

The role of design in socially responsible AI

Jodi Forlizzi, Herbert A. Simon Professor
HCII, Carnegie Mellon University
NSF CISE Talk | April 4, 2024

Jodi Forlizzi
Carnegie Mellon University

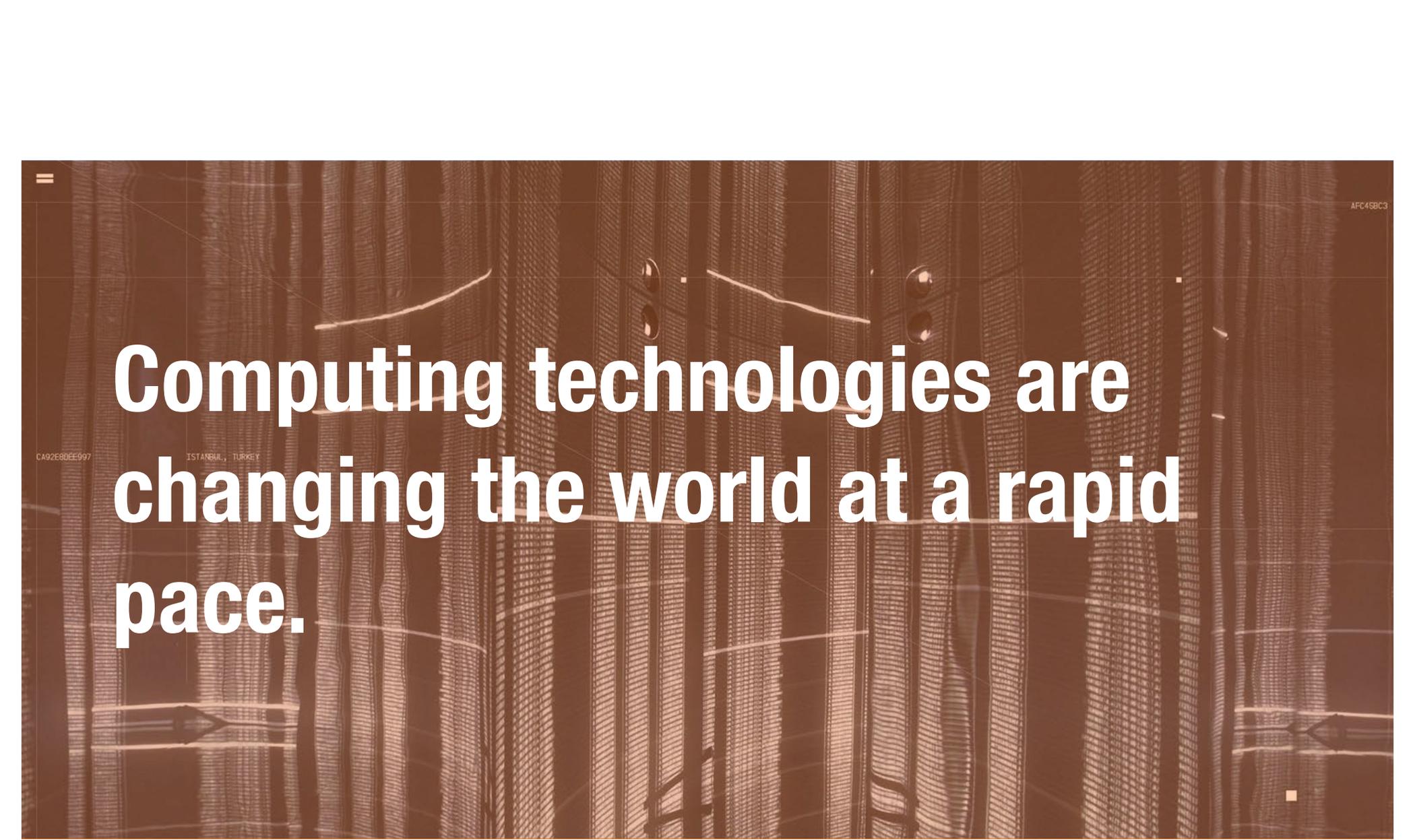


Who I am and why I'm here



Design as an accidental vagrant



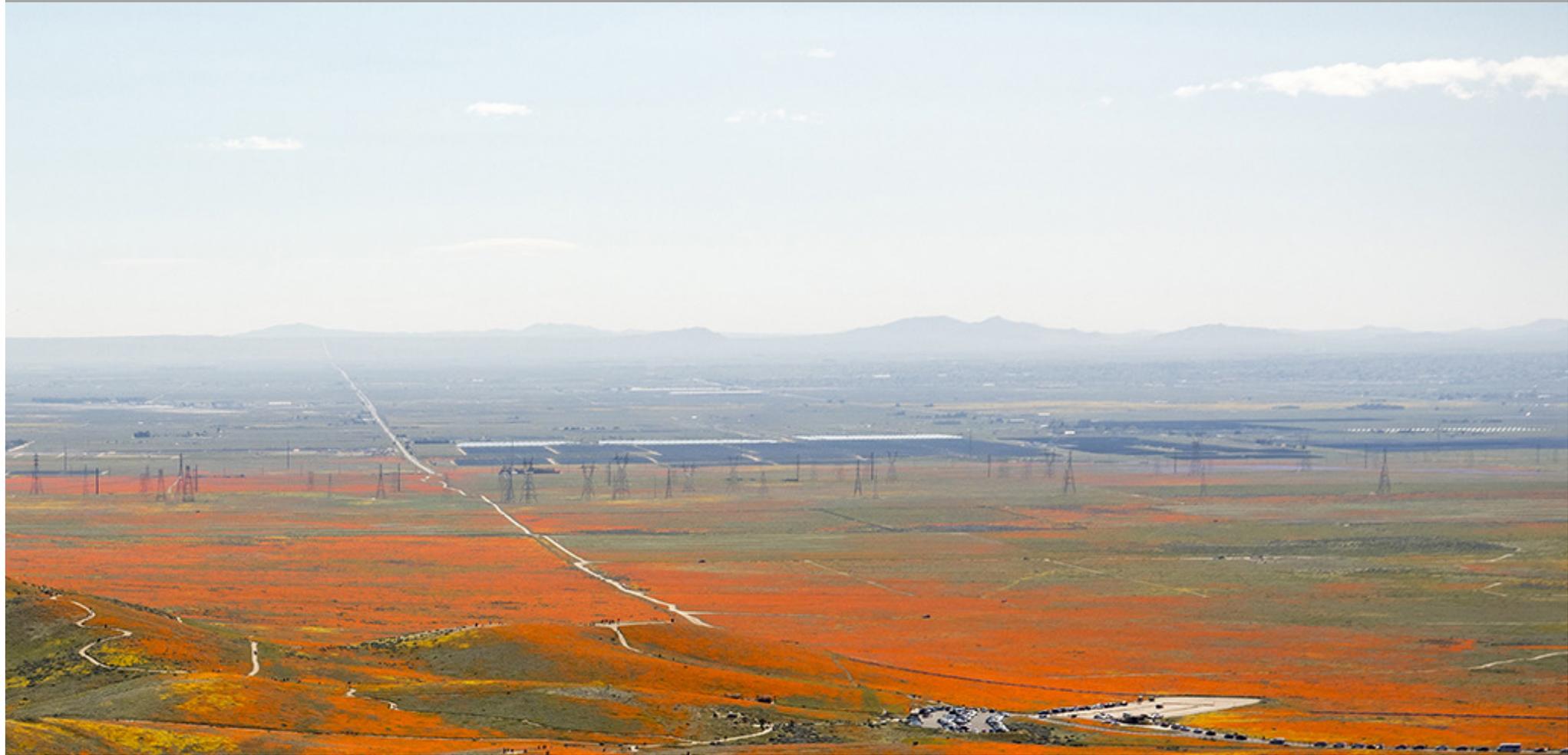


**Computing technologies are
changing the world at a rapid
pace.**

Jodi Forlizzi
Carnegie Mellon University



Sea change in technology



Data is the new oil, the new electricity

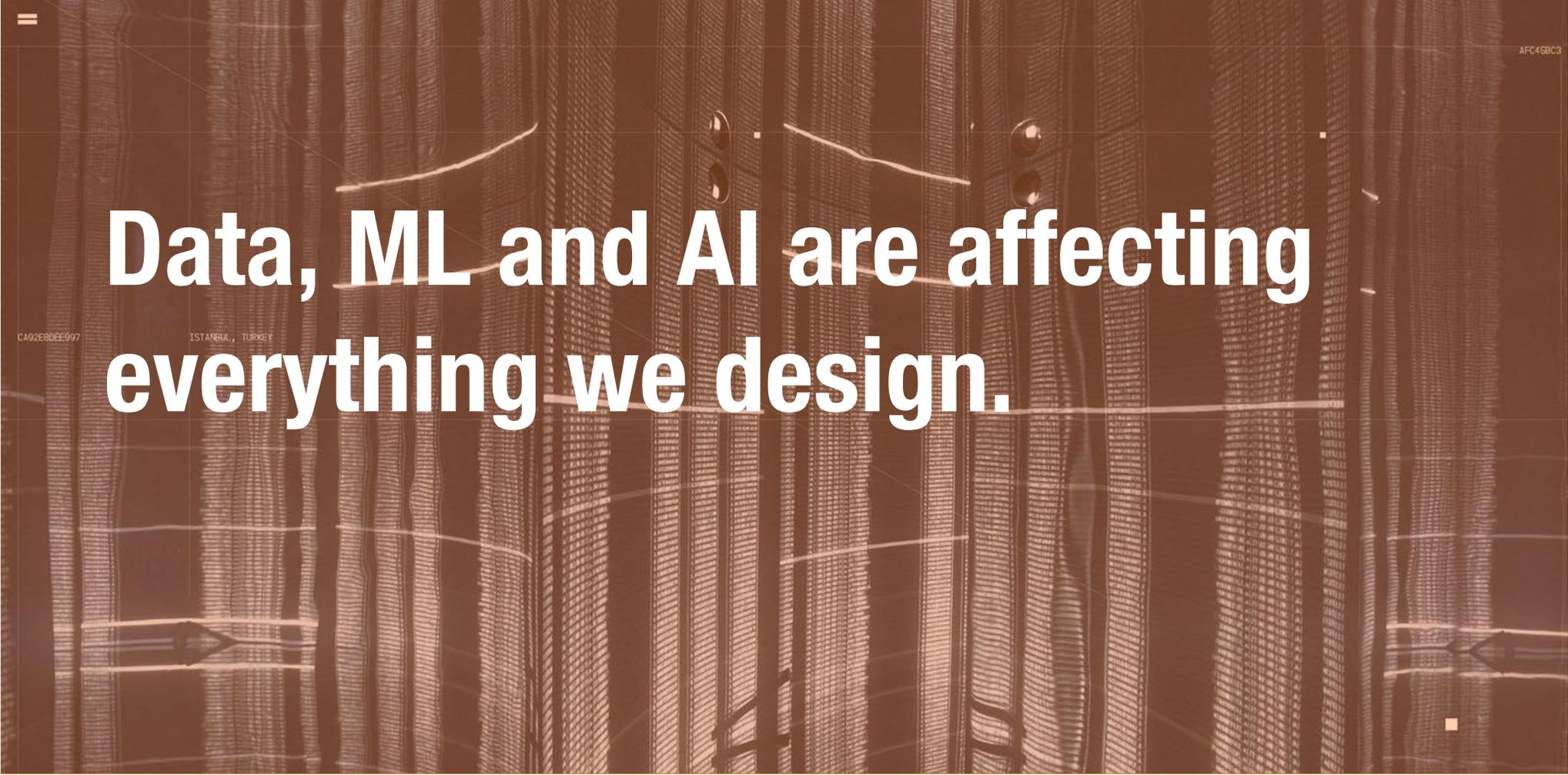


Blackmountainsand.com

AI is more profound than fire

<https://www.fastcompany.com/90768633/>
<https://www.redding.com/story/news/20forget-robots-taking-jobs-these-researchers-compare-ai-to-fire-heres-how-we-need-to-tend-it/10/11/11/trump-blames-state-fires-but-many-worst-federal-land/1971196002/>





**Data, ML and AI are affecting
everything we design.**

Jodi Forlizzi
