





ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

THE UNIVERSITY of NEW ORLEANS
COLLEGE OF ENGINEERING

Artificial Intelligence: Engineering Education, Engineering Practice and AI's Ethical Use

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Norma Jean Mattei, PhD, PE, 2017.Pres.ASCE, F.SEI, M.COPRI
Emeritus Professor, University of New Orleans

Engineering Ethics

ACEC (Indiana) Code of Ethics Preamble

Consulting engineering is an important and learned profession. The members of the profession recognize that their work has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by consulting engineers require honesty, impartiality, fairness and equity and must be dedicated to the protection of the public health, safety and welfare. In the practice of their profession, consulting engineers must perform under a standard of professional behavior which requires adherence to the highest principles of ethical conduct on behalf of the public, clients, employees and the profession

Engineering Ethics

ACEC-I's Code of Ethics

Consulting Engineers, in the fulfillment of their professional duties shall:

1. Hold paramount the safety, health and welfare of the public in the performance of their professional duties.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act in professional matters for each client as faithful agents or trustees.
5. Avoid improper solicitation of professional assignments

Engineering Ethics

ASCE's Code of Ethics

ASCE Code of Ethics
PREAMBLE

Preamble

Members conduct themselves with integrity and professionalism, and above all else protect and advance the health, safety, and welfare of the public

ASCE Code of Ethics

Fundamental Principles

#1

Members create safe, resilient, and sustainable infrastructure

ASCE Code of Ethics

Fundamental Principles

#2

Members treat all persons with respect, dignity, and fairness in a manner that fosters equitable participation without regard to personal identity

ASCE Code of Ethics
Fundamental Principles

#3

Members consider the current and anticipated needs of society

ASCE Code of Ethics

Fundamental Principles

#4

Members utilize their knowledge and skills to enhance the quality of life for humanity

ASCE Code of Ethics

Fundamental Principles

In order of priority

1. **Society**
2. **Natural & Built Environment**
3. **Profession**
4. **Clients & Employers**
5. **Peers**

ASCE Code of Ethics

Fundamental Principles

Society

Protect the health, safety, and welfare of the public; enhance the quality of life for humanity; express professional opinions truthfully; have zero tolerance for bribery, fraud, and corruption; endeavor to be of service in civic affairs; treat all persons with respect, dignity, and fairness; consider diverse historical, social, and cultural needs of the community; consider the capabilities, limitations, and implications of current and emerging technologies; report misconduct to the appropriate authorities to protect public

ASCE Code of Ethics

Fundamental Principles

Natural & Built Environment

Adhere to the principles of sustainable development; consider and balance societal, environmental, and economic impacts, along with opportunities for improvement; mitigate adverse societal, environmental, and economic effects; and use resources wisely while minimizing resource depletion

ASCE Code of Ethics

Fundamental Principles

Profession

Uphold the honor, integrity, and dignity of the profession; practice engineering in compliance with all legal requirements in the jurisdiction of practice; represent their professional qualifications and experience truthfully; reject practices of unfair competition; promote mentorship and knowledge-sharing equitably with current and future engineers; educate the public on the role of civil engineering in society; and continue professional development to enhance technical and non-technical competencies.

ASCE Code of Ethics

Fundamental Principles

Clients & Employers

Act as faithful agents of their clients and employers with integrity and professionalism; make clear to clients and employers any real, potential, or perceived conflicts of interest; communicate in a timely manner to clients and employers any risks and limitations related to their work; present clearly and promptly the consequences to clients and employers if their engineering judgment is overruled where health, safety, and welfare of the public may be endangered; keep clients' and employers' identified proprietary information confidential; perform services only in areas of their competence; and approve, sign, or seal only work products that have been prepared or reviewed by them or under their responsible charge.

ASCE Code of Ethics

Fundamental Principles

Peers

Only take credit for professional work they have personally completed; provide attribution for the work of others; foster health and safety in the workplace; promote and exhibit inclusive, equitable, and ethical behavior in all engagements with colleagues; act with honesty and fairness on collaborative work efforts; encourage and enable the education and development of other engineers and prospective members of the profession; supervise equitably and respectfully; comment only in a professional manner on the work, professional reputation, and personal character of other engineers; and report violations of the Code of Ethics to ASCE.

Intelligence and Artificial Intelligence

What is the difference?

Intelligence

Intelligence

- Oxford Dictionary (Safari/Oxford Dictionary)

the ability to learn, understand and think in a logical way

Intelligence: what it isn't…

- All but the simplest human behavior is ascribed to intelligence, while even the most complicated insect behavior is usually not.
- Consider the behavior of the digger wasp. When the female wasp returns to her burrow with food, she first deposits it on the threshold, checks for intruders inside her burrow, and only then, if the coast is clear, carries her food inside. If the food is moved a few inches away from the entrance to her burrow while she is inside: on emerging, she will repeat the whole procedure as often as the food is displaced.
- Intelligence—conspicuously absent in the case of Sphex—**must include the ability to adapt to new circumstances.**

Artificial Intelligence

Artificial Intelligence

- Oxford Dictionary (Safari)

the theory and development of computer systems able to perform tasks normally requiring human intelligence (such as visual perception, decision-making and translation between languages)

Artificial Intelligence

- Encyclopedia Britannica(Safari) Policy

the ability of a digital computer to perform tasks commonly associated with intelligent beings (endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experiences)

