketing Videos

https://www.youtube.com/watch?v=4RSTupbfGog

Coca-Cola causes controversy with AI-made ad

The video was meant to pay homage to a classic 1995 Coca-Cola commercial.

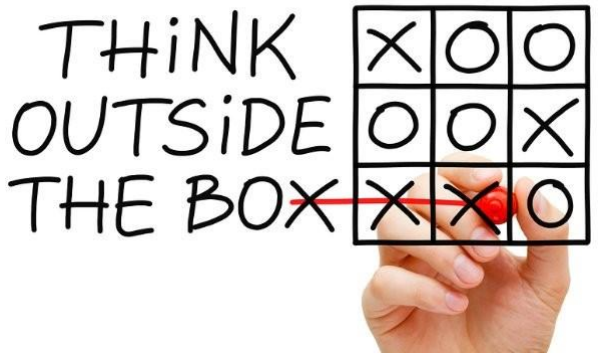
Coca-Cola is facing backlash online over an artificial intelligence-made Christmas promotional video that users are calling "soulless" and "devoid of any actual creativity."

The AI-made video features everything from big red Coca-Cola trucks driving through snowy streets to people smiling in scarves and knitted hats holding Coca-Cola bottles. The video was meant to pay homage to the company's 1995 commercial "Holidays Are Coming," which featured similar imagery, but with human actors and real trucks.

https://www.nbcnews.com/tech/innovation/coca-cola-causes-controversy-ai-made-ad-rcna180665

Challenges of AI-Enabled Innovation

Challenges of AI-Enabled Innovation



Innovation vs. Imitation:
Can AI truly innovate, or just imitate?

Data Dependency:
No AI-enabled innovation without data

Authorship Questions:
Who should be granted authorship of AI-enabled innovations?

Innovation vs. Imitation

“AI can help transmit information that is already known, but it is not an innovator […] These models can summarize conventional wisdom, but they cannot expand, create, change, abandon, evaluate, and improve on conventional wisdom in the way a young human can.”

Researchers tested how AI’s ability to imitate and innovate differs from that of children and adults:

- In one task, participants were asked how they could **draw a circle** without using a typical tool such as a compass (German: Zirkel). Given the choice between a similar tool like a ruler, a dissimilar tool such as a teapot with a round bottom, and an irrelevant tool such as a stove, **85% of children and 95% of adults** chose the **teapot**, a conceptually dissimilar tool that could nonetheless fulfill the same function as the compass by allowing them to trace the shape of a circle.



- When the same text description was provided to five large language models, their performance was much lower: Effective tools were selected anywhere from **8% of the time by the worst-performing model to 75% by the best-performing model**

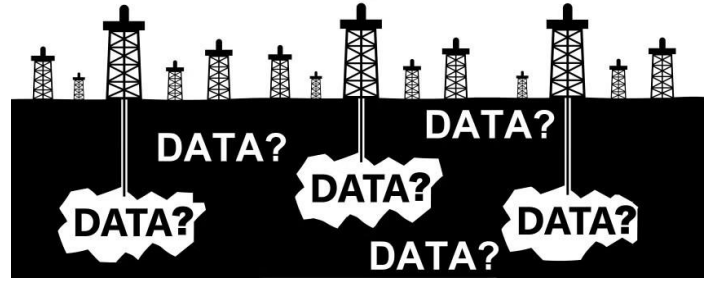
Yiu et al. 2024

Data Dependency: No AI Without Data

- **AI needs large amounts of training data** to generate, discover, and recognize new creative ideas and opportunities

- What about domains where no or only limited (high-quality) data is available?
  - Healthcare (e.g., lack of data on rare diseases)
  - Finance (e.g., privacy regulations limit the sharing of sensitive customer data)
  - …

- AI-enabled innovation will mostly benefit domains where abundant data are available → **domains for which limited data are available are not well-suited for AI**



Benbya et al. 2021

Authorship: AI as Inventors?

AI cannot be patent 'inventor', UK Supreme Court rules in landmark case

Allow patents on AI-generated inventions – for the good of science

Beyond recognition: why naming AI as inventor on patents doesn't compute

Artificial Intelligence Inventions Are Patentable Under U.S. Patent Law, Even If Artificial Intelligence Can't Be An Inventor

Who should be granted authorship of AI-enabled innovations?

Benbya et al. 2021

Authorship of AI-Enabled Innovations

Who should be granted authorship of innovations enabled through AI?

- User of the AI
- Company that the AI user works for
- Developer of the AI
- Provider of the AI's training data
- AI itself
- …?

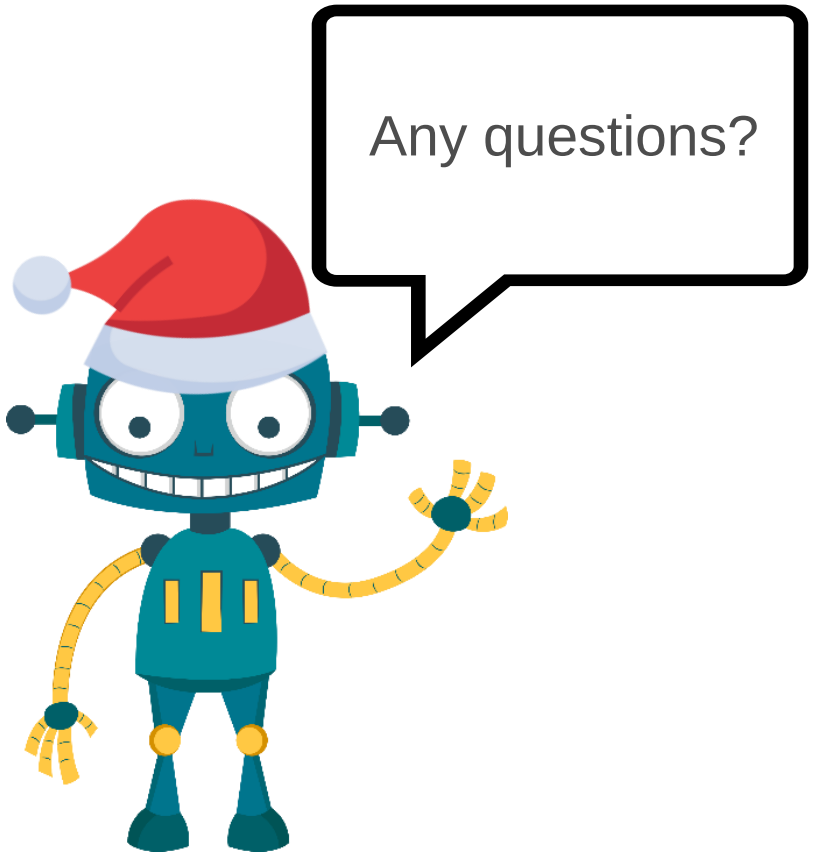
→ Discuss this question with a partner for **~5 minutes** and be ready to share your opinions

Key Takeaways From This Lecture

- (Digital) innovation is something that is perceived as new:
  1. New product or service
  2. New (business) process
  3. New business model

- The innovation process consists of three basic steps: ideation, development, and implementation
- Creativity plays an essential role in this process → AI can augment human creativity and might even produce more novel ideas than humans
- AI can be used to enhance various activities in the innovation process: market research, idea generation, prototype testing, marketing, …
- However, the use of AI for innovation raises important questions:
  - Can AI truly innovate, or just imitate?
  - What about domains where no or only limited (high-quality) training data is available?
  - Who should be granted authorship of AI-enabled innovations?

Thank you for your attention!



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