Carnegie Mellon University



Reduce recidivism rates

<https://freedomprojectwa.org/40> and a bus ticket/



Improve educational outcomes

<https://fsrv.org/wp-content/uploads/2019/01/canva-stock-photo-2.jpg>



Jodi Forlizzi | Carnegie Mellon University | 10



Prediction and prevention of disease



<https://www.commonwealthfund.org/publications/2020/apr/protecting-patients-compromised-kidney-function-during-pandemic-and-beyond>

Replicate identity using speech and video

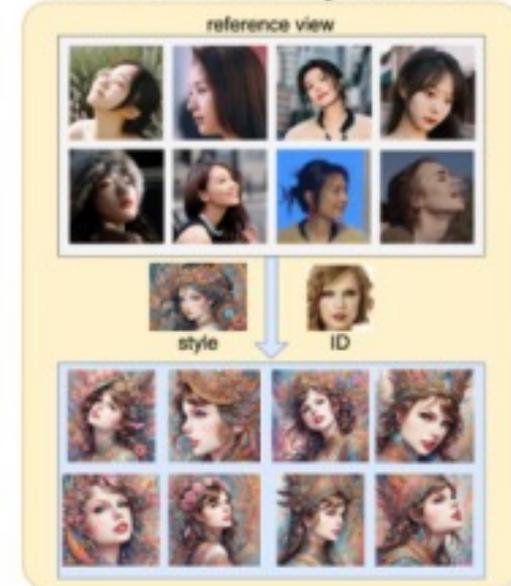
Multi-ID and Multi-Style Synthesis



Stylized Synthesis



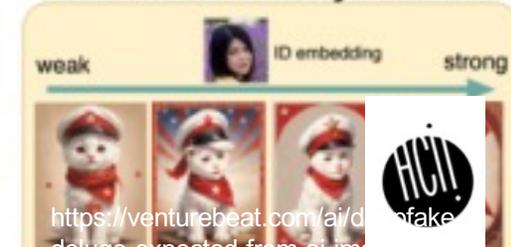
Novel View Synthesis



Realistic Synthesis



Non-Portrait Synthesis



Data, ML and AI impacts what we design



Customers who viewed this item also viewed



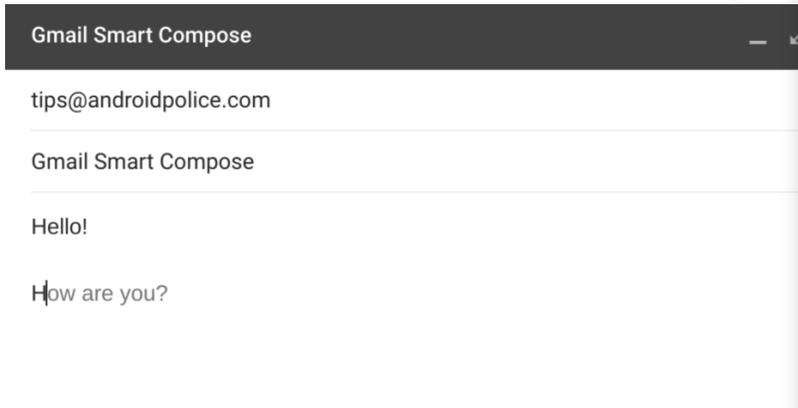
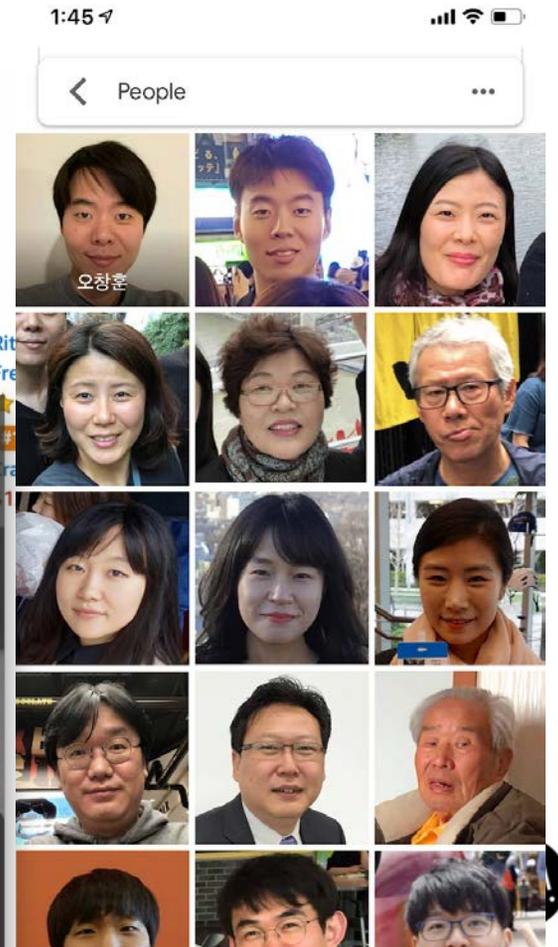
Quaker Chewy Granola Bars, Variety Pack, 18 Bars
★★★★★ 1,276
\$2.97 prime pantry

