

# AI-Based Business Information Systems

## AI-Enabled Automation



Prof. Dr. Ulrich Gnewuch

## Lecture

### AI-Enabled Business Capabilities

AI-Enabled Innovation

AI-Enabled Insights & Decisions

AI-Enabled Engagement

AI-Enabled Automation

### AI Technologies & Trends

AI Ethics & Responsible AI

Generative AI

Explainable AI

Conversational AI

### Foundations

Introduction to AI in Business  
& Information Systems

Design & Management of AI-  
Based Information Systems

## Exercise

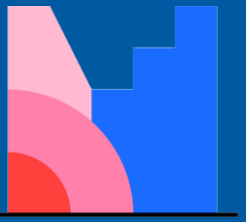
**Exercise 4:**  
Generative AI &  
Innovation

**Exercise 3:**  
Explainable AI  
Techniques

**Exercise 2:**  
Human-Centered  
Chatbot Design

**Exercise 1:**  
Robotic Process  
Automation Case Study

Industry Talk  
ZF Group



Mentimeter



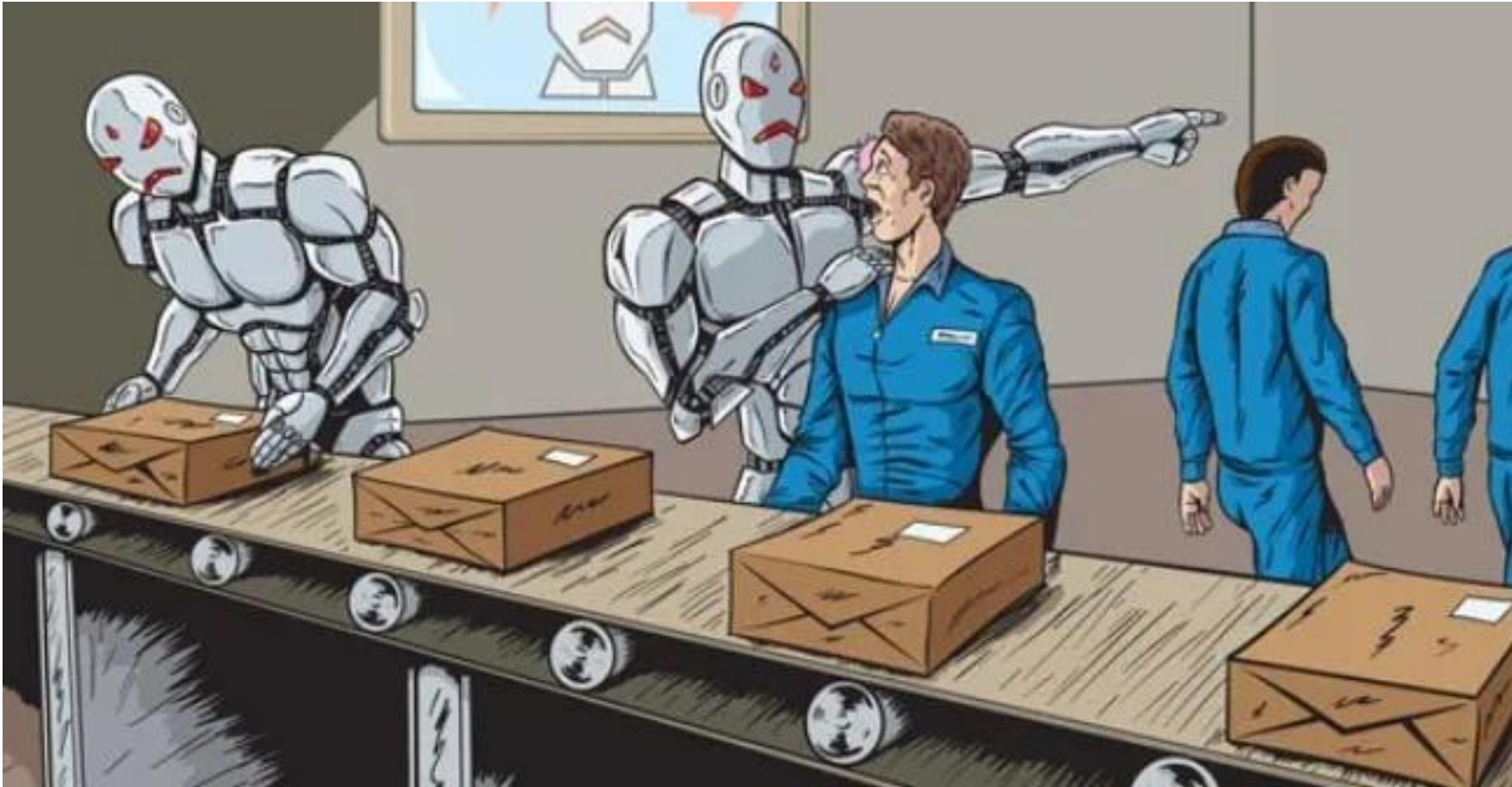
## RECAP FROM LAST LECTURE:

- Please arrange the steps of the basic design process of AI-based systems in the correct order.
- What are key differences between AI-specific vs. traditional design processes?
- What are potential questions related to managing AI at the strategic level?

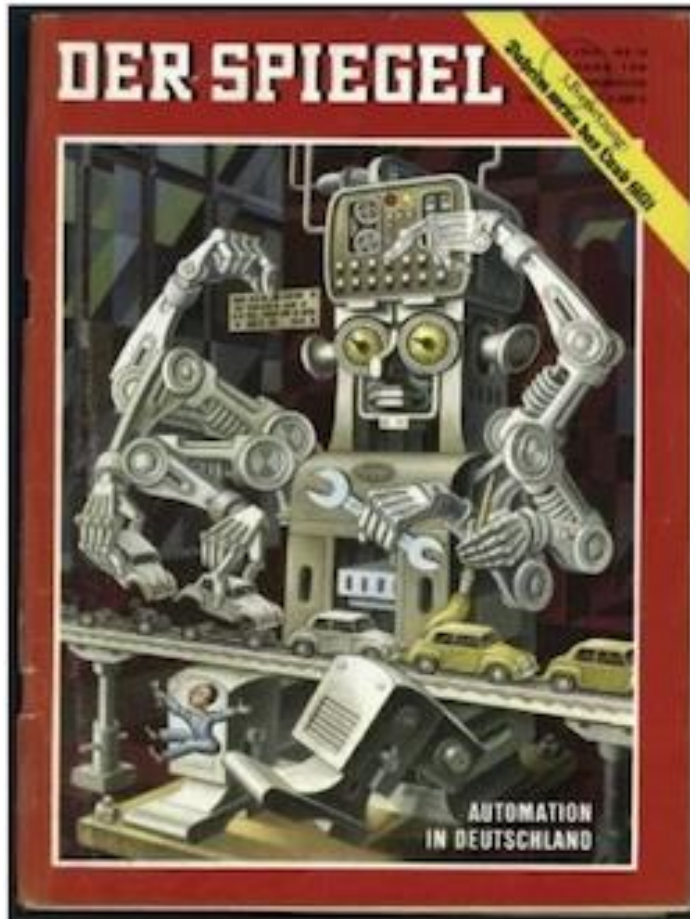


- Describe important types of AI-enabled automation of (work) tasks
- Explain how AI-enabled automation evolves over time
- Describe how humans respond to AI-enabled automation
- Contrast automation with augmentation and describe different types of augmentation

# Automation = Job Loss?







DER SPIEGEL Heft 14/1964

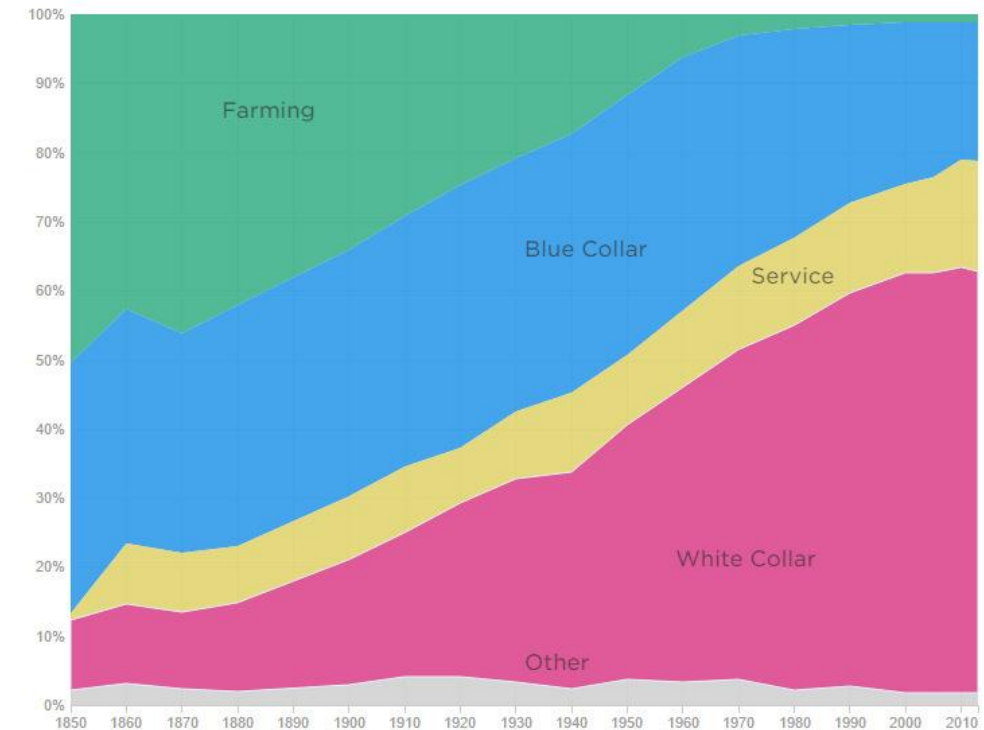


DER SPIEGEL Heft 16/1978

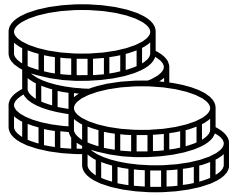


DER SPIEGEL Heft 36/2016

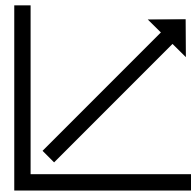
# Technological Unemployment Is Not a New Phenomenon



