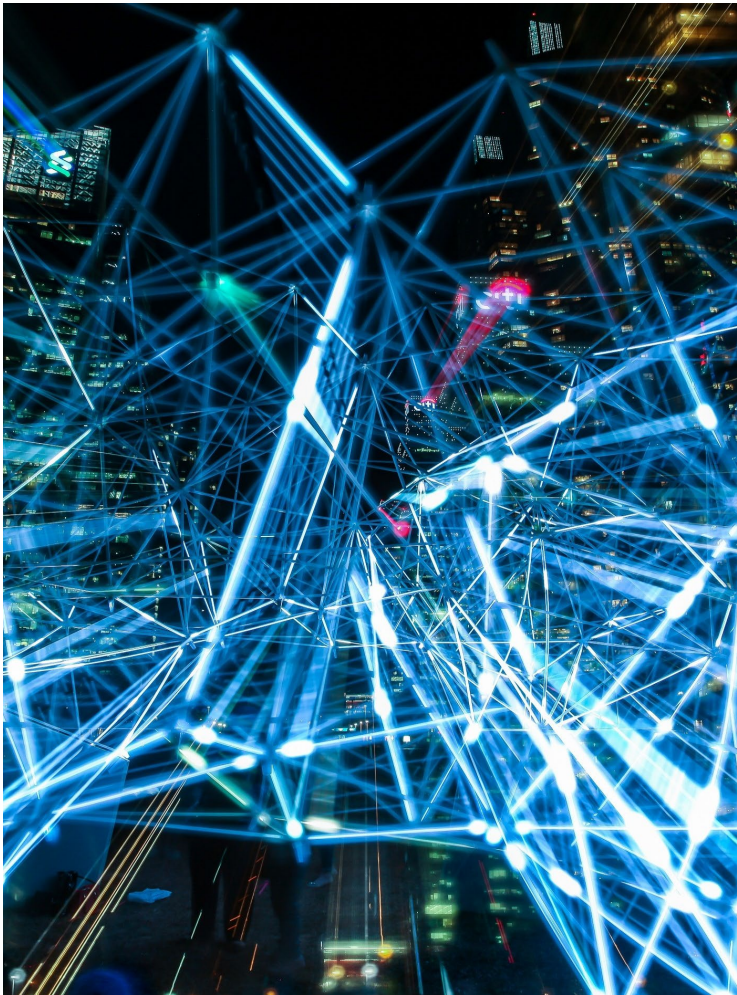


Human-Computer Interaction in the age of Artificial Intelligence

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Prevalence of AI

Fostering the mind-set

Examples of AI-enabled systems

- [Netflix](#), the online streaming service learns the viewers' watching patterns and behaviour, and suggests shows based on what they have watched.
- By using NLP, [Facebook](#) looks for patterns in user posts in order to understand how people feel about a certain brand or product.
- X-ray screening for tuberculosis; trauma imaging for fractures: the quality of AI interpretations of X-rays is now close to that of human analysis, and sometimes better

Education

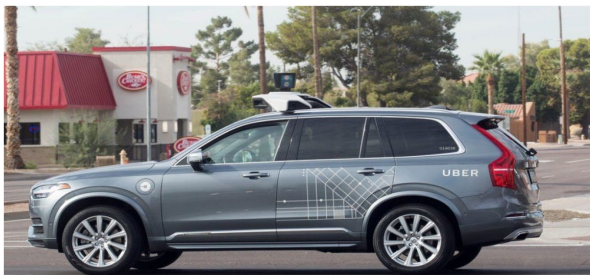
- automated marking
- adaptive personalised learning
- point to where the materials can be improved
- provide recommendations for improvements
- influence the searching of resources
- online proctoring / digital invigilation

Use of AI – some examples

Technology

Uber's self-driving operator charged over fatal crash

16 September 2020



Hundreds of sewage leaks detected thanks to AI

By Victoria Gill
Science correspondent, BBC News

8 hours ago

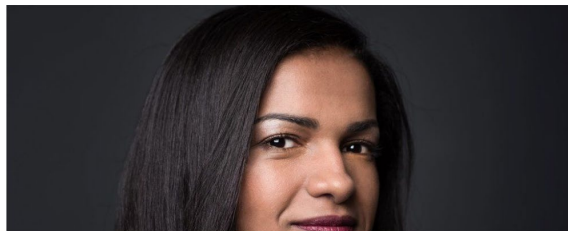


Business Your Money Market Data Companies Economy Global Car Industry Business of Sport