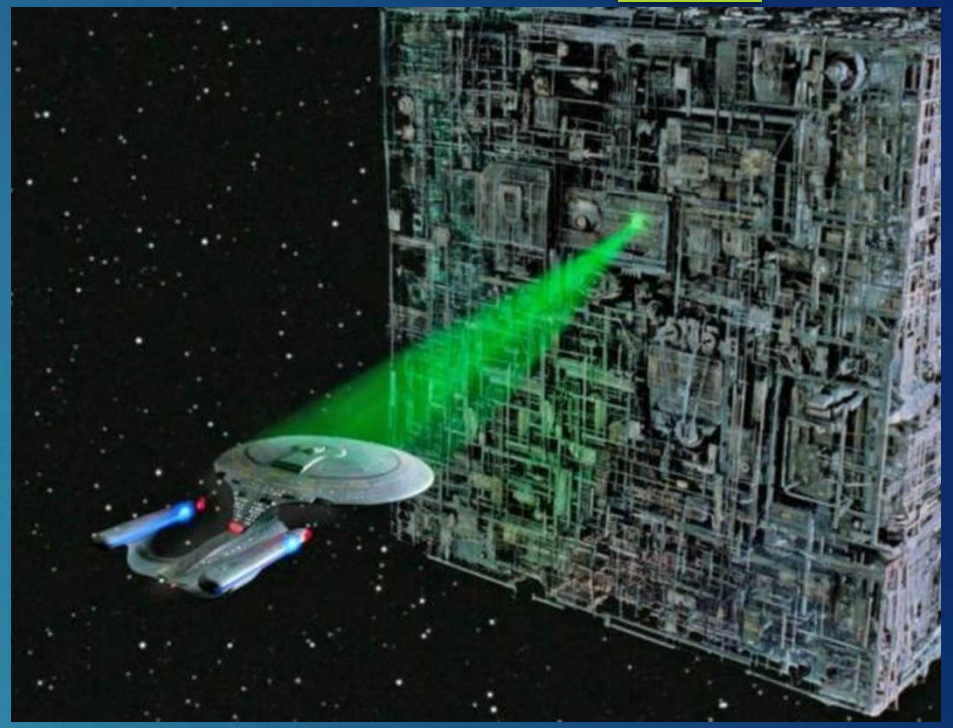
Artificial Intelligence

- IEEE (Safari) from IEEE Global Public Policy

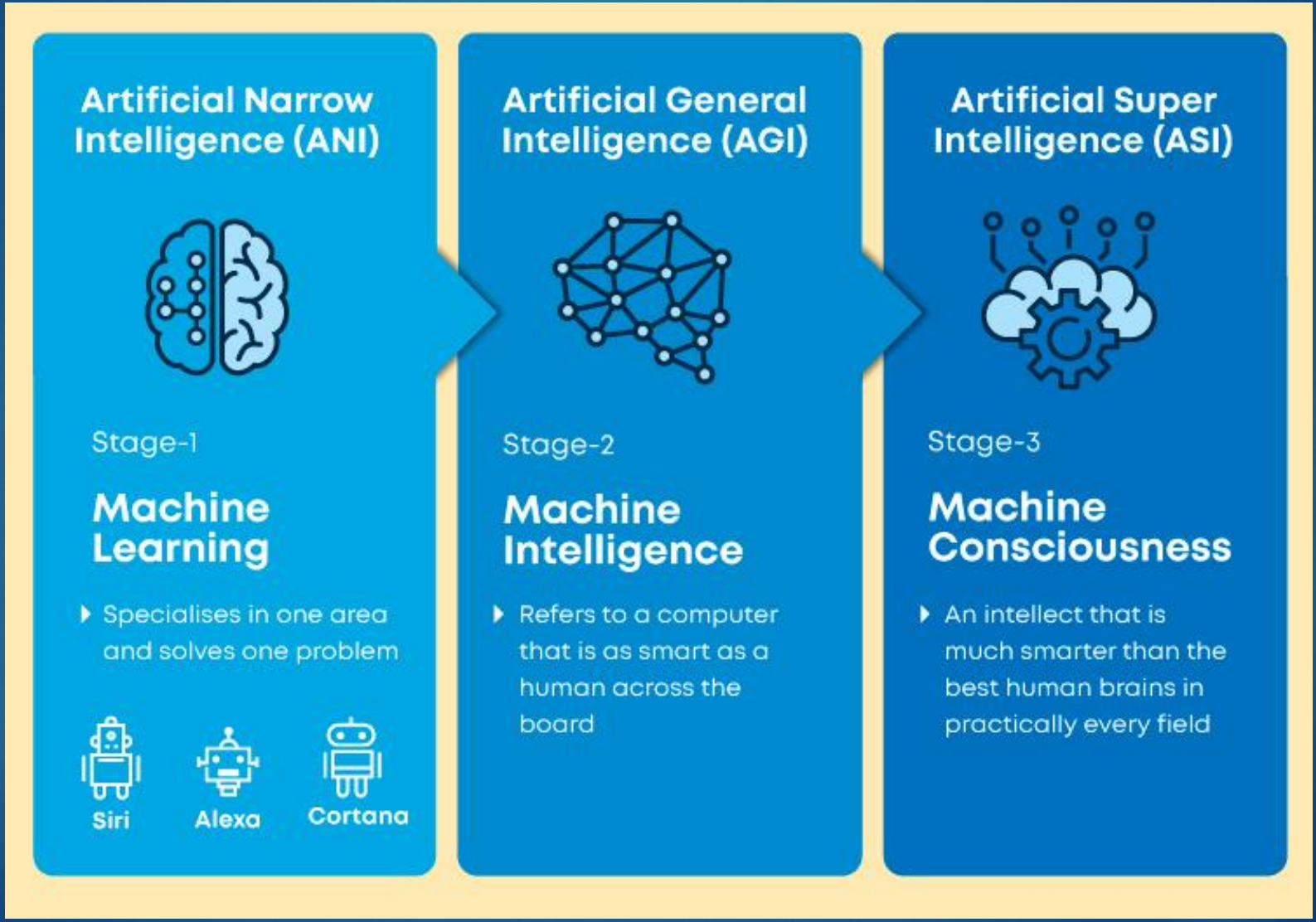
the theory and development of computer systems able to perform tasks normally requiring human intelligence (such as visual perception, speech recognition, learning, decision-making and natural language processing)