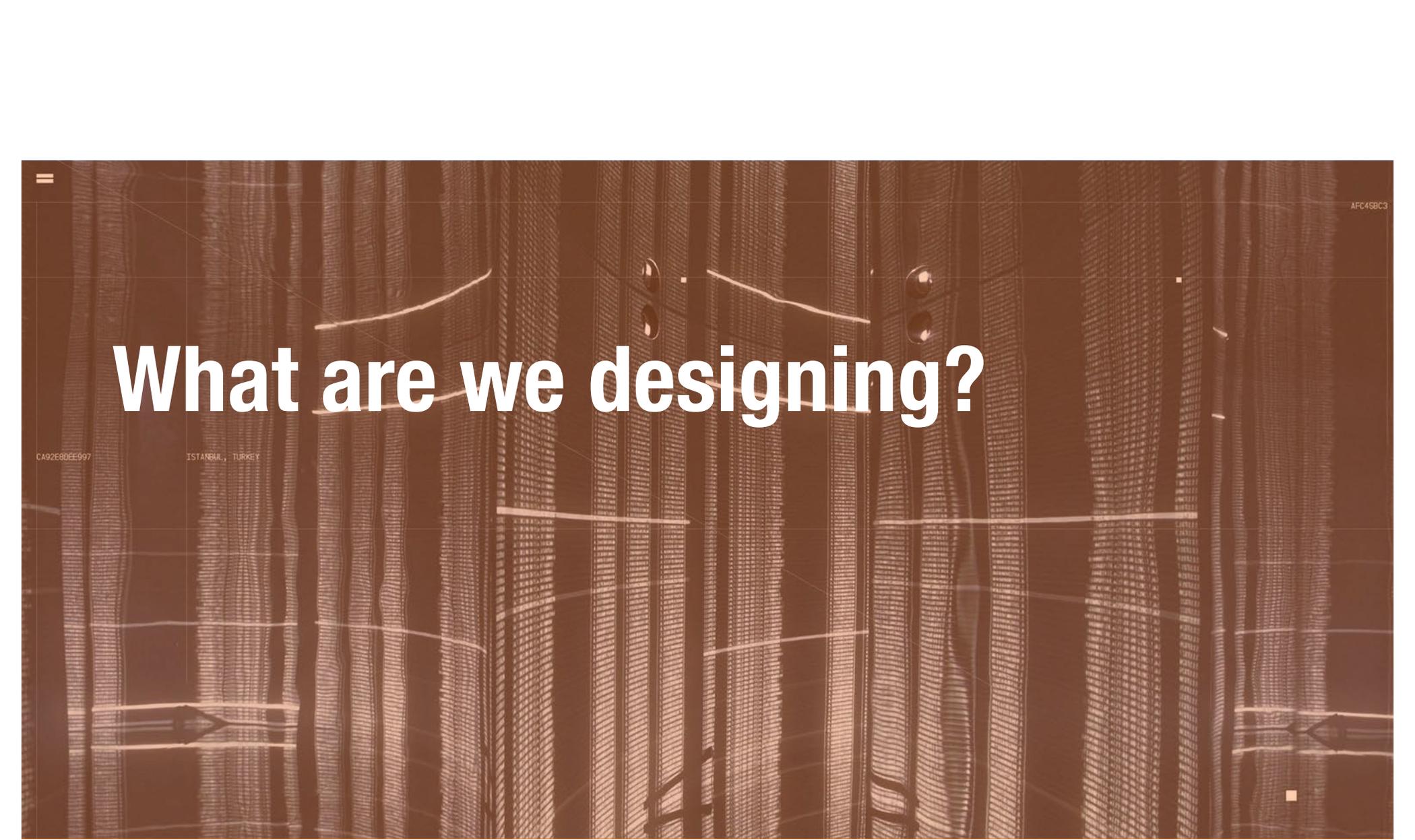


Snack Pack Chocolate and Vanilla Pudding Cups Family Pack, 12 Count
★★★★★ 5:40
#1 Best Seller in Pudding Mixes
\$2.53 prime pantry



Slim Jim Snack-Sized Smoked Meat Sticks, Original Flavor, Keto Friendly, 0.28 oz. 14 Sticks Inside!
★★★★★ 781
#1 Best Seller in Jerky & Dried Meats
\$2.98 prime pantry





What are we designing?

Jodi Forlizzi
Carnegie Mellon University



**We are
PRODUCTS**



**No, we are
SERVICES**



Products: A thing that is owned through the transfer of value



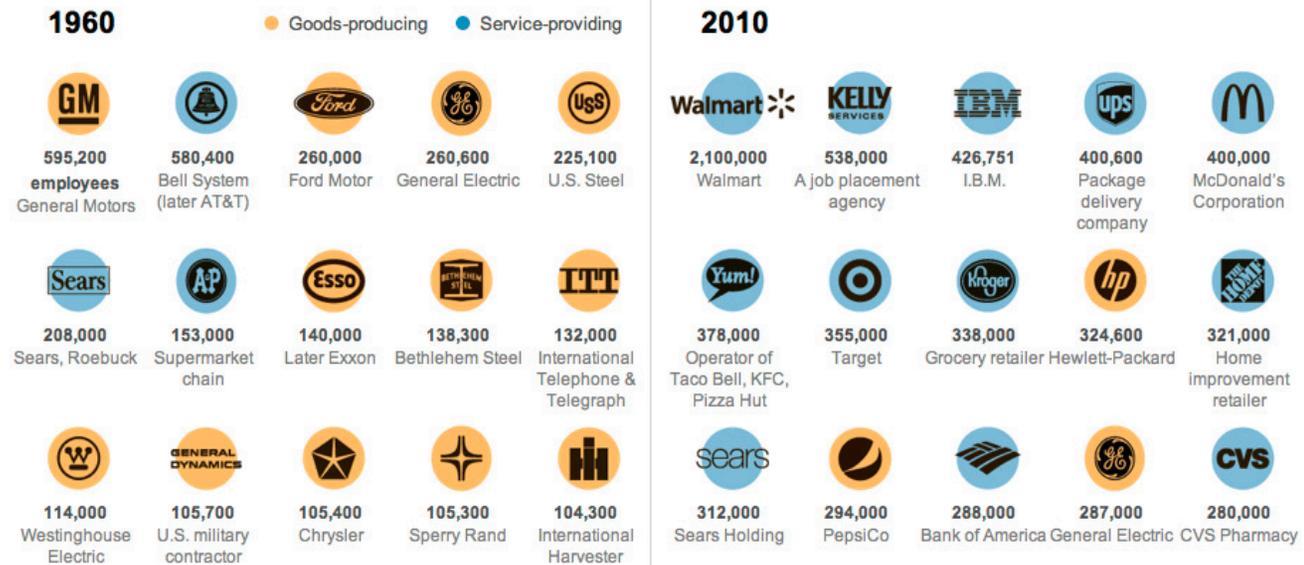
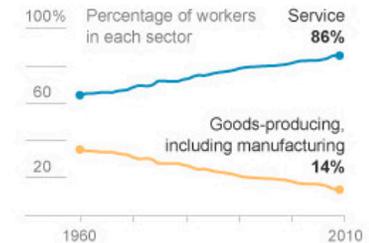
Services: Enacted to co-create value between provider and customer



Rise of a service economy worldwide

A Shift From Manufacturing

A look at the largest employers shows how America's economy has changed. Over the last 50 years, the country has shifted from creating goods to providing services. Today, about a tenth of Americans work in manufacturing, while service providers and retailers like Walmart and temp firms like Kelly Services employ about six in seven of the nation's workers.