How to investigate a firm with 60 million documents

By Michael Dempsey
Technology of Business reporter

19 January



RETAIL OCTOBER 11, 2018 / 12:04 AM / UPDATED 2 YEARS AGO

Amazon scraps secret AI recruiting tool that showed bias against women

By Jeffrey Dastin

8 MIN READ



SAN FRANCISCO (Reuters) - Amazon.com Inc's [AMZN.O](#) machine-learning specialists uncovered a big problem: their new recruiting engine did not like women.



Use of AI – more examples

Trove of unique health data sets could help AI predict medical conditions earlier

Nightingale Open Science data show what actually happened to patients rather than relying on doctor's notes



'More than 97% accuracy': Chinese scientists develop AI 'prosecutor'



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ANIT KATWALA

BUSINESS 05.12.2021 08:00 AM

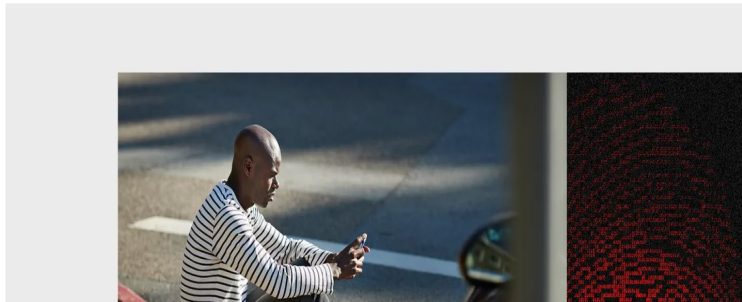
DeepMind Wants to Use AI to Transform Soccer

The Alphabet-owned company is working with Liverpool to bring computer vision and statistical learning to the high-stakes world of sports.



Crime Prediction Keeps Society Stuck in the Past

So long as algorithms are trained on racist historical data and outdated values, there will be no opportunities for change.



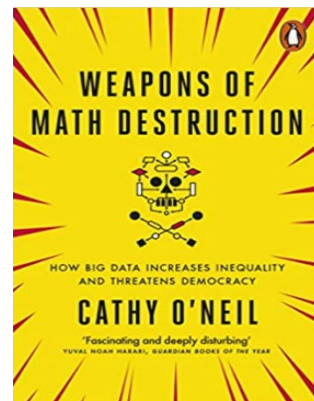
Implications for HCI/CS education/practice

- Using historical data (sometimes a 'dark' past) to make predictions of the future
- Bias comes from training data, which reflects human bias
- Algorithmic biases; unconscious bias; possible algorithmic harm
- Asymmetrical power distribution; no accountability; no appeal system for decisions taken
- Who is responsible? (e.g. prosecutor, AI system or the designer of the algorithm)



Education/practice

- aware of the possible biases; questioning the training data, source of data, ethical considerations of data use
- user control vs. system autonomy; designing for human-machine co-operation
- Working in interdisciplinary teams



Interdisciplinary approach

User experience is integral to Machine Learning/AI

Changing HCI practice (Holmquist, 2017, Yang et al., 2020)

- **interdisciplinary skills** to assess the ethics-related issues and help propose solutions from a broader sociotechnical systems perspective.
- to understand the capabilities and limitations of **Machine Learning (ML)/AI**
- **User Experience (UX) researchers and designers** should bring a human-centred perspective to the design of AI systems
- **ethical AI design** emphasises the enhancement/augmentation of human capabilities rather than their replacement (Automation vs. Autonomy); human remains the decision-maker.
- **UX cannot not be an afterthought of ML/AI**
 - ML professionals or data scientists and UX designers should work together to define UX criteria, test/optimize ML training data and algorithms iteratively, and work towards avoiding extreme algorithmic bias.

HCI in the age of AI

- UX of data (Koesten and Simperl, 2021)

Actively supporting people in understanding and working with datasets is critical to a good user experience.