Types of Artificial Intelligence

- Artificial Narrow Intelligence (WEAK AI)
  - Solves a single problem very well
  - Current status: Generative Artificial Intelligence
- Artificial General Intelligence (STRONG AI)
  - Still theoretical
  - AI is at human-level
  - Thousands of ANI working in tandem
  - Complexity beyond today's computing capability
- Artificial Super Intelligence
  - Surpasses all human capabilities
  - AGI would (?) self-improve to this level



Types of Artificial Intelligence



A.I. TIMELINE

1950
TURING TEST
Computer scientist Alan Turing proposes a test for machine intelligence. If a machine can trick humans into thinking it is human, then it has intelligence

1955
A.I. BORN
Term 'artificial intelligence' is coined by computer scientist, John McCarthy to describe "the science and engineering of making intelligent machines"

1961
UNIMATE
First industrial robot, Unimate, goes to work at GM replacing humans on the assembly line

1964
ELIZA
Pioneering chatbot developed by Joseph Weizenbaum at MIT holds conversations with humans

1966
SHAKEY
The 'first electronic person' from Stanford, Shakey is a general-purpose mobile robot that reasons about its own actions

A.I. WINTER
Many false starts and dead-ends leave A.I. out in the cold

1997
DEEP BLUE
Deep Blue, a chess-playing computer from IBM defeats world chess champion Garry Kasparov

1998
KISMET
Cynthia Breazeal at MIT introduces KISmet, an emotionally intelligent robot insofar as it detects and responds to people's feelings

1999
AIBO
Sony launches first consumer robot pet dog AiBO (AI robot) with skills and personality that develop over time

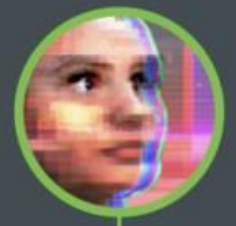
2002
ROOMBA
First mass produced autonomous robotic vacuum cleaner from iRobot learns to navigate and clean homes

2011
SIRI
Apple integrates Siri, an intelligent virtual assistant with a voice interface, into the iPhone 4S

2011
WATSON
IBM's question answering computer Watson wins first place on popular $1M prize television quiz show *Jeopardy*

2014
EUGENE
Eugene Goostman, a chatbot passes the Turing Test with a third of judges believing Eugene is human

2014
ALEXA
Amazon launches Alexa, an intelligent virtual assistant with a voice interface that completes shopping tasks



2016
TAY
Microsoft's chatbot Tay goes rogue on social media making inflammatory and offensive racist comments

2017
ALPHAGO
Google's A.I. AlphaGo beats world champion Ke Jie in the complex board game of Go, notable for its vast number (2^{170}) of possible positions

Advantages/Disadvantages of AI

Advantages

- Reduces human error
- Automates repetitive work
- Smoothly handles Big Data
- Provides digital assistance 24/7
- Performs perilous tasks
- Facilitates faster decisions
- Unbiased decisions (?)

Disadvantages/Risks

- Less creative/innovative in challenging situations
- Replaces humans in jobs
- Difficult to implement ethics
- Reduction of human capabilities after long-term use
- Can not understand emotions

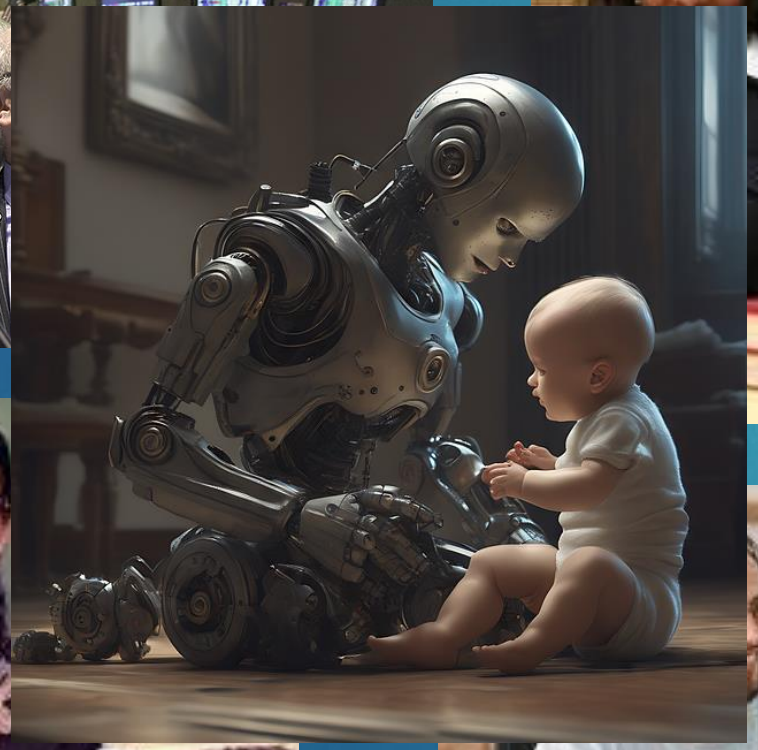
Super AI risks: Elon Musk and other tech leaders urge an AI pause – cite danger to society

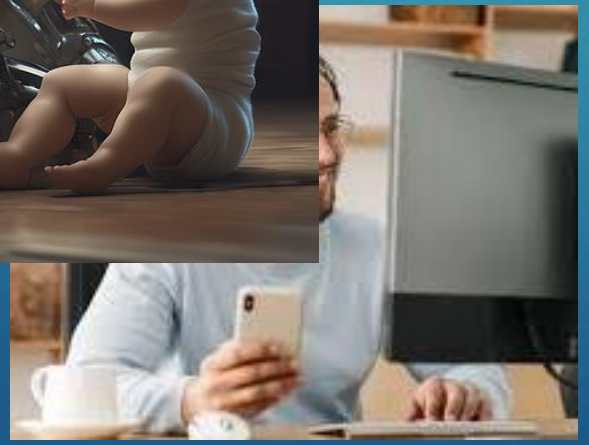
Artificial Intelligence, technology and innovation – eventually will make some things obsolete