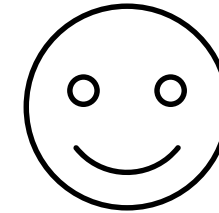
<https://www.npr.org/sections/money/2015/05/18/404991483/how-machines-destroy-and-create-jobs-in-4-graphs>



Cost  
reduction



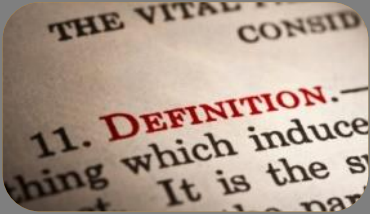
Increased  
efficiency



Relief from  
mundane tasks



# AI-Enabled Automation



Business capabilities refer to the core activities and competencies that enable an organization to achieve its business objectives and deliver value to its stakeholders. *(based on Margherita 2014)*

- *AI-enabled* business capabilities include:
  - **Automation**
  - Engagement
  - Insights & decisions
  - Innovation



AI-enabled automation refers to the use of AI to perform tasks and processes that traditionally required human involvement.



Physical automation



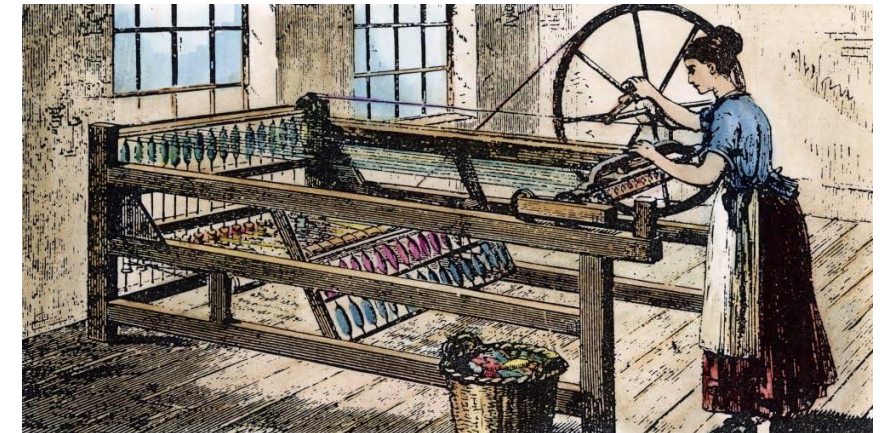
Cognitive automation

Benbya et al. 2021; Raisch & Krakowski 2021



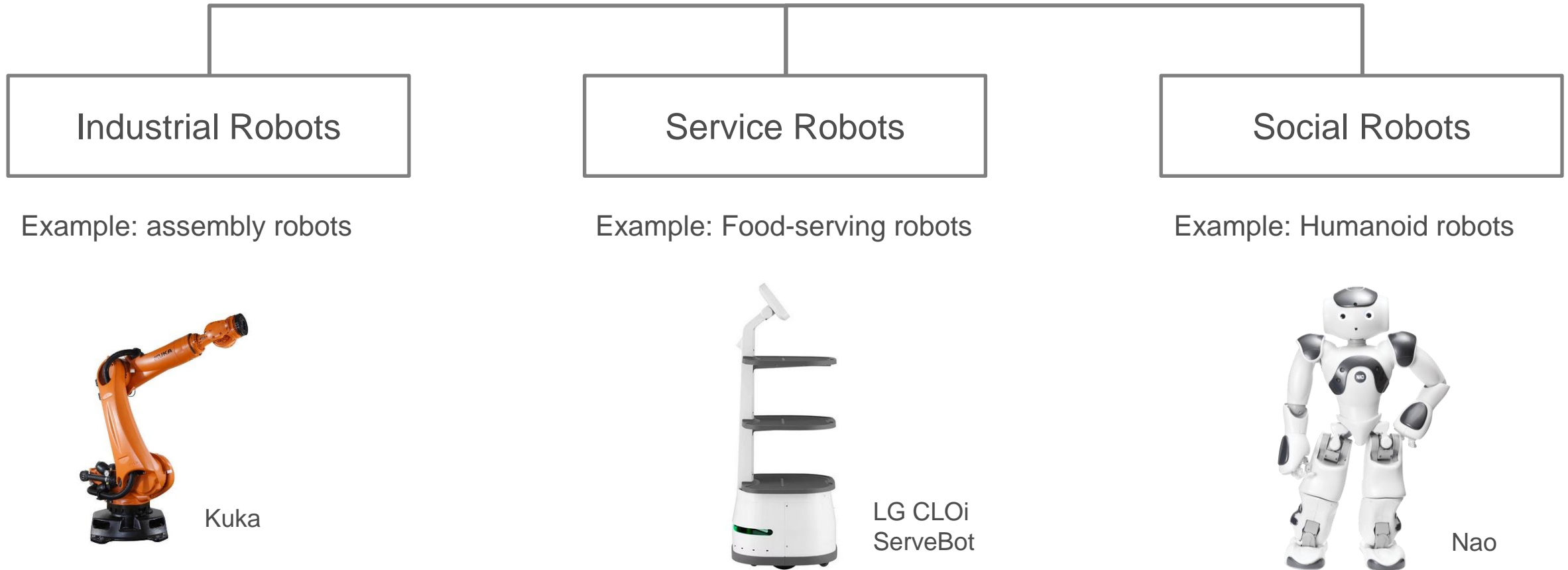
Physical automation focuses on the use of machines (e.g., robots) that execute tasks in the physical world.

- Physical automation is as old as the first industrial revolution
- Today, industrial robots can be found in many factories and warehouses
- While still emerging in Western countries, service robots are common in Asia
- Robots' physical activity causes visible changes in their physical environment



Spinning Jenny





# Example: Shelf Scanning Robots

- More than 20,000 items make up the average assortment of a drugstore in Germany
- Keeping track of how much of which product is still in stock and whether everything is in the right place is a huge task
- DM uses innovative scanning robots from the German start-up Ubica Robotics to check inventory levels at night
- On the next morning, employees evaluate the data and recognize which shelves need to be restocked, which items need to be reordered and which products need to be returned to their destination



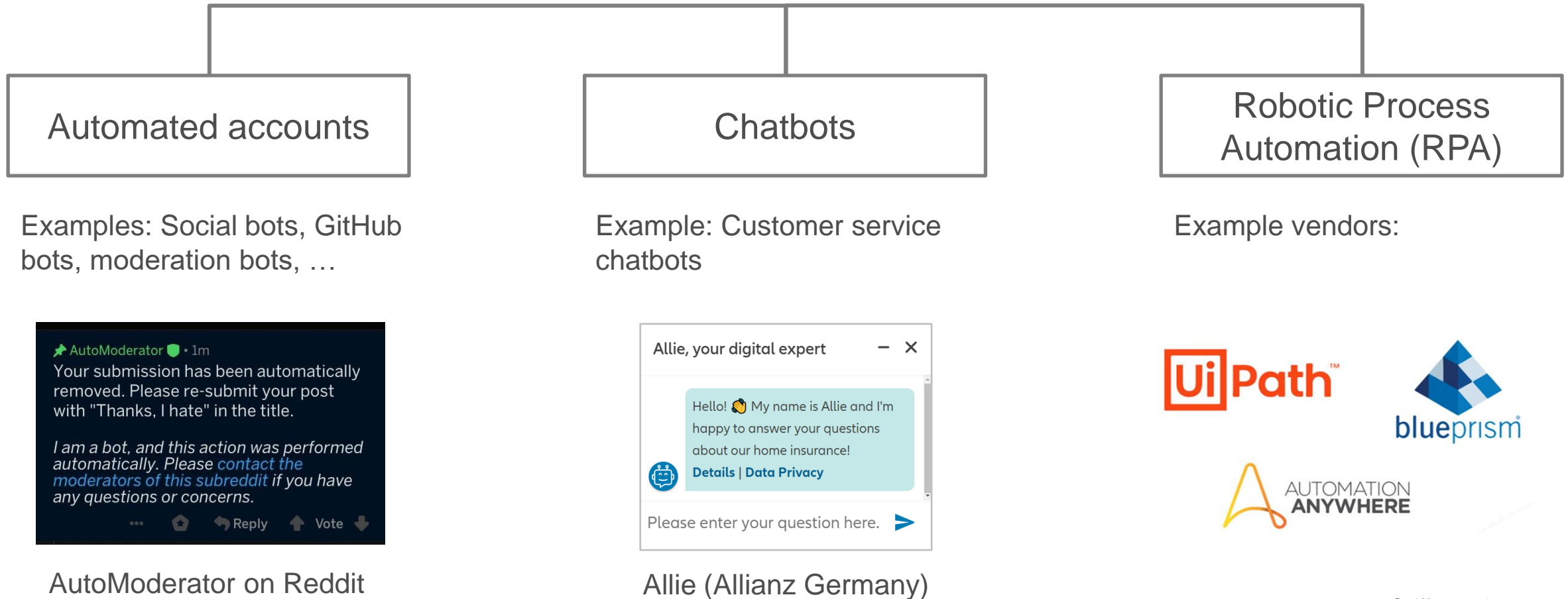
<https://www.businessinsider.de/wirtschaft/nachts-faehrt-ein-roboter-durch-die-dm-filialen-und-arbeitet-wie-die-drogeriekette-mit-maschinen-angestellte-entlasten-will-a/>



Cognitive automation focuses on the use of software (e.g., software robots) that execute tasks in the digital world.