- making data usable, relevant, and to have good enough quality
- FAIR (Findable Accessible Interoperable Reusable) principles in data science
- Explainability
 - How to present explanations that are trust-worthy and understandable?*
 - help explain the processes, services and decisions delivered or assisted by AI, to the individuals affected by them.
 - role of trust in user acceptance

Workers demand gig economy companies explain their algorithms

Frustrated workers say there is little redress after computers make decisions



WIT

Summary

Introduction

Part I

Part II

Managed by Bots

Data-Driven Exploitation in the Gig Economy

Ethical AI

Ethics in the design and use of AI-enabled systems

Responsible and ethical AI practices

- Algorithmic Audit, e.g. ORCAA is a consultancy that helps companies and organisations manage and audit algorithmic risks. *'When we consider an algorithm we ask two questions:*
 - *What does it mean for this algorithm to work?*
 - *How could this algorithm fail, and for whom?'*
- Responsible AI: fairness, interpretability, privacy, and security (Google AI), <https://ai.google/responsibilities/responsible-ai-practices/>
- MIT's AI Blindspots, A discovery process for spotting unconscious biases and structural inequalities in AI systems, <https://aiblindspot.media.mit.edu/index.html#about>
- Ethical AI design: Aletheia framework (Rolls Royce PLC), <https://www.rolls-royce.com/sustainability/ethics-and-compliance/the-aletheia-framework.aspx>
- **Educators:** online proctoring/invigilation tools, use of AI in delivering and assessing education



Case Study: HireVue AI-based recruitment system

- Ikea, L Oreal, Unilever, Amazon and others are using AI-powered recruitment systems like Robot Vera, chatbot called Mya, HireVue.
 - screening applications; assessment tools such as gamification; scrutinising videos that are sent by the candidates
 - claim that biases will be reduced *but the algorithms are only as good as their creators, and many of their creators rely on companies' prior workforce data, further entrenching bias into the hiring process and consequently the workforce.*
 - *Delegating repetitive tasks to AI, recruiters can focus instead on more creative and strategic matters in their daily routines;.. HR managers will shift their focus from operational tasks to a leadership role, motivating and cultivating their team's potential and skillsets.*
 - In 2021, in response to some complaints, HireVue changed its policies to remove facial expressions as a scoring factor in its algorithm towards employability score and also hired a third-party (ORCAA) to audit its algorithms.
 - *Independent auditors are struggling to hold AI companies accountable. Controversial AI company HireVue implied that an external audit showed its algorithms had no bias. But a look at the audit itself tells a different story.*

Implications for HCI/CS education/practice

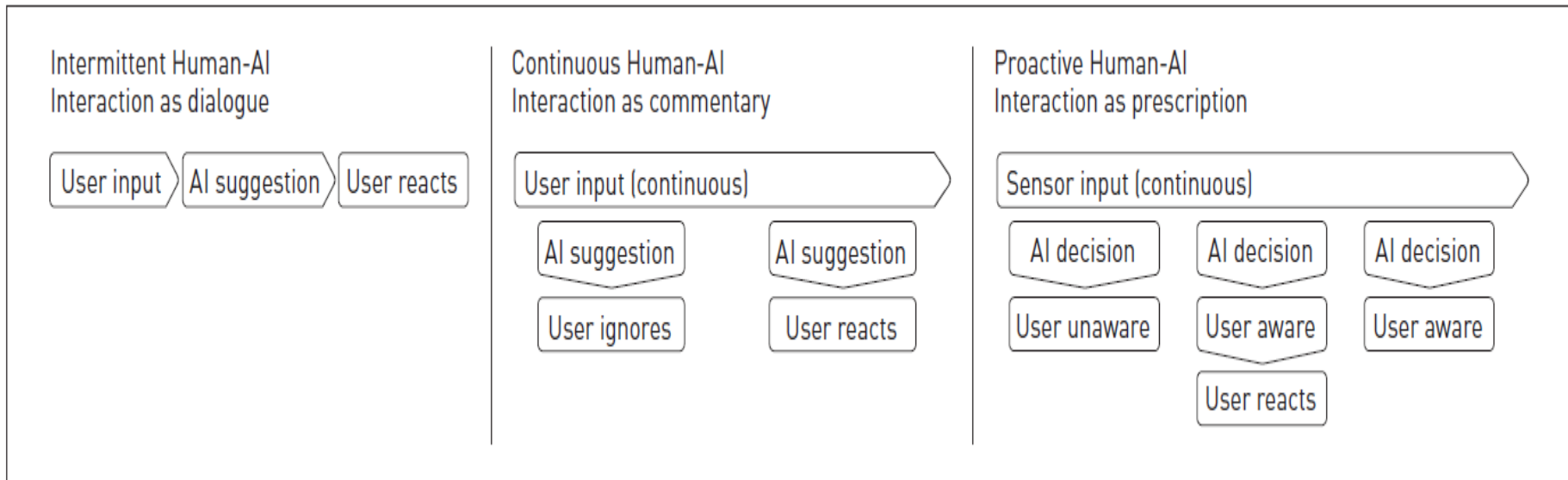
- Develop ethical skills and competencies of students and practitioners
- Awareness of
 - possible biases in AI
 - AI fairness
 - Ethical use of AI
 - Ethical implications of designing intelligent systems – what will be the impact of an AI-enabled system?
 - Governance structures for reliability, safety and trustworthiness of AI-enabled systems
- Making sense of the algorithmic audits
- Skills for working in multi-disciplinary teams: philosophers, sociologists, legal experts