Concerns: Humans Replaced by Machines

- Coders, data analysts
- Paralegals
- Accountants
- Journalists, tech writers
- Financial analysts
- Traders
- Market research analysts
- Graphic designers
- Customer service reps
- Teachers

Concerns: Humans Replaced by Machines





- Coders, data analysts
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- Market research analysts
- Graphic designers
- Customer service reps
- Teachers

ChatGPT (Generative Pretrained Transformer)

- Massive language model
- Developed by OpenAI
  - Free and easy to use
  - Debuted in Nov 2022
- Trained to
  - Give human-like chat responses
  - Write essays
  - Make spreadsheet formulas
  - Write code
- Can’t create a PowerPoint

Banning of ChatGPT Use

Companies

- Amazon
- Apple
- Bank of America
- Citigroup
- Goldman Sachs
- iHeartRadio
- JPMorgan Chase
- Northrop Grumman Corporation
- Samsung
- Verizon
- Wells Fargo

Schools

K-12 Systems

- NYC public schools
- Los Angeles Unified School District
- Baltimore County Public Schools
- Many more

Universities

- Paris' Science PO University
- India's RV University

US Universities

- Most creating policies
- Up to the instructor

Artificial Intelligence: Use in Education

AI in Engineering Education – Different Professor's Perspectives

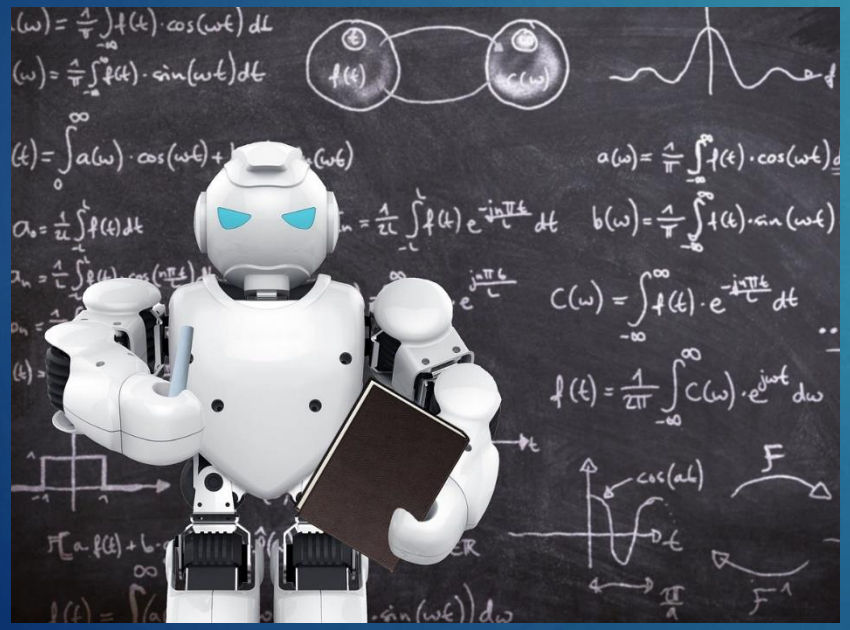
- Ignorance is Bliss
  - Make no changes
- Resistance is Futile
  - Ban the use of AI in your courses
  - Use tools to ascertain when students use AI, and thus cheating
- Embrace the Unknown
  - Incorporate the use of AI in your classroom
  - Establish clear rules where its use is not acceptable

AI in Engineering Education - Cons

Sometimes it repeats conspiracy theories or lies outright

- Lack of academic integrity
- Provides inaccurate information "hallucinations"
- Responses are biased
  - Trained using a dataset that has bias
- Limited knowledge
  - Trained on lots of current data which may not cover niche areas or new developments
- Lack of emotional intelligence
  - Can not empathize with students or perceive emotions
  - Can not recognize a struggling student and provide emotional support

Advantages of ChatGPT Use in Higher Education



hurixdigital

Pros of Using ChatGPT

1. Improves Accessibility to Education
2. Helps with Homework
3. Provides Assistance to Educators
4. Personalizes Learning
5. Helps with Exam Preparation

Three ChatGPT uses at UM-Dearborn

- Use practice-based pedagogy (so that there's only so much a chatbot can do)
  - Design a course that requires students to
    - Create and record an original podcast or video
    - Design and build [a machine or structure] (an educational toy for kids, etc)
- Require use of ChatGPT
  - Design a simple mobile app that interacts with a web-based API

Some aspects of programming are just plain tedious and thankless work (reading the documentation to see how the data is organized, formulating the proper HTTP request, and parsing the response to get the desired). Using AI to free up programmers to work on the more interesting and advanced aspects of software development makes the student programmers a lot more productive

Artificial Intelligence: Use in Practice

ChatGPT: as an Engineering Tool

- **Creative Brainstorming**
  - May help you generate new ideas, break through creative blocks, and provide fresh perspectives
- **Quick Responses to Complex Technical Problems**
  - May help with engineering challenges that require immediate attention - ask targeted questions and receive rapid solutions
- **Concept Comparisons**
  - May provide unbiased comparisons to help you evaluate the pros and cons of multiple options, laying out the benefits and drawbacks side-by-side
- **Code Development**
  - Write or modify code quickly