- Cognitive automation typically targets knowledge and service work tasks, for which automation seemed unimaginable a decade ago
- Software robots (“bots”) are computer programs and have no physical form at all
- The activity of software robots may not be visible to humans

Coombs et al. 2020; Engel et al. 2022



Seiffer et al. 2021





Robotic process automation (RPA) enables digital processes to be automated through software robots (“bots”) that operate on the user interface in the same way as humans do.

- RPA bots essentially mimic human behavior by logging in with an account and password, entering data, clicking buttons, etc.
- Typically, RPA bots are designed to interact with existing IT systems (e.g., Microsoft Outlook, SAP ERP) and perform routine tasks in a rule-based manner, such as copying and pasting data from one system to another
- Though RPA is less “intelligent” than other AI technologies, it is usually considered part of AI, especially as RPA vendors are adding more intelligence to their software (e.g., integrating computer vision and machine learning capabilities)

Willcocks et al. 2016; Schulte-Derne & Gnewuch 2024

- RPA bots are ideally suited to replace humans for so called “swivel chair” processes
- Processes where humans take inputs from one set of systems (for example email), process those inputs using rules, and then enter the outputs into systems of record (e.g., Enterprise Resource Planning systems)

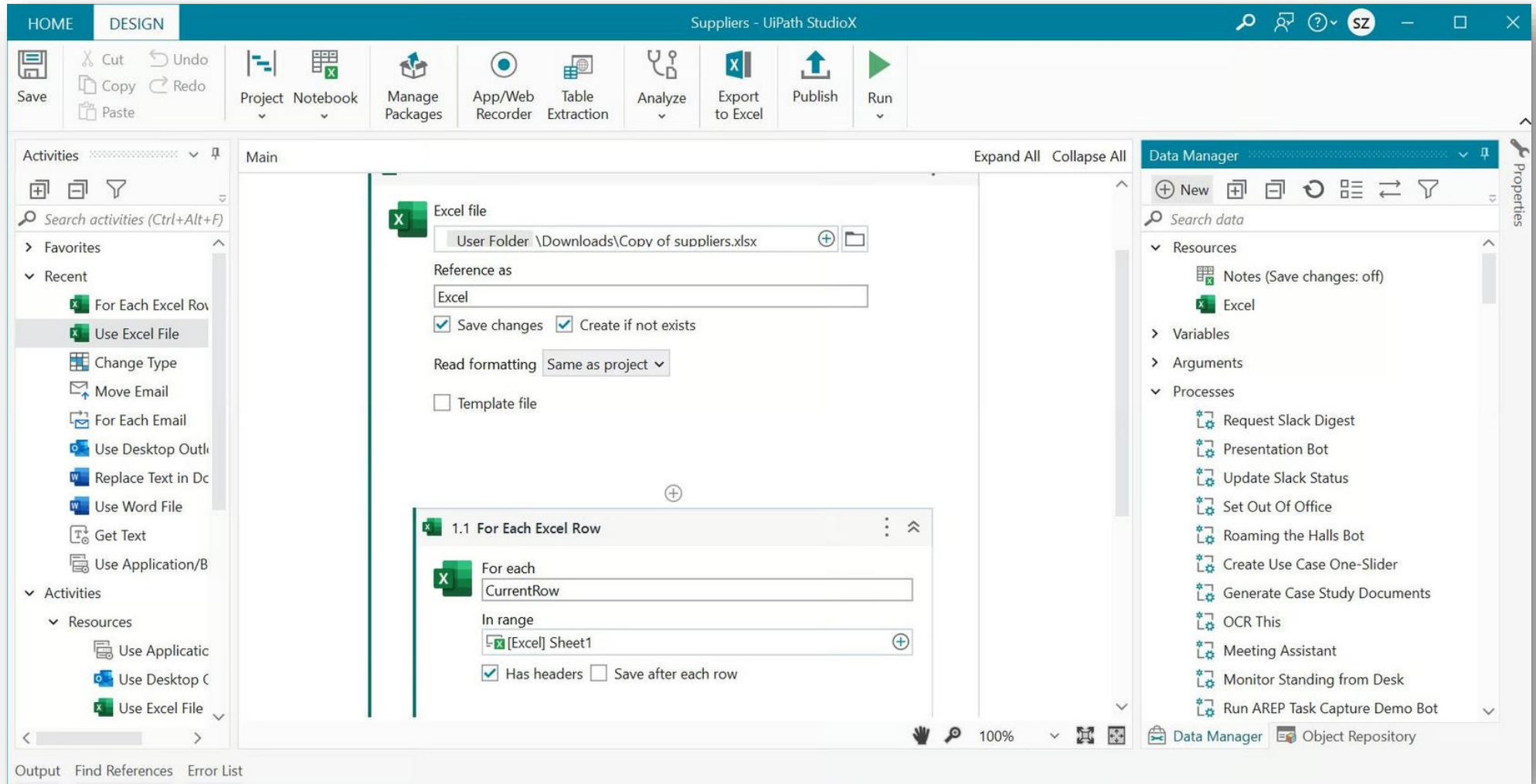


# *Example: UiPath Robotic Process Automation (RPA)*



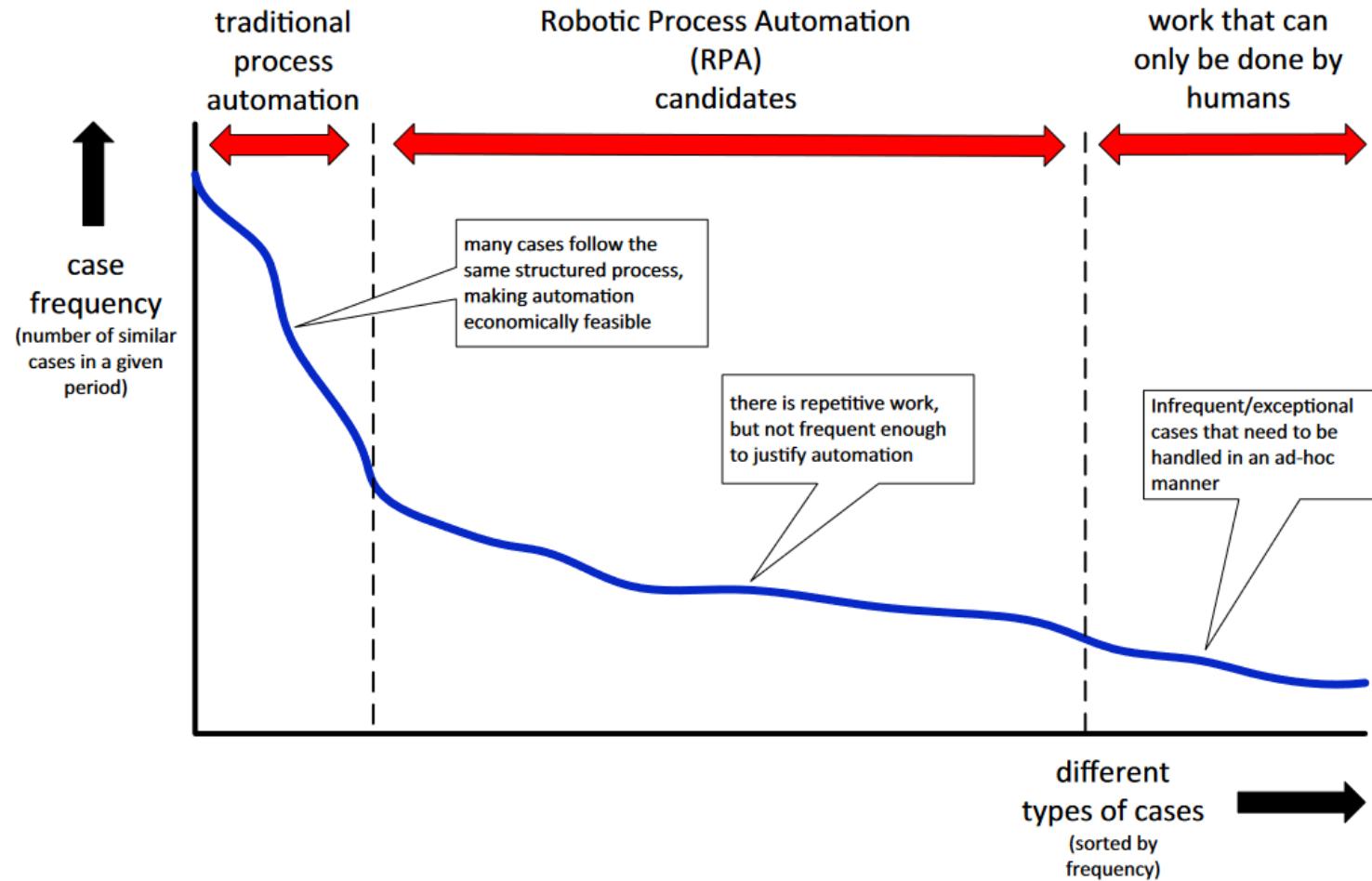
<https://www.youtube.com/watch?v=3wV271YNyfY>