Core HCI

Methods for design and evaluation of human-centred
AI in AI-enabled systems

Three types of human-AI interaction paradigms

- intermittent, continuous, and proactive



From van Berkel *et al.*, 2021

Implications for HCI/CS education/practice

- Users have traditionally constructed mental models in interactions that follow a turn-taking process. These mental models do not apply to non-intermittent human-AI interaction scenarios.

HCI researchers and practitioners therefore must assist users in constructing correct mental models to increase user understanding and prevent future errors. This is undoubtedly a challenging task in the context of systems that may change their behavior based on observed user behavior.

- **Non-intermittent human-AI interaction:** Questions concerning user intentions and correction of system errors, as well as user consent.
- **Fairness, Accountability, and Transparency (ACM):** How to embed these concepts in continuous or proactive human-AI interaction?

In the context of continuous interaction, users may not want to receive transparent explanations on how the decision making came about, as it could distract from their primary task.

In proactive AI scenarios, the user group is not tightly defined, with many (future) users of the system likely not present when decisions are made or explanations are provided.

AI and data as design materials

- AI can enrich a UI in interesting and useful ways. Adaptive user interfaces (AUIs) employ elements of AI to improve UX.

It is no longer enough for user experience (UX) designers to only improve user experience by paying attention to usability, utility, and interaction aesthetics.

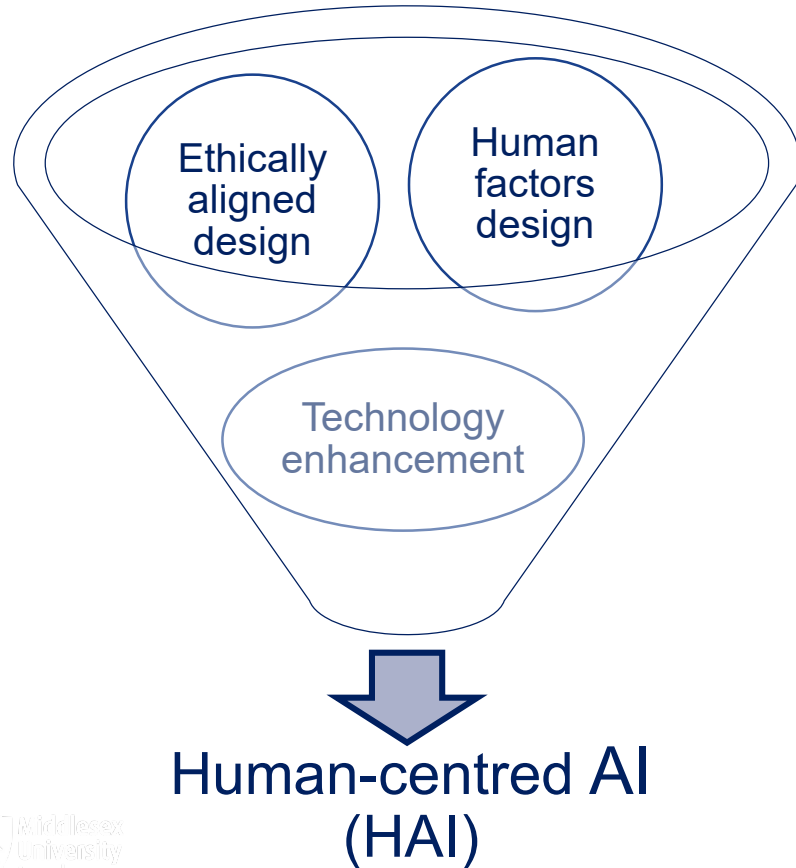
Instead, the best user experiences may come from services that automatically personalize their offers to the user and context, and systems that leverage more detailed understandings of people and the world in order to provide new value. (Dove et al., 2017)

- HC-Interaction to HC-Integration (Farooq and Grudin, 2016; Xu, 2019)



Designer needs to step back from the basic interaction to consider the engagement as an ongoing partnership.