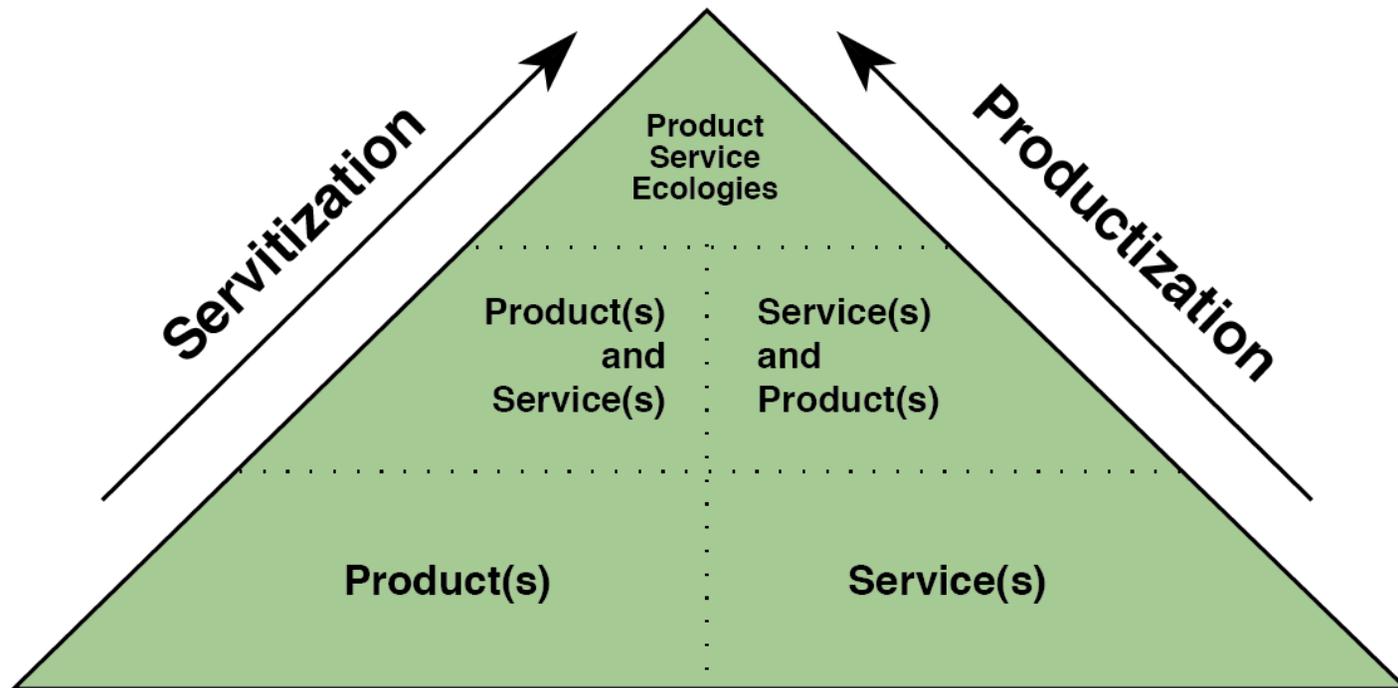
Benefits of a multistakeholder view



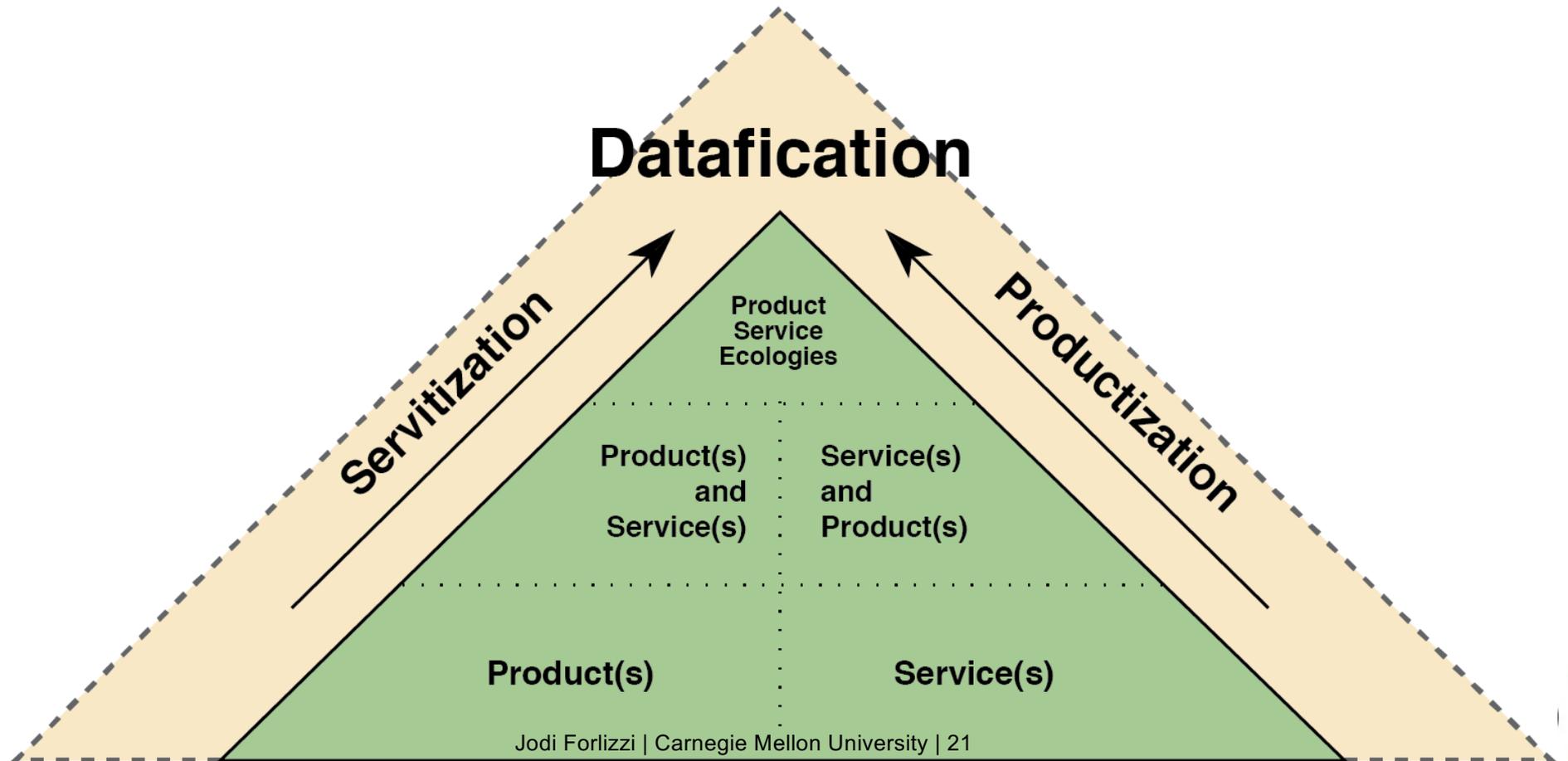
- Anyone with a stake in the service design project
- Anyone who is impacted by the service design outcomes
- Concepts of serving vs. helping or fixing [Remen]