# Example: UiPath Robotic Process Automation (RPA)



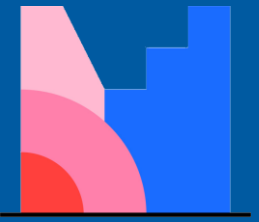


# How To Choose Which Processes To Automate With RPA?



van der Aalst et al. 2018

# Evolution of AI-Enabled Automation



Mentimeter

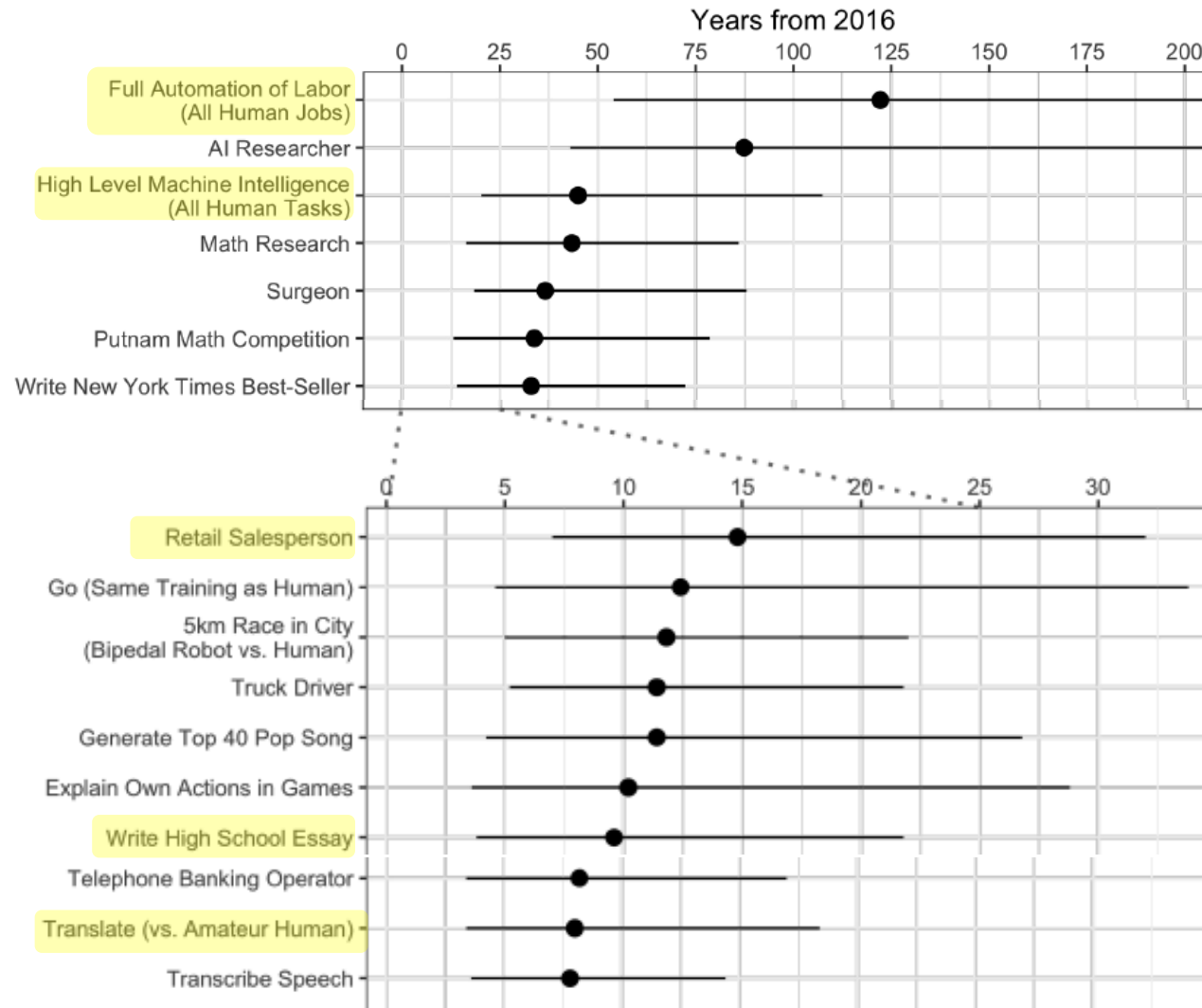


**In how many years do you expect AI to be able to perform the following jobs at or above the level of a typical human?**

- News writer
- Surgeon
- Retail salesperson
- Truck driver
- All human jobs

# When Will AI Automate All Jobs?

Survey of 352  
AI Experts  
(in 2017):