Extended Human-Centred AI (HAI) framework (Xu, 2019)



ethically aligned design, AI solutions that avoid discrimination, maintain fairness and justice, and do not replace humans

technology that fully reflects human intelligence, which further enhances AI technology to reflect the depth characterised by human intelligence

human factors design to ensure that AI solutions are explainable, comprehensible, useful, and usable

Human-centred AI canvas

<https://medium.com/@albmllt/introducing-the-human-centered-ai-canvas-a4c9d2fc127e>

The Human-Centered AI Canvas

Designed for:

Designed by:

Date:

Version:

Jobs-to-be-Done ©

What are you trying to accomplish?

A.I. Promise ↗ (gain creators)

How might AI help you with the problem you are trying to solve?
Which benefits the use of AI might bring to your organization?
How might the use of AI help you in achieving your goal or completing your task?

Machine Activities 🧠

What AI technology allows your human agents to focus on?
How might you make best use of human agents' judgment, flexibility and creativity?
Which activities where AI can't be used should be overtaken by your human agents?

Human Reinforcement ⇄

How might AI to influence the work of your human agents?
How might AI enhance your human agents by adding to their capabilities and improving their decision-making process?
What feedback loop will you build between the machine and your human agents to augment their intelligence and abilities?

Benefits for Humans 🙌 (pain relievers)

How might the human agents part of your process benefit from using AI?
What AI is freeing up in your human agents' capabilities?
Which repetitive tasks that your human agents are performing can be eliminated?

Human Activities 🧑

Which tasks in your process are best suited for machines rather than human?
How might you make the best use of machine precision and accuracy?
Which limitations of human abilities could be taken over by machines in your process?

Collaboration

What's the role of your human agents in overseeing the performance of the machine and refining the model?
How might you use the input from your human agents to improve the effectiveness of your machine?
What is the relationship between your human agents and your machine?

Critical Thinking & Biases ⚖️

What are the limits to what you can do with AI in your process?
Which major or complex decisions can't be taken over by machines in your process?
How might you apply critical thought to your machine performance and overcome its potential biases?