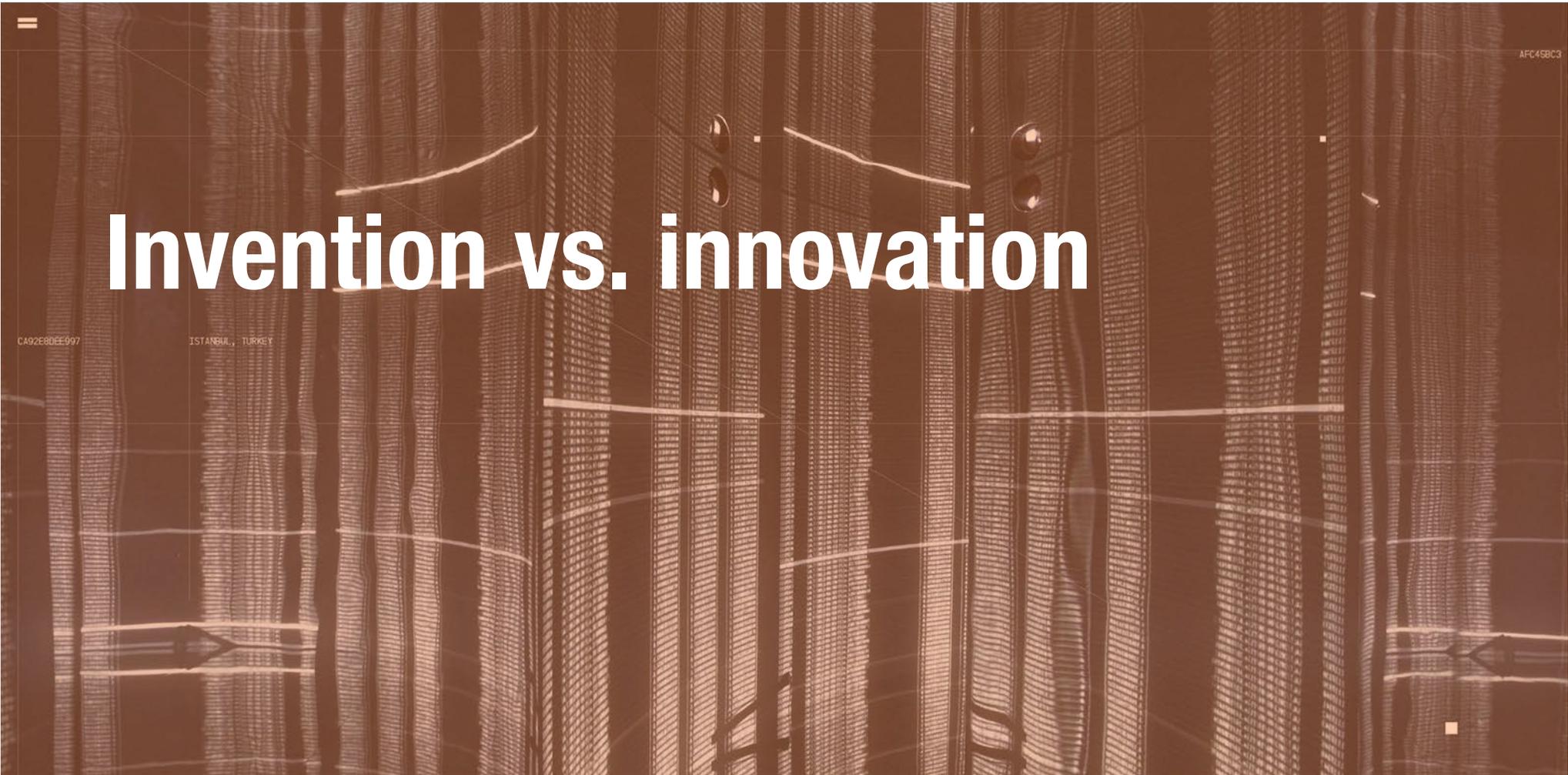


Products and services are blending



Products, services, and data are blending





Invention vs. innovation

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ISTANBUL, TURKEY

APC45BC3

Jodi Forlizzi
Carnegie Mellon University



Invention vs. Innovation



1963 Philips
cassette recorder
Mechanism and
capabilities

Innovation: Recognizing and giving form and value





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ISTANBUL, TURKEY

An innovation gap exists with AI.

Jodi Forlizzi
Carnegie Mellon University



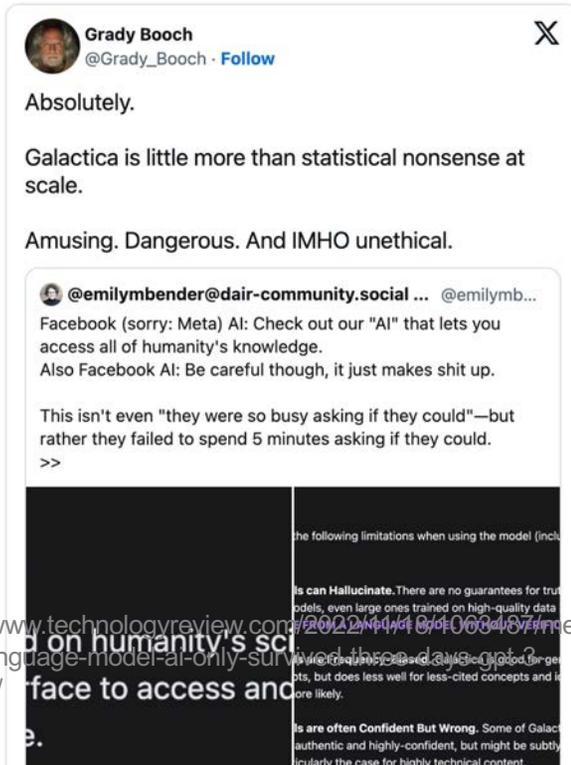
Most AI Products Fail
[Harvard Business Review, 2023]

**85% of AI
Implementations Will
Fail By 2022**
[Gartner, 2021]

AI Has A Poor Track Record
[Industry Week, 2022]

Model performance

... a business but that cannot get past from history. It might be that, but we were sharing its biased and incorrect results on social media.



<https://www.technologyreview.com/2022/11/14/01-00-07/meta-large-language-model-ai-only-survived-three-days-not-science/>

Teams cannot achieve the model performance they need to have a good enough AI product



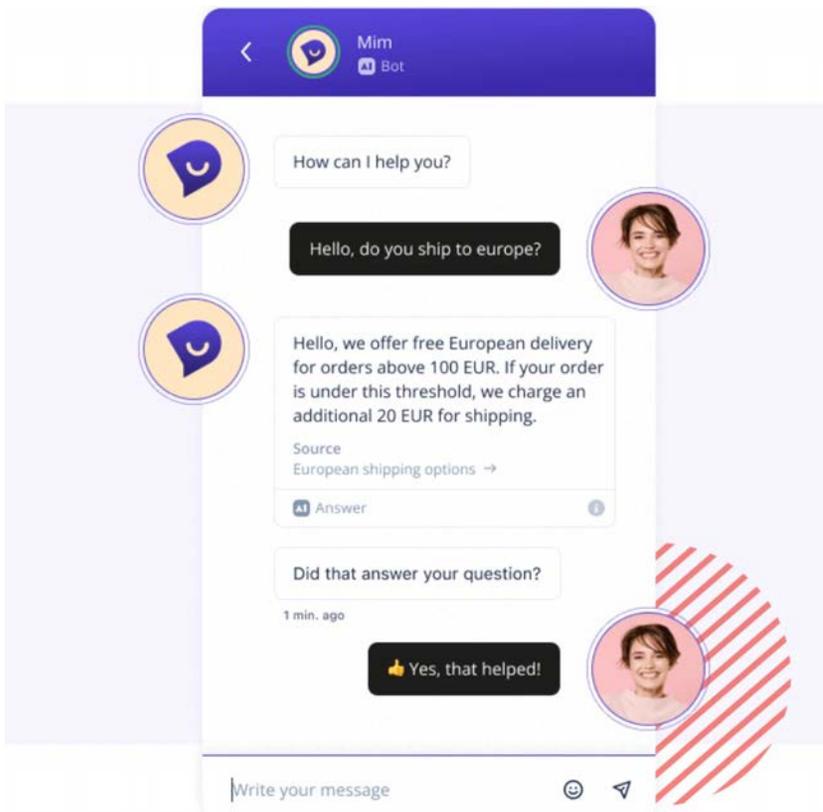
No service value



The system does not generate enough value to the company to make it worthwhile



Not desirable to the intended customer



The system does not generate customer or user value and is abandoned

<https://watermelon.ai/blog/best-ai-chatbots-customer-service/>



Ethical risks



<https://journals.sagepub.com/doi/10.1177/20539517231215360>

The system may have ethical issues with data privacy, algorithmic bias, or some other type of unintended harm