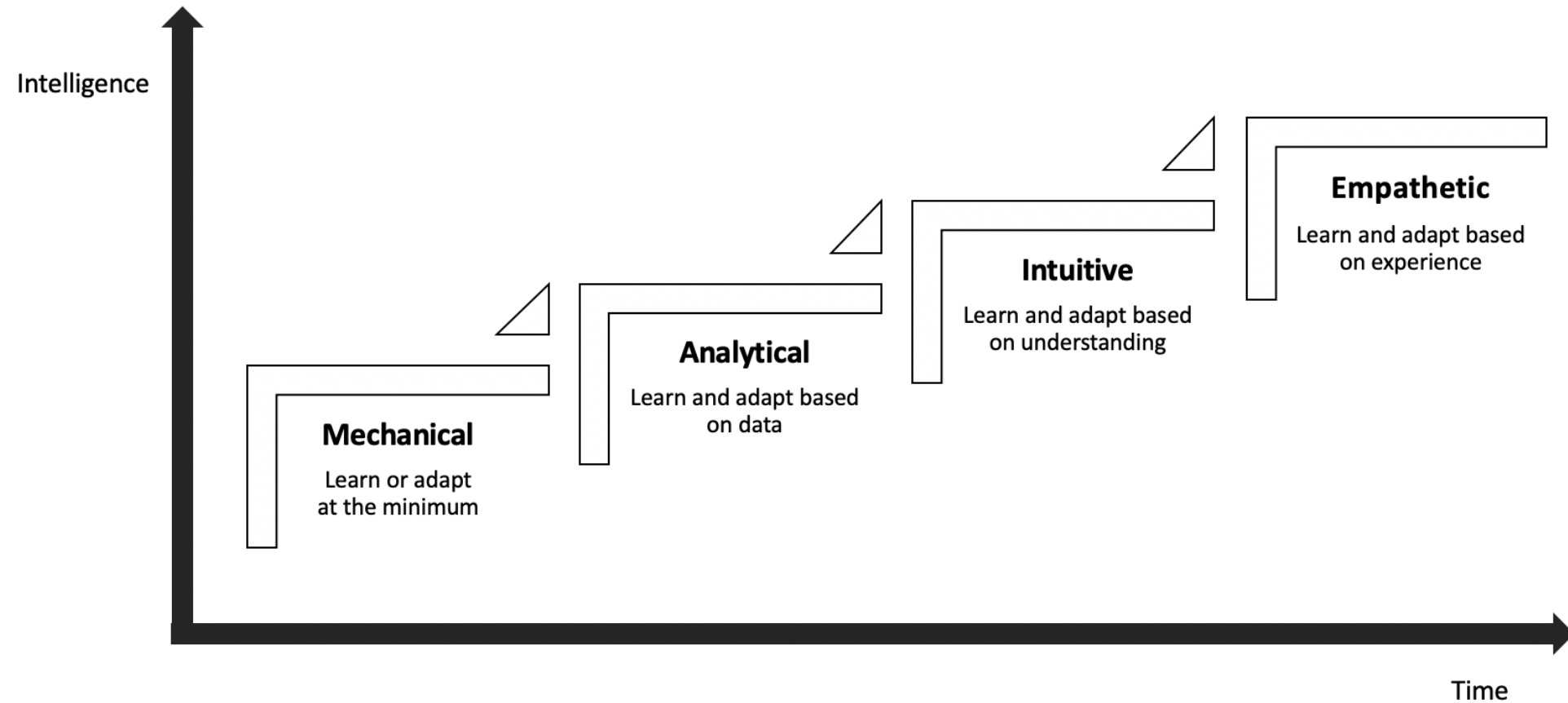


Grace et al. 2018

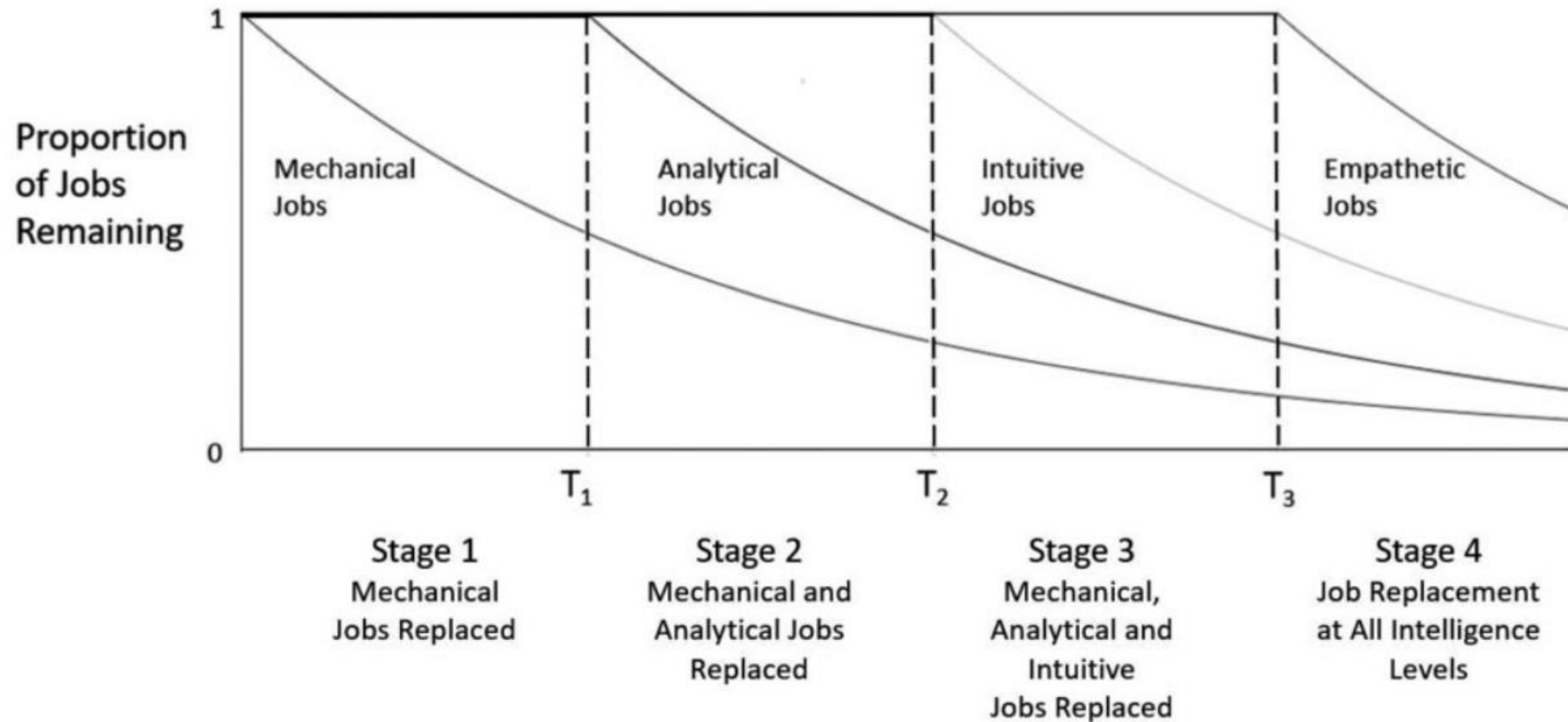


- Four intelligences: mechanical, analytical, intuitive, empathetic

Intelligences	Tasks	Example Jobs
<b>Mechanical</b>	Simple, standardized, repetitive, routine, and transactional tasks	Call center agents, retail salespersons, waiters/waitress, taxi drivers, ...
<b>Analytical</b>	Tasks that require logical thinking and decision-making	Data scientists, accountants, financial analyst, auto service technicians, engineers, ...
<b>Intuitive</b>	Tasks that require intuitive, holistic, experiential and contextual interaction	Marketing managers, management consultants, lawyers, doctors, sales managers, senior travel agents, ...
<b>Empathetic</b>	Social, emotional, communicative, and highly interactive tasks	Politicians, negotiators, psychiatrists, ...

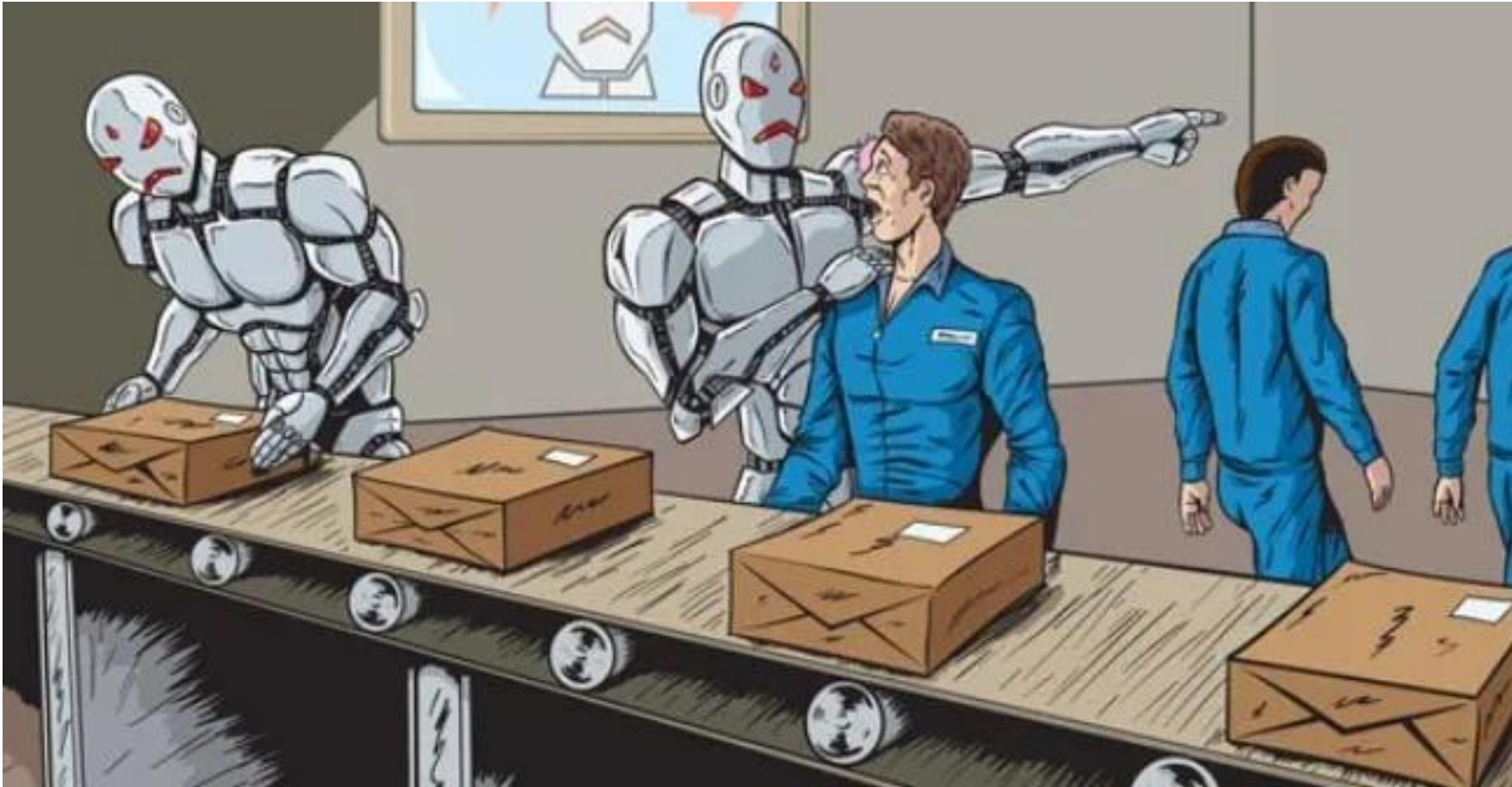


Huang & Rust 2018



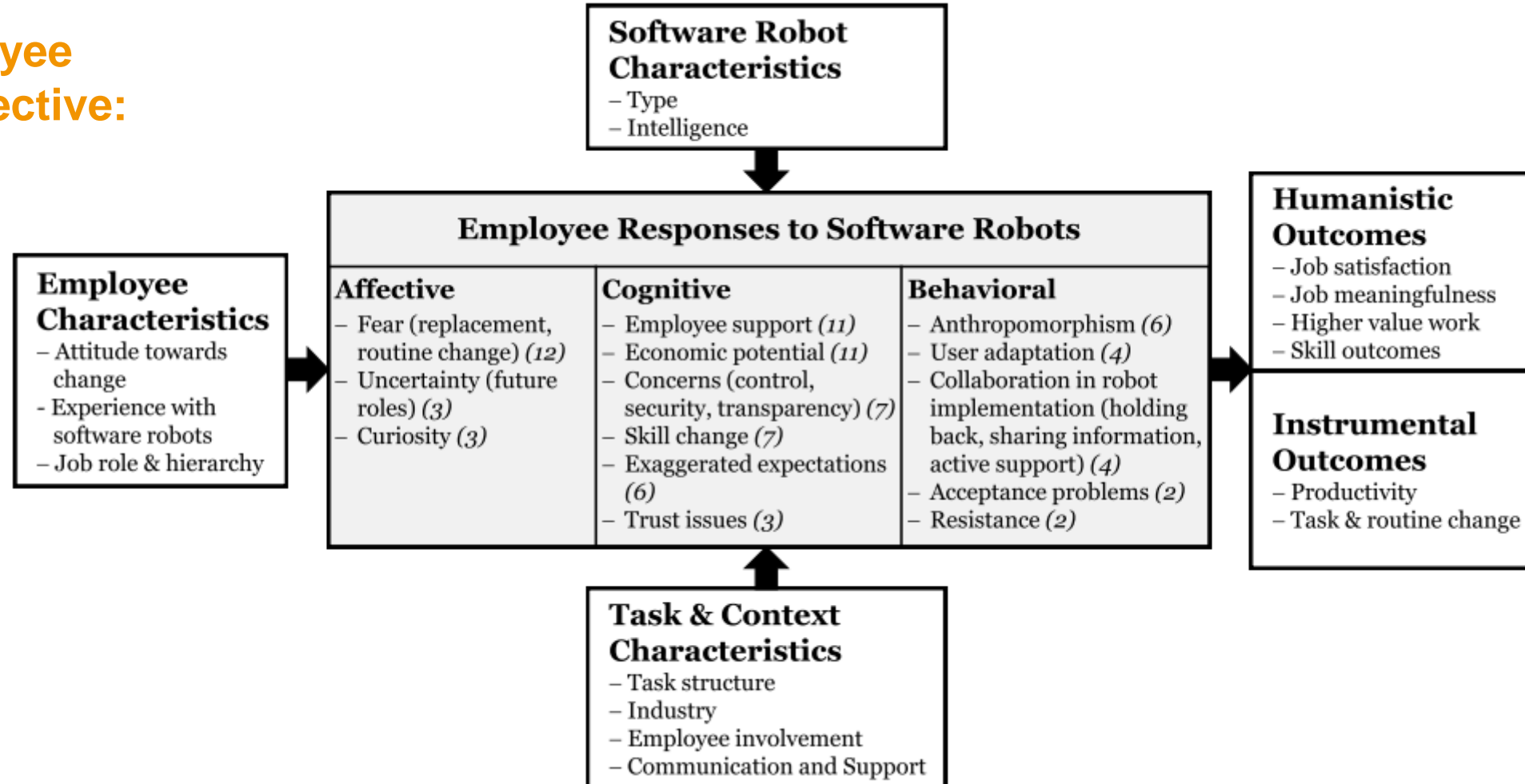
Huang & Rust 2018

# Human Responses to AI-Enabled Automation





## Employee Perspective:



*“Especially the fear of the robots, all of those movies that we've seen where the robots take over... so they're like I'm going to lose my job over this, you know? It's always that fear.”*