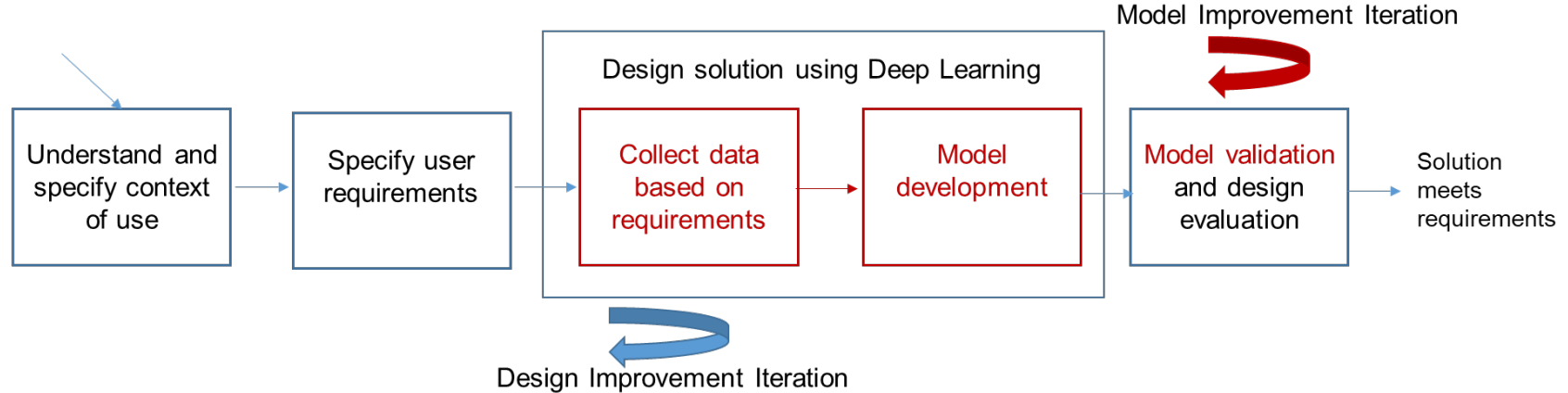
Considerations & Implications 🛡️

How might you ensure that your AI is developed in a responsible, safe and reliable manner?
How might you address the societal issues that the way you are using AI bring about?
Which morals, ethical or philosophical norms should be taken into consideration?

Change Management 🔄

How will you manage the anxieties of your employees that might be worried about their role being disrupted?
How will you re-train your workforce to ensure a smooth transition of your company to the age of artificial intelligence?
How will you communicate the difference between your human and machine-led experiences to your customers?

Adapted UCD process for deep learning (Viet Le et al., 2021)



The user-centered design process must be adapted by incorporating data collection and iterative model development.

Guidelines for Human-AI Interaction (Microsoft)

G1 Make clear what the system can do.

- Help the user understand what the AI system is capable of doing.
- [Activity Trackers] *“Displays all the metrics that it tracks and explains how. Metrics include movement metrics such as steps, distance travelled, length of time exercised, and all-day calorie burn, for a day.”*

G2 Make clear how well the system can do what it can do.

- Help the user understand how often the AI system may make mistakes.
- [Music Recommenders] *“A little bit of hedging language: ‘we think you’ll like’.”*

G11 Make clear why the system did what it did.

- Enable the user to access an explanation of why the AI system behaved as it did.
- [Navigation] *“The route chosen by the app was made based on the Fastest Route, which is shown in the subtext.”*
- Guidelines for Human-AI Interaction, (2019). <https://www.microsoft.com/en-us/research/project/guidelines-for-human-ai-interaction/>

IBM: Creating impactful, responsible, and human-centric AI

continuous cycle of observing, reflecting, and making



- IBM Design Thinking Toolkit for AI:
<https://www.ibm.com/design/thinking/page/toolkit>
- **Observe**: interviews, contextual inquiry and cognitive walkthrough
- **Reflect**: **intent**: determine why you would or wouldn't use AI to solve your users' problems; **data**: **identify** the data you have and what data you need to get; **understanding**: deconstruct your data sources into the components you need to teach your AI; build a better understanding of your users' current experience **as-is-scenario maps**, stakeholder mapping, empathy mapping, prioritisation grid
- **Make**: vignettes, paper-based prototyping, experience-based roadmaps

Google: People + AI Guidebook

- **User needs and defining success:** Identify user needs, find AI opportunities, and design your reward function.
- **Data collection and evaluation:** Decide what data are required to meet your user needs, source data, and tune your AI.
- **Mental models:** Introduce users to the AI system and set expectations for system-change over time.
- **Explainability and trust:** Explain the AI system and determine if, when, and how to show model confidence.
- **Feedback and control:** Design feedback and control mechanisms to improve your AI and the user experience.
- **Errors and graceful failure:** Identify and diagnose AI and context errors and communicate the way forward.
- Google PAIR. *People + AI Guidebook*, (2021). pair.withgoogle.com/guidebook

Designing and evaluating Human-AI systems

Methodology	Methods and techniques
Design Thinking	empathise: empathy mapping define: personas, journey mapping; experience mapping ideate: brainstorming; storyboarding IBM's Design Thinking toolkit for AI Wizard of Oz prototyping
Guidelines-driven design	Microsoft's Guidelines for Human-AI interaction Google's People + AI Guidebook Amazon's Alexa design guide for Voice User Interfaces
Design frameworks	Extended Human-Centred AI (HAI) framework Human-centred AI canvas
Design/ethical considerations	Google's Responsible AI practices Aletheia Framework™ MIT's AI Blindspots
Function allocation in human-autonomy teaming (<i>Roth et al., 2019</i>)	Co-active design method MABA-MABA ("Men are better at, Machines are better at") LOA (Levels of Automation) Cognitive Task Analysis Cognitive Work Analysis

Implications for HCI/CS education/practice

- concept of a socio-technical system
 - socio-technical system is one that considers requirements spanning hardware, software, personal, and community aspects
 - context of system use
 - contextual design
- awareness of technologies/concepts
 - AI and AI technologies, data science, machine learning, ethical considerations or responsible AI; explainability, trust
- design and evaluation methods
 - design thinking mind-set
 - human-machine integration/teaming, cognitive systems engineering
- skills for working and influencing multi-disciplinary teams
 - data scientists, machine learning specialists.