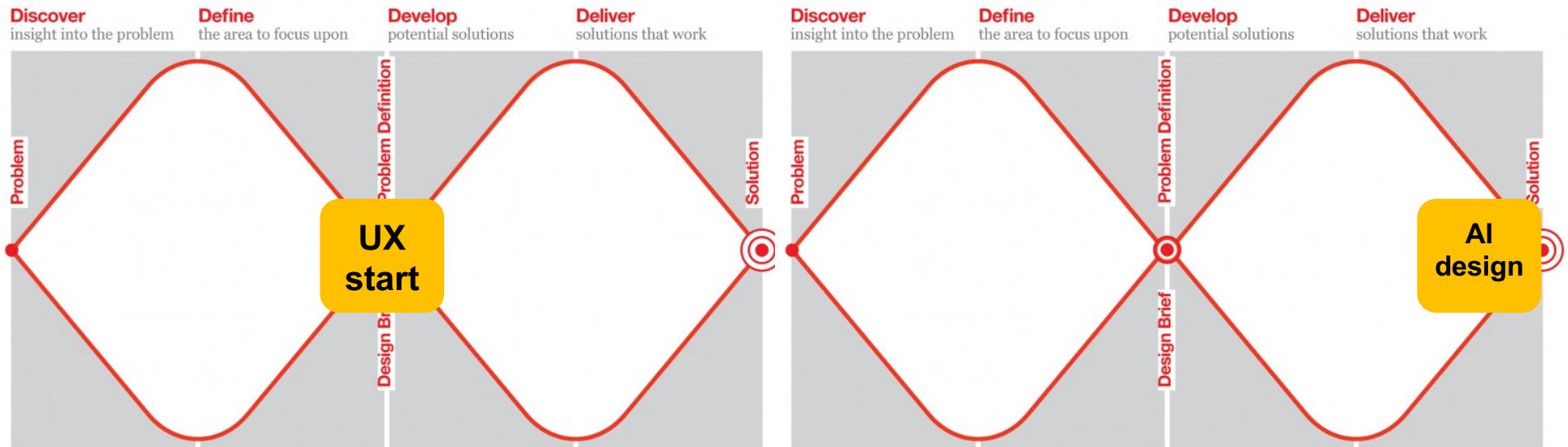


**New methods and processes are
needed to successfully and
responsibly innovate with AI.**

Jodi Forlizzi
Carnegie Mellon University



Traditional design processes may not apply

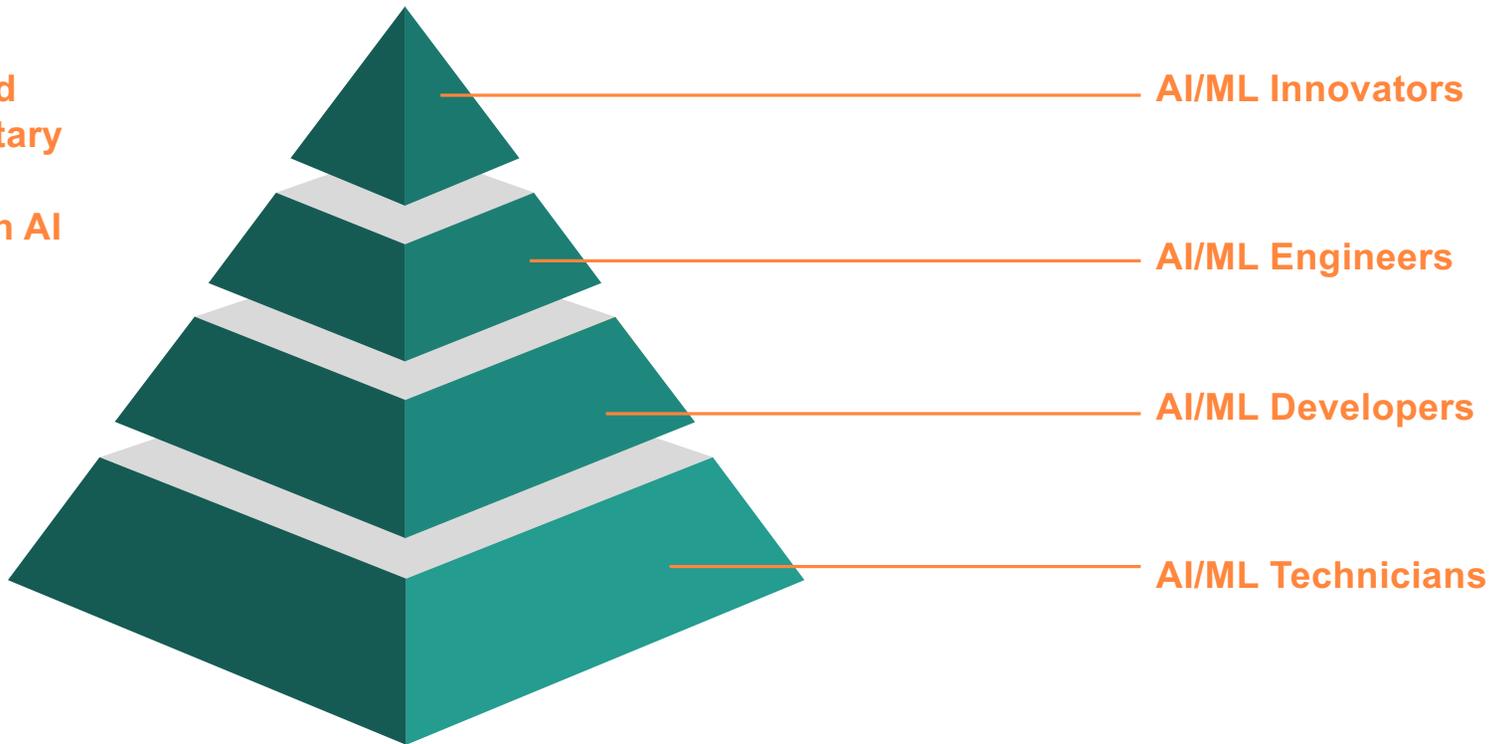


<https://uxdesign.cc/beyond-the-double-diamond-thinking-about-a-better-design-process-model-de4fdb902cf>