**Fear**

*“The team were delighted with this process right, because they don't want to sit around doing these transactions anyways... [...] So having such a repetitive manual task taken away from you they thought was really cool, 'cause then they can get on and do much more human add value work”*

**Excitement**

*“They do not fully trust the robots because robots do not get it right every time. It’s assisting us to some degree... But what I’m saying is we can’t rely on the robot for any overdraft account that he’s giving us the full picture.”*

## **(Mis)trust**

*“We don’t want the robot to be a superuser as an individual bot can do random stuff to the database, which is quite risky”*

## **Security Concerns**

Waizenegger & Techatassanasoontorn 2022; Techatassanasoontorn et al. 2023;

*"People talk about the robot as if it's like a person. They go, 'The robot – it's kicking out a lot of exceptions today'. And I know one of the other teams calls it [the bot] Robby ... Their nickname for it is Robby and they're like, 'Robby's having a few troubles this morning'"*

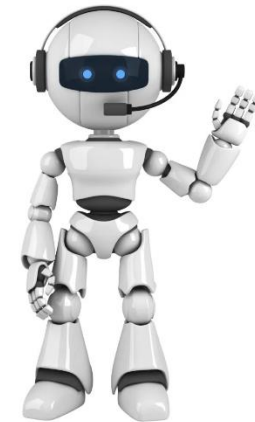
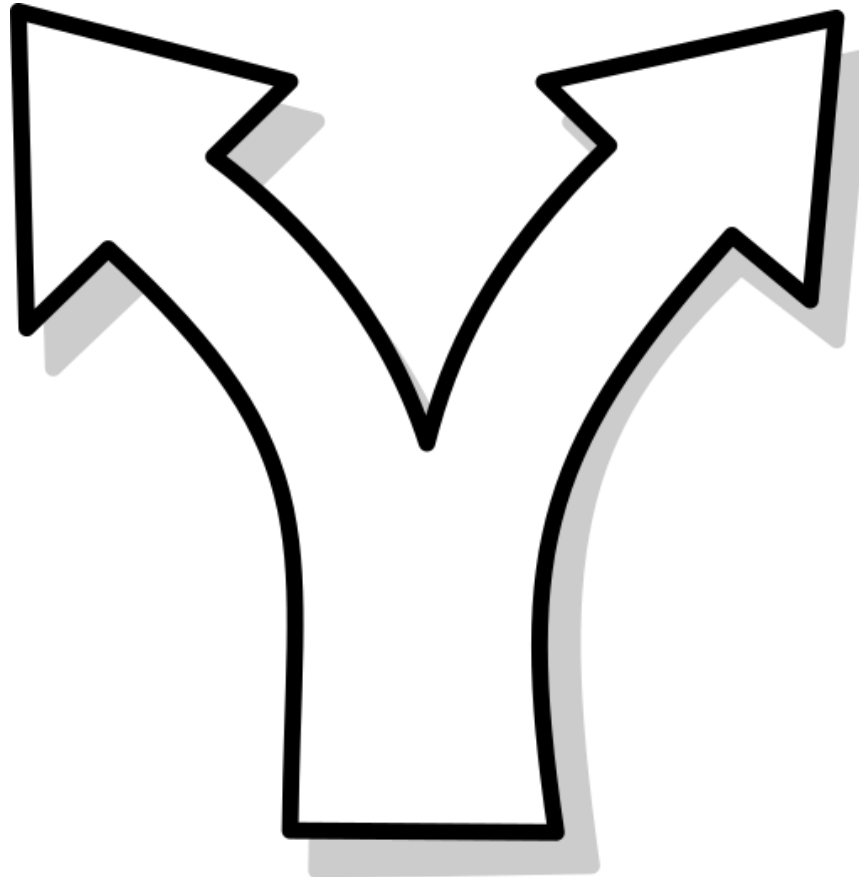
## Anthropomorphism

*"Once you bring in automation, that's when they are like, I don't understand this. I don't like this. I'm going to go back to doing it myself."*

## Resistance



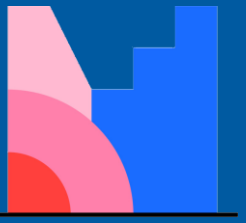
Humans



AI

Humans vs. AI: Who should do the job?





Mentimeter



## AI or human: which would you prefer to perform these tasks for you?

- Recommending a marketing strategy
- Hiring and firing employees
- Buying stocks
- Diagnosing a disease

# How Do Humans Respond to Automation?

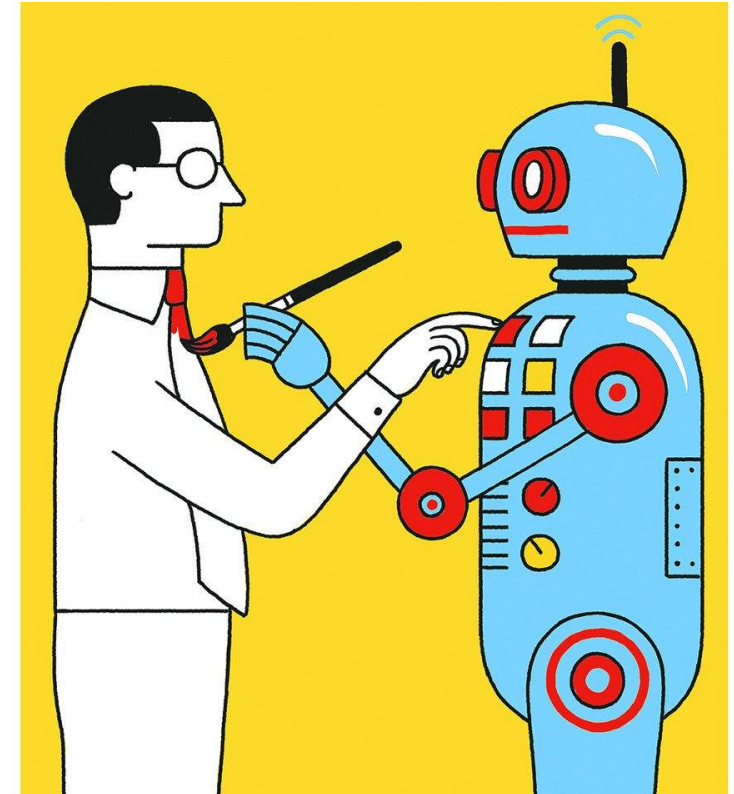
## User Perspective:

	Trust Human	Trust Algorithm	Human– Algorithm Gap
Predicting joke funny	65	30	<b>35</b>
Hiring and firing employees	72	34	<b>38</b>
Recommending a romantic partner	59	37	<b>22</b>
Writing news article	79	37	<b>42</b>
Predicting recidivism	54	42	<b>12</b>
Composing a song	81	43	<b>38</b>
Driving a truck	81	43	<b>38</b>
Recommending a gift	75	46	<b>29</b>
Predicting student performance	63	46	<b>17</b>
Piloting a plane	79	47	<b>32</b>
Driving a car	81	47	<b>34</b>
Recommending disease treatment	73	48	<b>25</b>
Diagnosing a disease	73	48	<b>25</b>
Predicting employee performance	61	50	<b>11</b>

	Trust Human	Trust Algorithm	Human– Algorithm Gap
Driving a subway	77	52	<b>25</b>
Predicting an election	51	54	<b>–3</b>
Recommending a marketing strategy	70	56	<b>14</b>
Recommending music	75	59	<b>16</b>
Recommending a movie	76	59	<b>17</b>
Buying stocks	62	60	<b>2</b>
Playing a piano	84	61	<b>23</b>
Predicting stocks	55	63	<b>–8</b>
Predicting weather	57	67	<b>–10</b>
Scheduling events	78	69	<b>9</b>
Analyzing data	69	80	<b>–11</b>
Giving directions	70	82	<b>–12</b>

Castelo et al. 2019

- Skill erosion refers to the process of losing skills and knowledge needed to perform a job/task when automation takes over
- Examples:
  - Financial advisors are no longer able to analyze loan applications and make loan decisions independently
  - AI writing assistance leads to a decline in writing skills
  - Generative AI leads to an erosion of human creativity (e.g., ChatGPT writes poems or essays)
  - ...



Rinta-Kahila et al. 2023

Is it still necessary to learn spelling and grammar in the age of AI and AI-based writing assistance?

## Philologen: Beherrschung von Rechtschreibung nicht verhandelbar – trotz KI

30. April 2024

3

**BERLIN. Muss Rechtschreibung in Zeiten von KI und intelligenten Korrekturprogrammen überhaupt noch intensiv gelernt werden? Unbedingt, fordern die organisierten Gymnasiallehrkräfte und warnen vor einer Aufweichung.**

Der deutsche Philologenverband warnt davor, angesichts von Korrektur-Programmen und Künstlicher Intelligenz (KI) die souveräne Beherrschung der deutschen Rechtschreibung infrage zu stellen. Diese sei auch in Zeiten von KI nicht verhandelbar, hieß es am Dienstag in einer Mitteilung des Verbands. Die Vorsitzende Susanne Lin-Klitzing kritisierte Aussagen von Baden-Württembergs Ministerpräsident Winfried Kretschmann. Der Grünen-Politiker hatte kürzlich in einem «Zeit»-Interview gesagt: «Ich frage mich: Ist Rechtschreibung tatsächlich so wichtig, wenn das Schreibprogramm alles korrigiert?» ([News4teachers berichtete.](#))

<https://www.news4teachers.de/2024/04/philologen-beherrschung-von-rechtschreibung-nicht-verhandelbar-trotz-korrekturprogrammen/>



## Erosion of Language Skills in the Age of AI

Today, AI-based writing tools can not only provide language feedback but also generate entire texts on their own. With this in mind, do you believe it is still necessary to learn spelling and grammar in high school? Why or why not?