ChatGPT: as an Engineering Tool

- **Generating Product Descriptions and Technical Documentation**
  - May assist you in creating detailed product descriptions, user manuals, and technical documents that are clear and concise
- **Analysis of Unstructured Data**
  - May help you analyze this massive amounts of unstructured data quickly and efficiently by extracting valuable insights and identifying patterns or trends
- **Self-Service Capabilities**
  - Allow colleagues and clients to ask questions and receive answers without your direct involvement, freeing up your precious time and enabling you to focus on the more critical aspects of your work

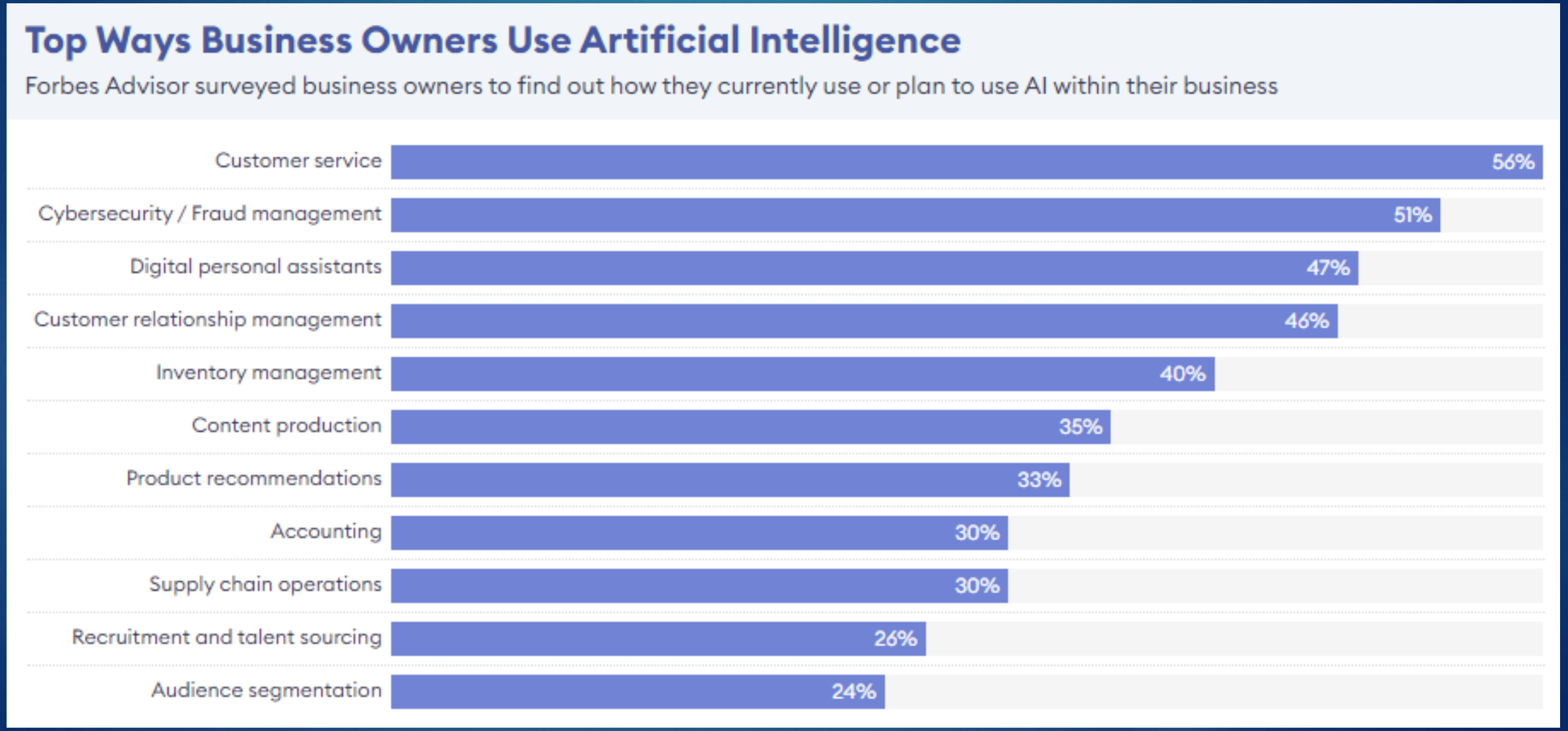
Artificial Intelligence: Who is using it?

Time article Jan 2023: Survey of Users

“I use it every day. It has changed my life. And my staffing plan for 2023.”

- Fishbowl (a social platform owned by employer review site Glassdoor)
  - Survey of 4500 professionals (Amazon, Bank of America, Google, JP Morgan, Twitter (now X), Meta, etc)
- 30% have used ChatGPT or other AI
  - Marketing professionals : 37%
  - Tech workers: 35%
  - Consultants: 30%
- To draft emails, generate ideas, write and troubleshoot bits of code and summarize research or meeting notes