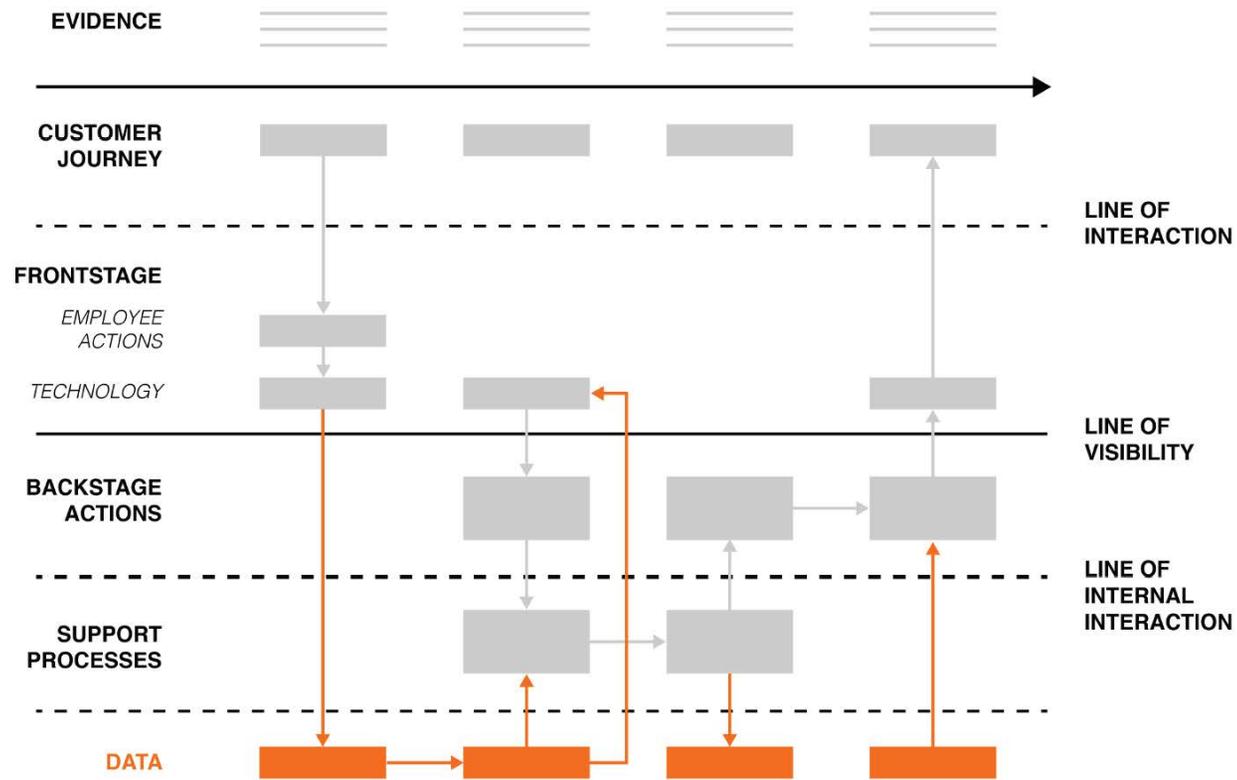


An AI Product Team is multifaceted

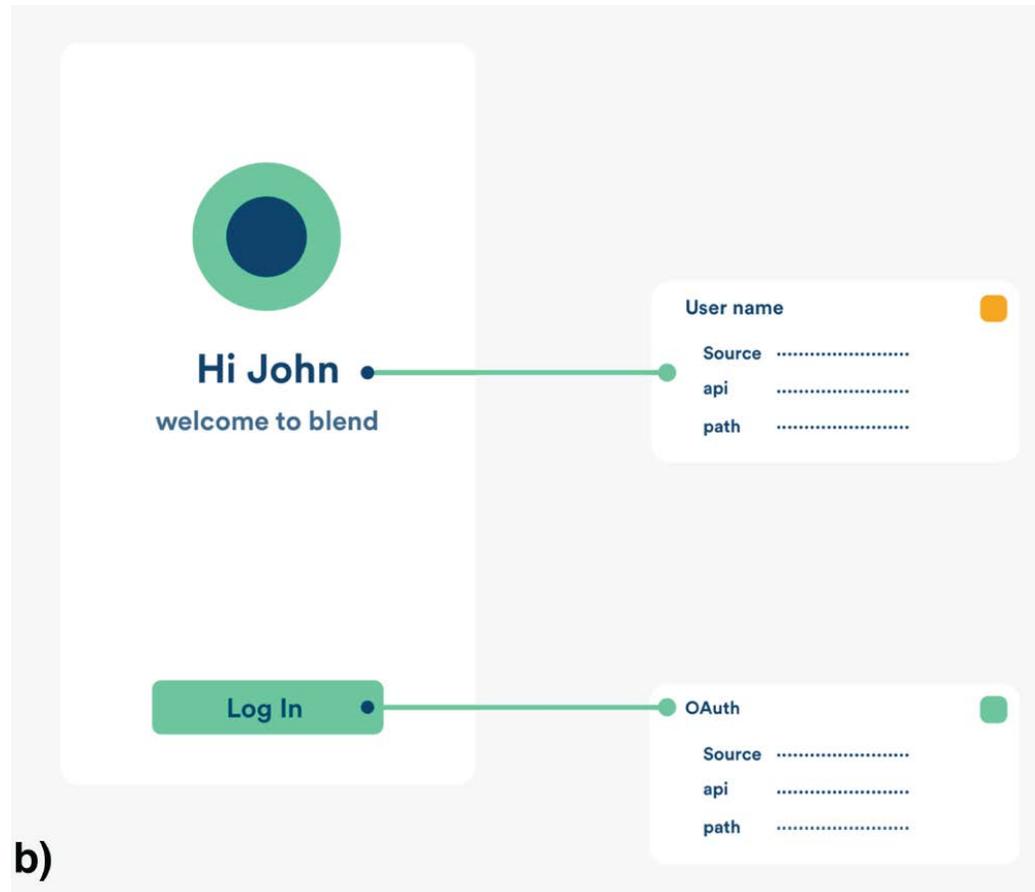
Different and complementary skills in working with AI



Service blueprinting: Add a data layer



UX Wireframing: Add a data source



Matchmaking

Matchmaking for AI-IoT Applications

Specific Capability	Domain and/or Activity	Customer	Application
1 Light sensors use photocells to measure light intensity. Inference capabilities include obstacle detection, motion, context (in pocket, outdoors, mood, state) Sensing: \$	Home improvement	Homeowners	smart lighting control system that adjusts the intensity and color temperature of indoor lighting based on the natural light available
2 Computation: \$	Energy	Green (solar) energy	use light sensors to determine the best locations to place solar panels based on measures of light intensity patterns (varying by location and time of day)
3	Technology	Devices	enhanced device tracking using light sensors to detect whether item is in a small and/or dark location
4	Health	Skincare	application that measures light intensity outside to recommend SPF levels and other skincare tips
5	Agriculture	Farmers	use light sensor data to analyze light intensity patterns in order to optimize crop growth/health in greenhouse environments
6 RADAR sensors measure distance and shape. Inference capabilities include obstacle detection,	Security and policing	Security systems	security system using RADAR sensors to alert for/track movements within a certain area of a building or home
7 object recognition, motion detection, activity recognition	Accessibility	Blind people	application using RADAR sensors and AI algorithms to assist visually impaired individuals in navigating their surroundings (identify obstacles or other moving objects)
	Energy	Building/home owners	use RADAR sensing to detect the presence of people in a room and turn on lights or other electric devices as needed (optimize energy use)
	Health	Parents	baby monitor that can update or alert parent when baby's movement is detected using RADAR sensing
	Transportation	Autonomous vehicles	combine RADAR sensing with machine learning algorithms to detect obstacles, recognize objects, and navigate safely in various environments
	Transportation	Transportation departments (traffic regulation)	Use sensors to infer about weather and modify control of traffic flow accordingly (EX if detects that a storm is coming, start dispersing traffic away from highways which can get backed up)
		Personal vehicles	Help maintain driver's ideal environments by adapting from outside conditions (like how you can automatically adjust seats/mirrors per person, adjust conditions instead)
	Agriculture	Greenhouse industry	Greenhouse environmental control—use AI to automatically adjust environment to adapt for optimal plant conditions based on sensor readings
		Crop farmers	Detect surrounding humidity/temperature and release certain