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



# Automation vs. Augmentation


## 8. We foster the cooperative model.

We believe that human and machine intelligence are complementary, with each bringing its own strength to the table. While we believe in a people first approach of human-machine collaboration, we recognize, that humans can benefit from the strength of AI to unfold a potential that neither human or machine can unlock on its own.

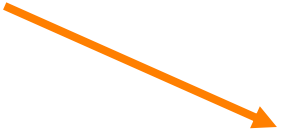
We recognize the widespread fear, that AI enabled machines will outsmart the human intelligence. We as Deutsche Telekom think differently. We know and believe in the human strengths like inspiration, intuition, sense making and empathy. But we also recognize the strengths of AI like data recall, processing speed and analysis. By combining both, AI systems will help humans to make better decisions and accomplish objectives more effective and efficient.

<https://www.telekom.com/en/company/digital-responsibility/details/artificial-intelligence-ai-guideline-524366>

- IT has always been used to automate work, but the growing capabilities of AI may allow automation on a much larger scale
- Still, not all tasks can be (fully) automated
- Key strategic decision between *automation* and *augmentation*:



**Automation:** Humans hand over a task to AI with little or no further involvement.



**Augmentation:** Humans collaborate closely with AI to perform a task.

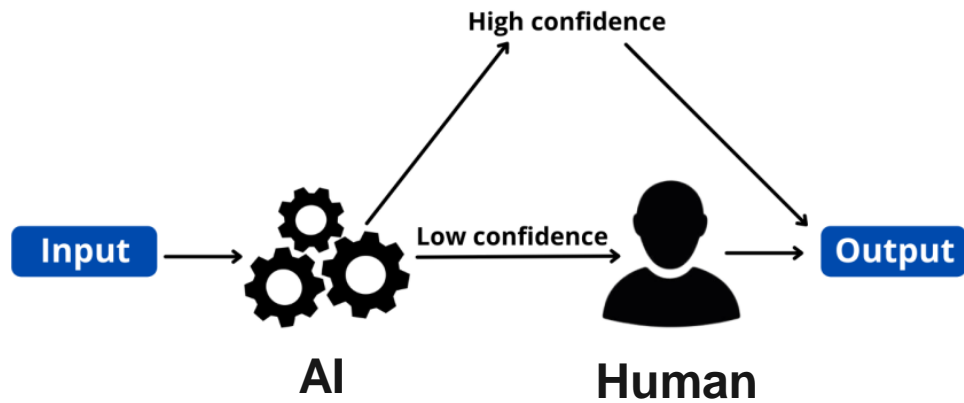


Reduce costs and free up staff for more value-added work

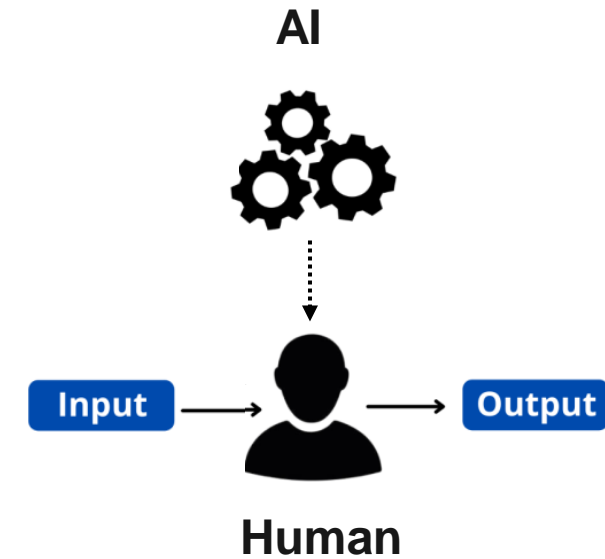


Leverage complementary strengths and enable mutual learning

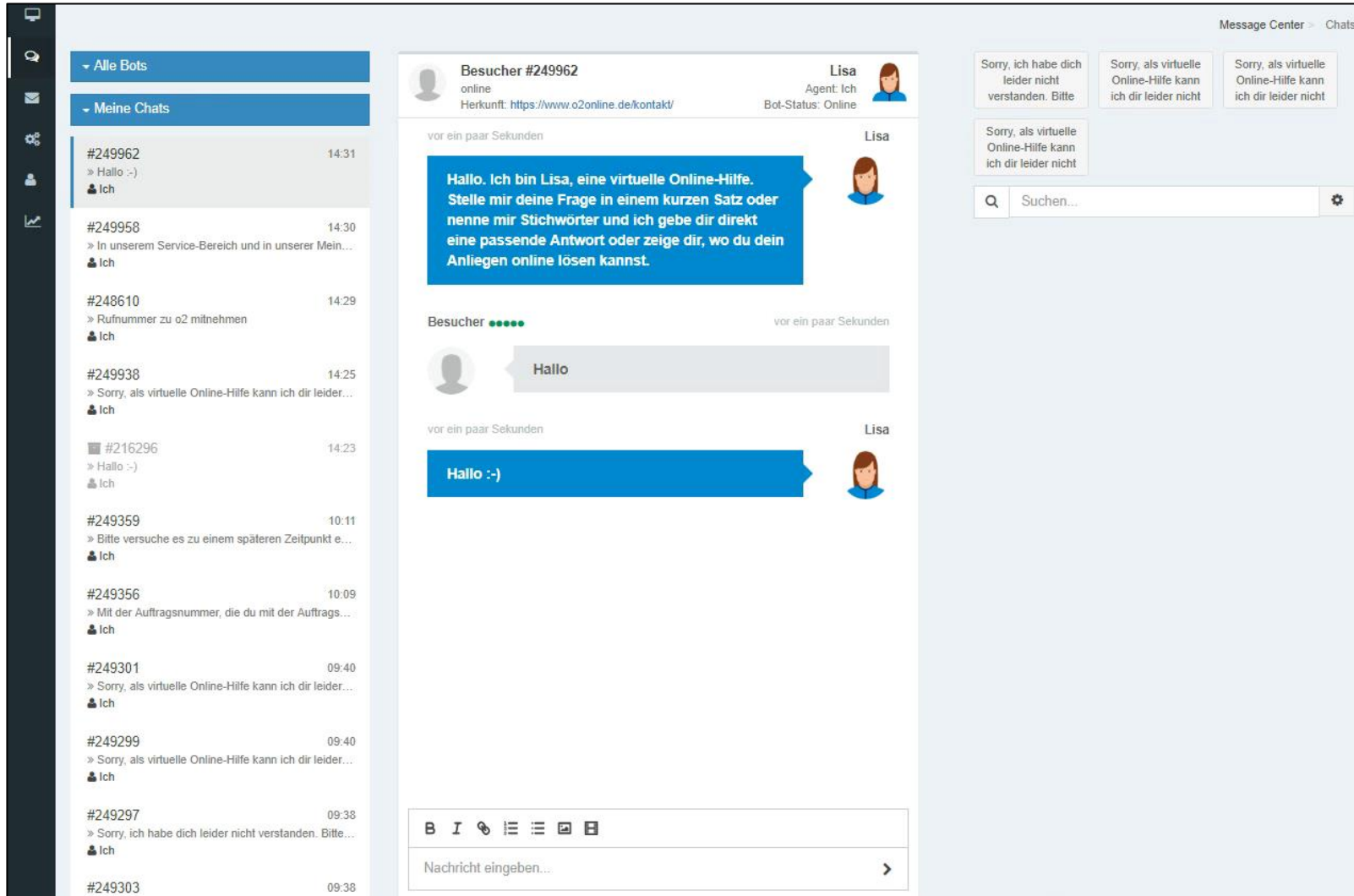
Raisch & Krakowski 2021; Rai et al. 2019



**Human-in-the-Loop  
(HITL)**



**AI-in-the-Loop**



The screenshot displays a chat application interface. On the left, a sidebar lists several chat sessions with their IDs and timestamps. The main area shows a detailed view of a chat session with a visitor and a virtual agent named Lisa.