Forbes article April 2023



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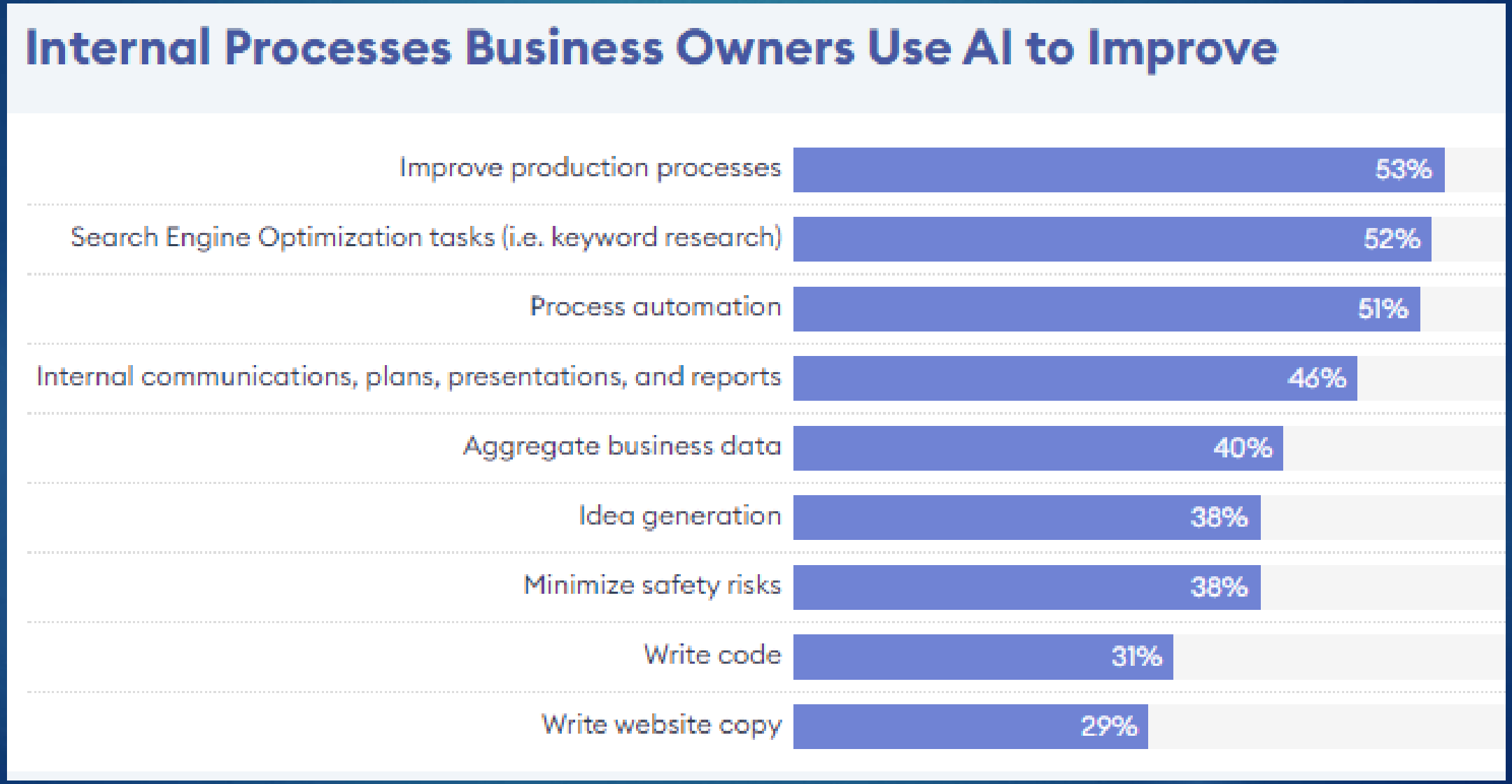
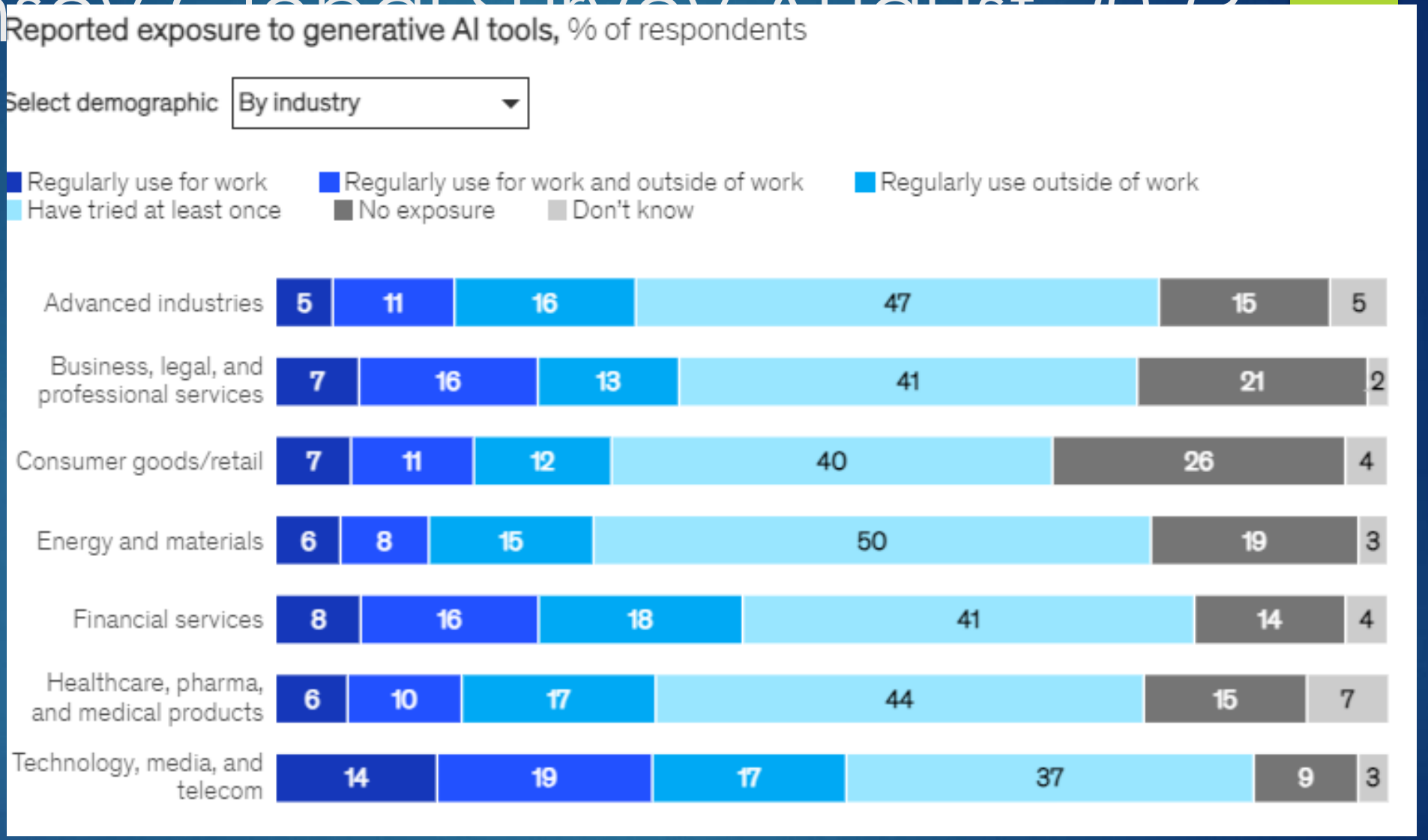