Resources

Research papers and web-links to articles in the grey literature

All the links were last accessed on 12 January 2022

Resources

- Yang, Q., Steinfeld, A., Rosé, C. and Zimmerman, J. (2020). Re-examining Whether, Why, and How Human-AI Interaction Is Uniquely Difficult to Design', in Proceedings of the 2020 CHI Conference on human factors in computing systems. ACM, pp. 1-13.
- Holmquist, L. (2017). Intelligence on tap: artificial intelligence as a new design material', Interactions (New York), vol. 24, no. 4, pp. 28-33.
- Koesten, L. and Simperl, E. (2021). UX of data: making data available doesn't make it usable. interactions vol. 28, no. 2, pp. 97-99.
- Dove, G., Halskov, K. Forlizzi, J. and Zimmerman, J. (2017). UX Design Innovation: Challenges for Working with Machine Learning as a Design Material. In Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17). Association for Computing Machinery, New York, NY, USA, pp. 278-288.
- Farooq, U. and Grudin, J. (2016). Human-computer integration. interactions vol. 23, no. 6, pp. 26–32.
- Xu, W. (2019). Toward human-centered AI: a perspective from human-computer interaction. interactions vol. 26, no. 4, pp. 42–46.
- Roth, E., Sushereba, C., Militello, L., Diulio, J., and Ernst, K. (2019). Function Allocation Considerations in the Era of Human Autonomy Teaming. Journal of Cognitive Engineering and Decision Making, vol. 13, no. 4, 199-220.
- Viet Le, H. Mayer, S. and Henze, N. (2021). Deep learning for human-computer interaction. interactions vol. 28, no. 1, pp. 78–82.
- van Berkel, N., Skov, M. B. and Kjeldskov, J. (2021). Human-AI interaction: intermittent, continuous, and proactive. interactions vol. 28, no. 6, pp. 67-71.

Resources

- What is Artificial Intelligence exactly? Video: <https://www.youtube.com/watch?v=kWmX3pd1f10> (9.21 minutes)
- What is AI exactly, <https://www.accenture.com/us-en/insights/artificial-intelligence/what-ai-exactly>
- The Applied Intelligence Glossary, <https://www.accenture.com/gb-en/insights/applied-intelligence/artificial-intelligence-glossary>
- Intentionally Ethical AI experiences <https://uxpajournal.org/ethical-ai-experiences/>
- Contextual AI: The next frontier of artificial intelligence, <https://digiday.com/sponsored/adobesbl-contextual-ai-the-next-frontier-of-artificial-intelligence/>
- Explainable Artificial Intelligence, https://en.wikipedia.org/wiki/Explainable_artificial_intelligence
- Explaining decisions with AI, <https://ico.org.uk/for-organisations/guide-to-data-protection/key-dp-themes/explaining-decisions-made-with-ai/>
- The U.S. Military Wants Its Autonomous Machines to Explain Themselves, <https://www.technologyreview.com/2017/03/14/243295/the-us-military-wants-its-autonomous-machines-to-explain-themselves/>
- Teaching HCI for AI: Co-design of a Syllabus, <http://sigchitaly.eu/en/hci4ai-syllabus/>
- From a Workshop to a Framework for Human-Centered Artificial Intelligence, https://link-springer-com.libezproxy.open.ac.uk/chapter/10.1007/978-3-030-77772-2_11