**Chat List (Left Sidebar):**

- #249962 14:31: Hallo :-)
- #249958 14:30: In unserem Service-Bereich und in unserer Mein...
- #248610 14:29: Rufnummer zu o2 mitnehmen
- #249938 14:25: Sorry, als virtuelle Online-Hilfe kann ich dir leider...
- #216296 14:23: Hallo :-)
- #249359 10:11: Bitte versuche es zu einem späteren Zeitpunkt e...
- #249356 10:09: Mit der Auftragsnummer, die du mit der Auftrags...
- #249301 09:40: Sorry, als virtuelle Online-Hilfe kann ich dir leider...
- #249299 09:40: Sorry, als virtuelle Online-Hilfe kann ich dir leider...
- #249297 09:38: Sorry, ich habe dich leider nicht verstanden. Bitte...
- #249303 09:38:

**Chat Detail View (Right):**

**Visitor Information:** Besucher #249962, online, Herkunft: https://www.o2online.de/kontakt/

**Agent Information:** Lisa, Agent: Ich, Bot-Status: Online

**Chat History:**

- vor ein paar Sekunden: Lisa: **Hallo. Ich bin Lisa, eine virtuelle Online-Hilfe. Stelle mir deine Frage in einem kurzen Satz oder nenne mir Stichwörter und ich gebe dir direkt eine passende Antwort oder zeige dir, wo du dein Anliegen online lösen kannst.**
- vor ein paar Sekunden: Besucher: Hallo
- vor ein paar Sekunden: Lisa: Hallo :-)

**Message Input:** Nachricht eingeben...

**Message Center (Top Right):** Chats

**Feedback Buttons (Top Right):**

- Sorry, ich habe dich leider nicht verstanden. Bitte
- Sorry, als virtuelle Online-Hilfe kann ich dir leider nicht
- Sorry, als virtuelle Online-Hilfe kann ich dir leider nicht
- Sorry, als virtuelle Online-Hilfe kann ich dir leider nicht

**Search Bar (Bottom Right):** Suchen...

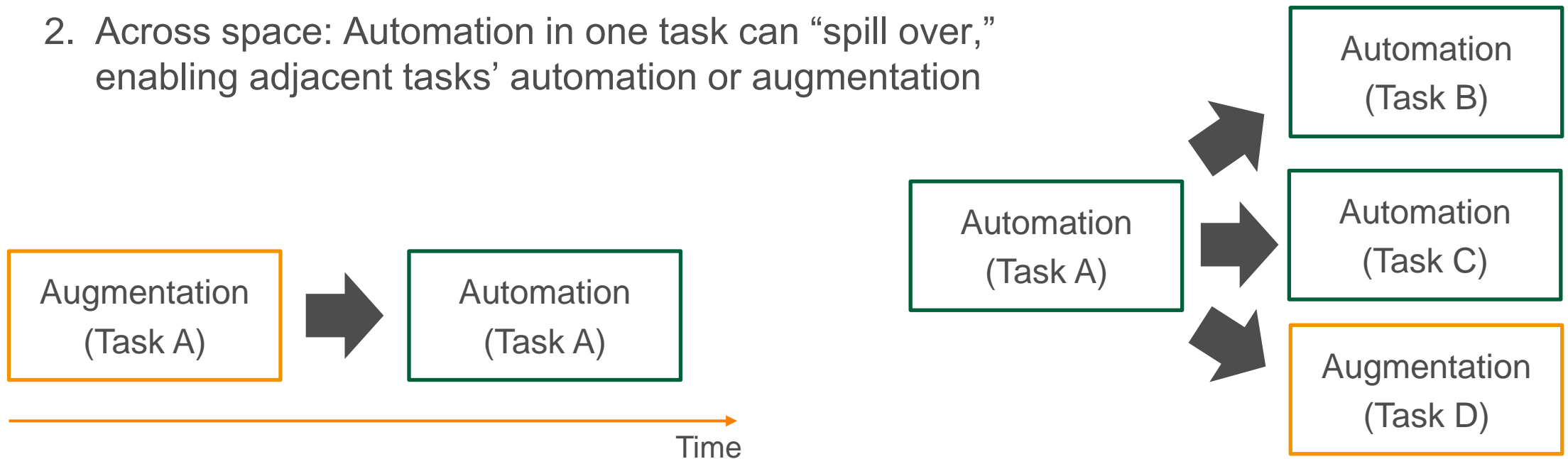




<https://www.youtube.com/watch?v=oe35a-JwRqA>

## Automation and augmentation are interdependent!

1. Across time: Augmentation of a task can allow subsequent automation (see example from self-study material)
2. Across space: Automation in one task can “spill over,” enabling adjacent tasks’ automation or augmentation



Raisch & Krakowski 2021

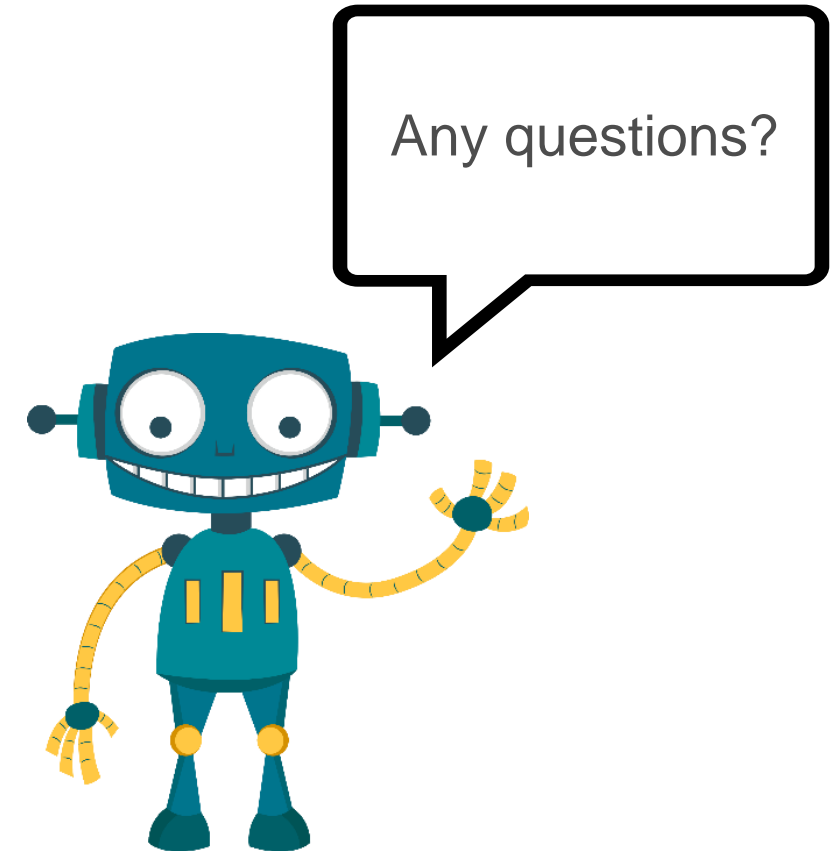
# Key Takeaways From This Lecture

---

- Humans have long been at risk of unemployment brought by new technologies (not just AI)
- There are two main types of AI-enabled automation: physical and cognitive automation
- AI-enabled automation advances from mechanical to analytical, intuitive, and empathetic tasks
- There is a wide range of affective, cognitive, and behavioral responses (both positive and negative) from humans toward AI-enabled automation
- AI-enabled automation creates benefits but also poses risks (e.g., skill erosion)
- Augmentation (e.g., human-in-the-loop) is often described as an alternative to automation, but the two approaches are not independent from each other



***Thank you for  
your attention!***



- Benbya, H., Pachidi, S., & Jarvenpaa, S. L. (2021). Special Issue Editorial : Artificial Intelligence in Organizations : Implications for Information Systems Research. *Journal of the Association for Information Systems*, 22, 281–303.
- Castelo, N., Bos, M. W., & Lehmann, D. R. (2019). Task-Dependent Algorithm Aversion. *Journal of Marketing Research*, 56(5), 809–825.
- Coombs, C., Hislop, D., Taneva, S. K., & Barnard, S. (2020). The strategic impacts of Intelligent Automation for knowledge and service work: An interdisciplinary review. *The Journal of Strategic Information Systems*, 29(4), 101600.
- Davenport, T. H., & Ronanki, R. (2018). Artificial intelligence for the real world. *Harvard business review*, 96(1), 108-116.
- Dellermann, D., Ebel, P., Söllner, M., & Leimeister, J. M. (2019). Hybrid Intelligence. *Business & Information Systems Engineering*, 61(5), 637–643.
- Engel, C., Ebel, P., & Leimeister, J. M. (2022). Cognitive automation. *Electronic Markets*, 32(1), 339-350.
- Grace, K., Salvatier, J., Dafoe, A., Zhang, B., & Evans, O. (2018). When will AI exceed human performance? Evidence from AI experts. *Journal of Artificial Intelligence Research*, 62, 729-754.
- Grønsund, T., & Aanestad, M. (2020). Augmenting the algorithm: Emerging human-in-the-loop work configurations. *The Journal of Strategic Information Systems*, 29(2), 101614.
- Huang, M.-H., & Rust, R. T. (2018). Artificial Intelligence in Service. *Journal of Service Research*, 21(2), 155–172.
- Rai, A., Constantinides, P., & Sarker, S. (2019). Editor's Comments: Next-Generation Digital Platforms: Toward Human–AI Hybrids. *MIS Quarterly*, 43(1), iii–ix.
- Raisch, S., & Krakowski, S. (2021). Artificial Intelligence and Management: The Automation–Augmentation Paradox. *Academy of Management Review*, 46(1), 192–210.
- Rinta-Kahila, T., Penttinen, E., Salovaara, A., Soliman, W., & Ruissalo, J. (2023). The vicious circles of skill erosion: a case study of cognitive automation. *Journal of the Association for Information Systems*, 24(5), 1378-1412.
- Schulte-Derne, D., Gnewuch, U. (2024). "Translating AI Ethics Principles into Practice to Support Robotic Process Automation Implementation". *MIS Quarterly Executive*, 23(2).
- Seiffer, A., Gnewuch, U., & Maedche, A. (2021). Understanding Employee Responses to Software Robots: A Systematic Literature Review. *Proceedings of the 42nd International Conference on Information Systems (ICIS 2021)*.
- Techatassanasoontorn, A. A., Waizenegger, L., & Doolin, B. (2023). When Harry, the human, met Sally, the software robot: Metaphorical sensemaking and sensegiving around an emergent digital technology. *Journal of Information Technology*, 38(4), 416-441.
- Van der Aalst, W. M., Bichler, M., & Heinzl, A. (2018). Robotic process automation. *Business & information systems engineering*, 60, 269-272.
- Waizenegger, L., & Techatassanasoontorn, A. A. (2022). When robots join our team: A configuration theory of employees' perceptions of and reactions to Robotic Process Automation. *Australasian journal of information systems*, 26.
- Willcocks, L., Lacity, M., & Craig, A. (2016). Robotic process automation at Telefónica O2. *MIS Quarterly Executive*, 15(1), 21-35.