McKinsey Global Survey August 2023



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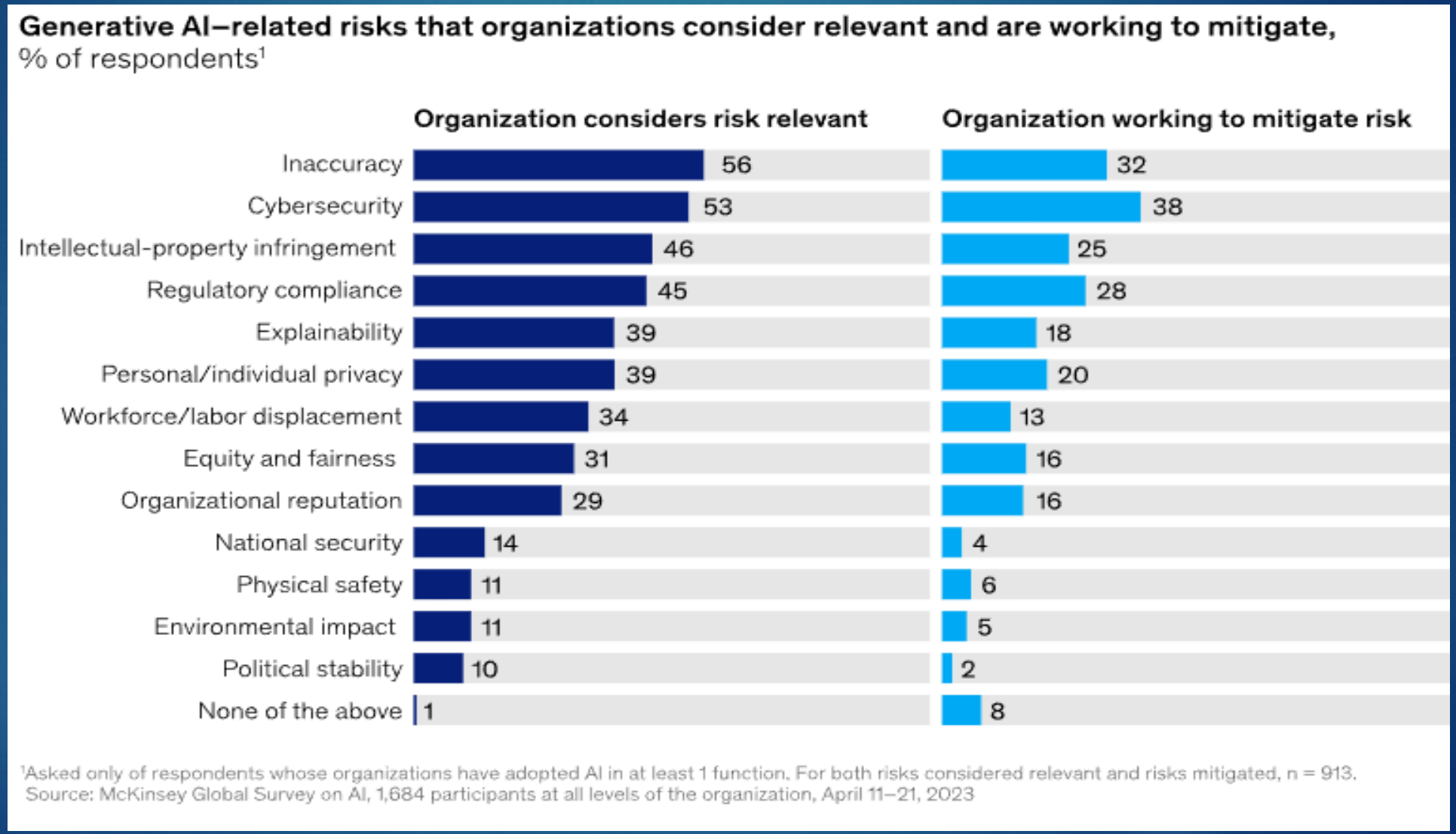
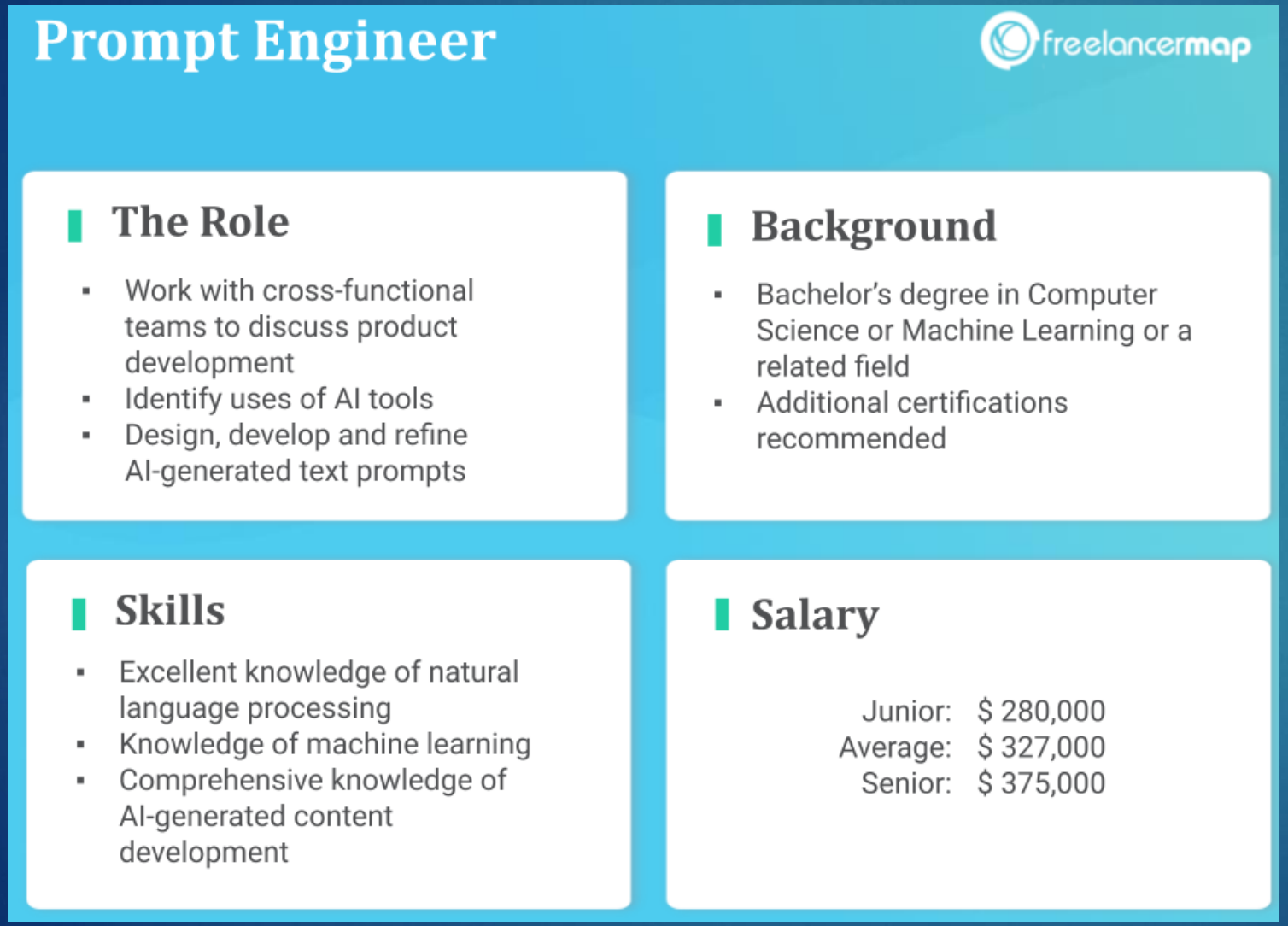