Resources

- 'More than 97% accuracy': Chinese scientists develop AI 'prosecutor', https://www.koreatimes.co.kr/www/world/2021/12/672_321168.html
- Is artificial intelligence ready for the great rehiring?, <https://www.weforum.org/agenda/2021/07/is-ai-ready-for-the-great-rehiring/>
- Artificial Intelligence on BBC's site, <https://www.bbc.co.uk/news/topics/ce1qrvleleqt/artificial-intelligence>
- Introducing the Human-Centered AI Canvas, <https://medium.com/@albmlt/introducing-the-human-centered-ai-canvas-a4c9d2fc127e>
- AI is design's latest material, <https://design.google/library/ai-designs-latest-material/>
- Designing AI, <https://interactions.acm.org/archive/view/november-december-2018/introduction19>
- Artificial Intelligence and User Experience, <https://www.uxmatters.com/mt/archives/2019/11/artificial-intelligence-and-user-experience.php>
- Alexa Design Guide, <https://developer.amazon.com/en-GB/docs/alexa/alexa-design/get-started.html>
- AI guidelines in the creative process, <https://medium.com/microsoft-design/ai-guidelines-in-the-creative-process-807b6d31cda2>

Resources

- IDEO's Beliefs About Creating Value Through Augmented Intelligence: <https://www.ideo.com/post/ideos-beliefs-about-creating-value-through-augmented-intelligence>
- A face-scanning algorithm increasingly decides whether you deserve the job, <https://www.washingtonpost.com/technology/2019/10/22/ai-hiring-face-scanning-algorithm-increasingly-decides-whether-you-deserve-job/>
- Independent auditors are struggling to hold AI companies accountable, <https://www.fastcompany.com/90597594/ai-algorithm-auditing-hirevue>
- The pandemic showed remote proctoring to be worse than useless, <https://doctorow.medium.com/the-pandemic-showed-remote-proctoring-to-be-worse-than-useless-4d607546c898>
- Managed by Bots: Data-Driven Exploitation in the Gig Economy, <https://www.workerinfoexchange.org/wie-report-managed-by-bots>
- Workers demand gig economy companies explain their algorithms, <https://www-ft-com.libezproxy.open.ac.uk/content/95e7f150-b0f9-4602-8e5d-76a138b59851> (requires OU login)
- Research shows AI is often biased. Here's how to make algorithms work for all of us, <https://www.weforum.org/agenda/2021/07/ai-machine-learning-bias-discrimination/>

Resources

- Review: Weapons of Math Destruction; in this book, Cathy O'Neil warns us that algorithms can and do perpetuate inequality, <https://blogs.scientificamerican.com/roots-of-unity/review-weapons-of-math-destruction/>
- Coded Bias, a documentary on Netflix, <https://www.netflix.com/gb/title/81328723>
- DeepMind Wants to Use AI to Transform Soccer, <https://www.wired.com/story/deepmind-wants-to-use-ai-to-transform-soccer/>
- Trove of unique health data sets could help AI predict medical conditions earlier, <https://www-ft-com.libezproxy.open.ac.uk/content/af763300-9fc6-4863-b5bf-c3e670301c09> (requires OU login)
- Crime Prediction Keeps Society Stuck in the Past, <https://www.wired.com/story/crime-prediction-racist-history/>
- Amazon scraps secret AI recruiting tool that showed bias against women, <https://www.reuters.com/article/us-amazon-com-jobs-automation-insight-idUSKCN1MK08G>
- Human dimension presents new hurdles for AI in medicine, <https://www-ft-com.libezproxy.open.ac.uk/content/151dbf12-970d-49af-9d10-d417921f7066> (requires OU login)

Resources

- Hundreds of sewage leaks detected thanks to AI, <https://www.bbc.co.uk/news/science-environment-56351501>
- Reith Lectures: AI and why people should be scared, <https://www.bbc.co.uk/news/technology-59326684> and <https://www.bbc.co.uk/programmes/articles/1N0w5NcK27Tt041LPVLZ51k/reith-lectures-2021-living-with-artificial-intelligence>
- Are we witnessing the dawn of post-theory science?, <https://www.theguardian.com/technology/2022/jan/09/are-we-witnessing-the-dawn-of-post-theory-science>
- How to investigate a firm with 60 million documents, <https://www.bbc.co.uk/news/business-55306139>
- Uber's self-driving operator charged over fatal crash, <https://www.bbc.co.uk/news/technology-54175359>
- Independent auditors are struggling to hold AI companies accountable, <https://www.fastcompany.com/90597594/ai-algorithm-auditing-hirevue>
- AI is making applying for jobs even more miserable, <https://www-ft-com.libezproxy.open.ac.uk/content/a81245ee-9916-47e2-81b9-846e9403be00>
(requires OU login)

Discussion and thank you