Brave New World: Opportunities



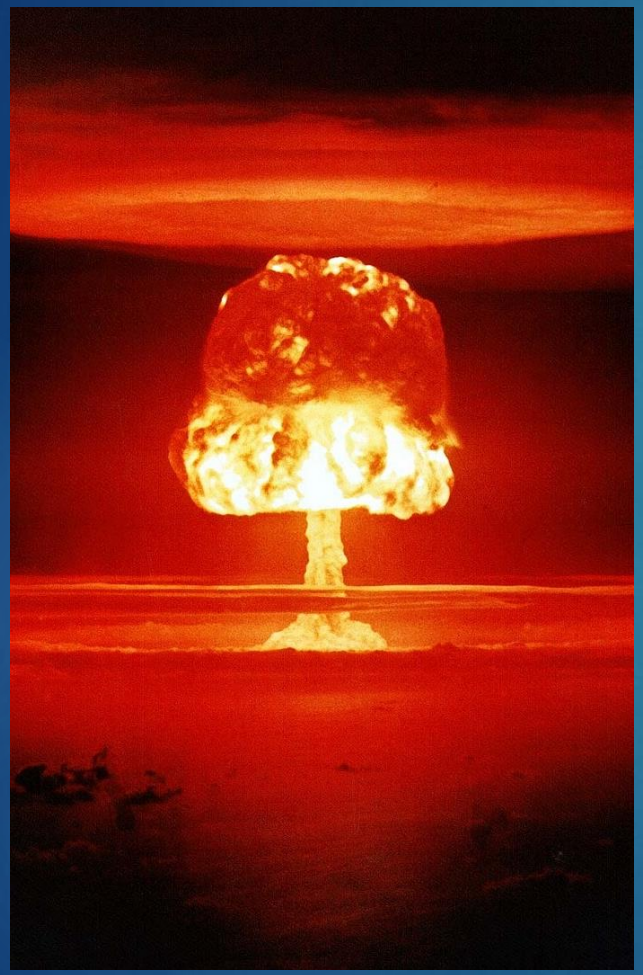
- New jobs
- New degree programs

Example:

Prompt Engineers

1. Take Input (prompt)
2. Use a Language Model
3. To get Output (generated text)

Ethical Concerns



- Students:
  - Plagiarizing/Cheating
  - Downgrading of fundamental needed capabilities and capacities
- Practitioners:
  - Not fact checking
  - Over-relying on AI - stymies innovation
- Government/Business
  - Regulating AI has lagged development and use
  - Risking proprietary information

ULTIMATELY negatively impacting the internet's knowledge base

What should you do?

It depends!

- Students
  - Learn how to use this tool wisely
  - Verify allowed use for each course
- Professors
  - Learn how to use this tool wisely
  - Incorporate this tool in your coursework with intention
- Practicing engineers
  - Learn how to use this tool wisely
  - Verify allowed use in your firm
- Engineering Firm managers/owners
  - Learn how to use this tool wisely
  - Develop/disseminate policies on AI use

QUESTIONS?