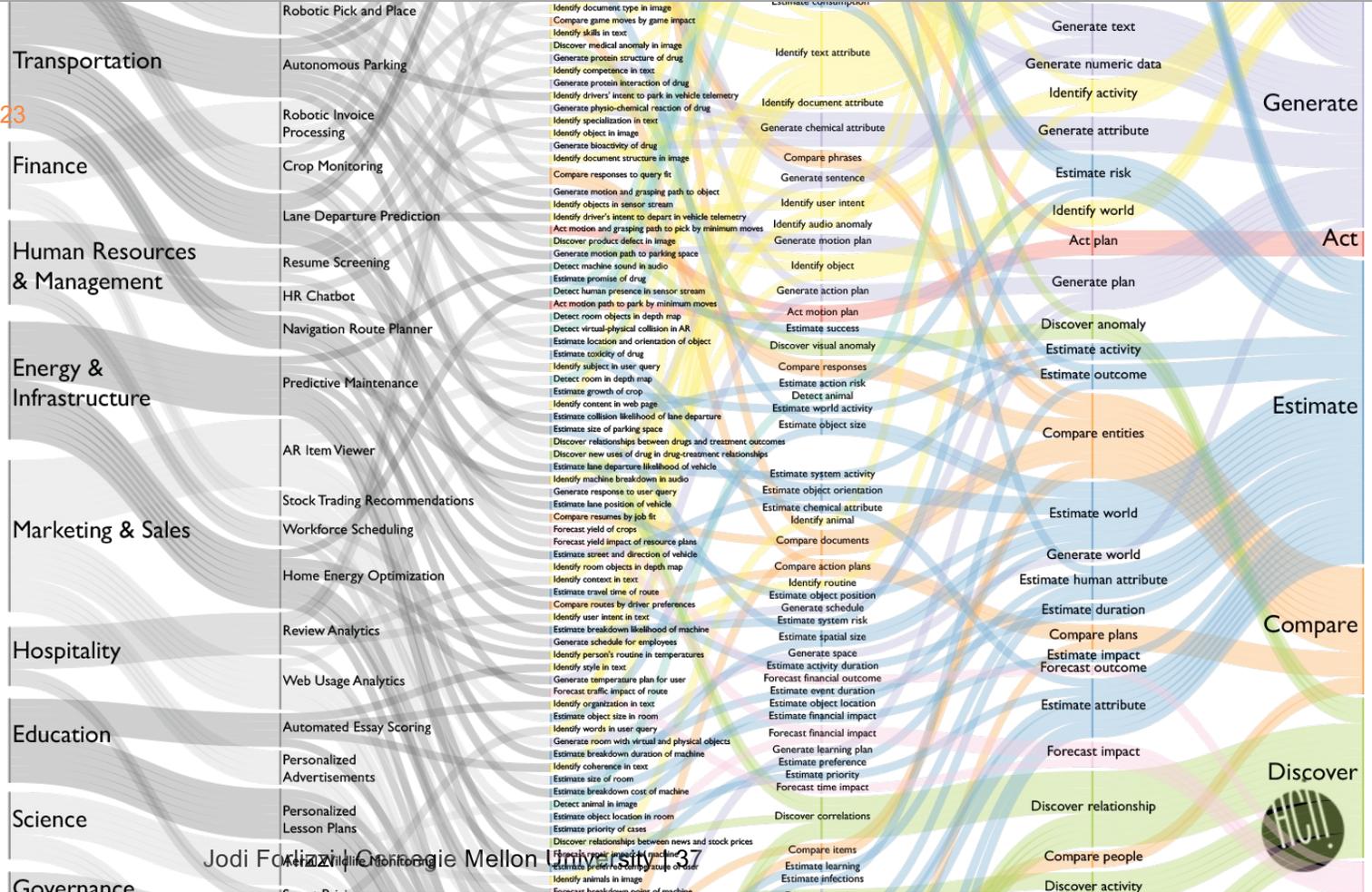
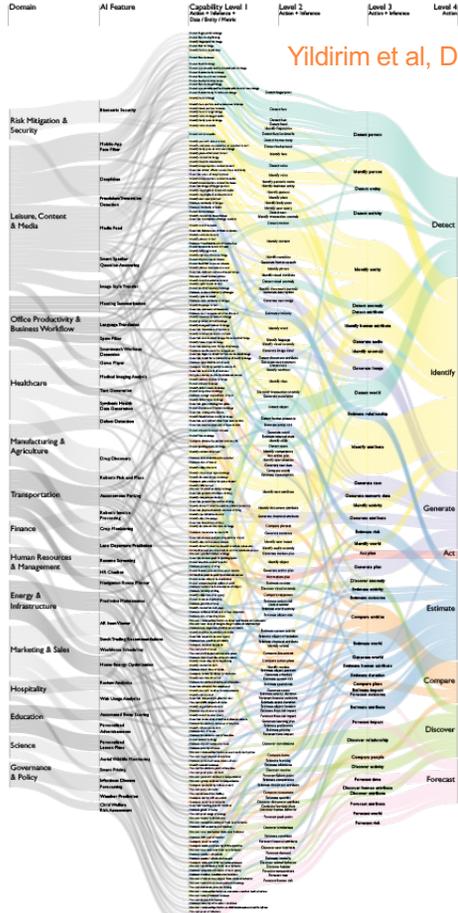


AI taxonomy

Taxonomy of AI Capabilities | February 2022

Level 1
Level 2
Level 3
Level 4

Yildirim et al, DIS 23



Jodi Forlizzi, Carnegie Mellon University



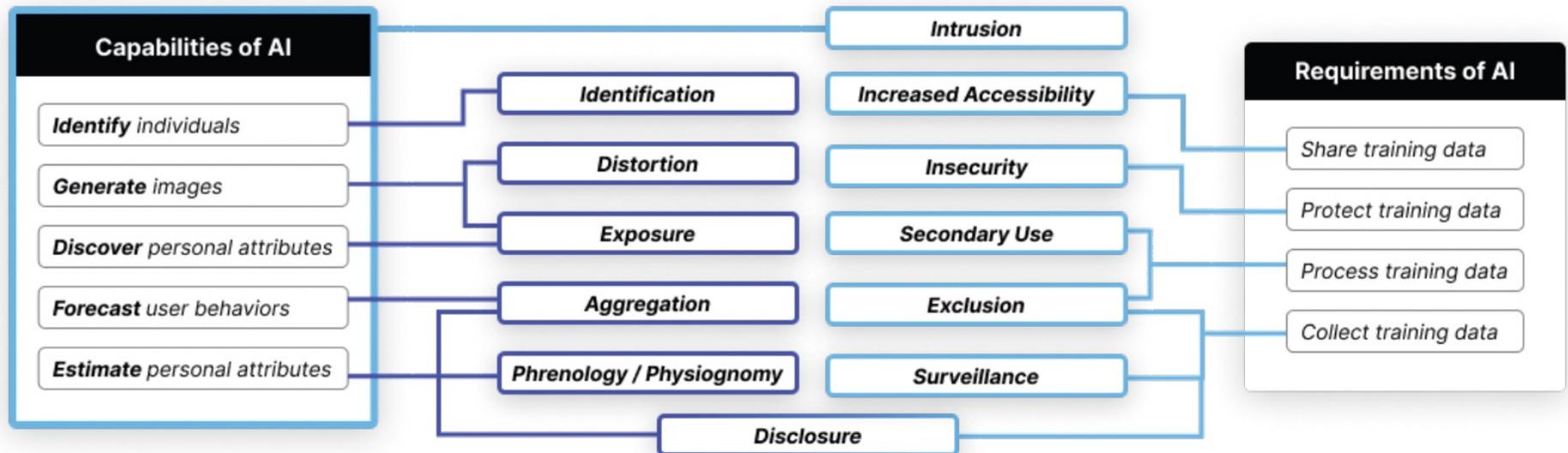
AI capabilities act as design patterns

Capability + synonyms	Definition	Examples
Estimate Rate, Grade, Measure, Assess	Infer a value (ex: position, size, duration, cost, impact) related to the current situation. This is about making an inference about now.	Estimate driving time (navigation maps) Estimate chances this is spam (email) Estimate direction sound came from (smart speaker)
Forecast Predict, Guess, Speculate	Infer a value that will be true or some attribute or impact of a future situation that may or may not happen (stock price, sales, weather, chance of something being true).	Forecast best time to buy stock (financial planner) Forecast tomorrow's weather (weather app) Forecast max price for my house (real estate app)
Compare Rank, Order, Find Best, Find Fastest, Find Cheapest, Recommend	Compare a collection of the same things based on a metric, such as comparing a set of social media ads based on the likelihood a user might click. Compare allows services to select, rank, or curate a collection of things.	Compare items by likelihood of purchase (online store) Compare posts by likely engagement (social media) Compare movies by likelihood of watching (media)
Detect Monitor, Sense, Notice, Classify, Discriminate	Notice if a specific kind of a thing is in a data set or if it shows up in a sensor stream.	Detect human voice in audio (smart speaker) Detect face in image (camera) Detect step in motion sensor stream (smartwatch)
Identify Recognize, Discern, Find, Classify, Perceive	Notice if a specific item or class of items shows up in a set of like items.	Identify if message is spam (email) Identify if Steve's face (security) Identify the type of cancer (medical imaging)
Discover Extract, Notice, Organize, Cluster, Group, Connect, Reveal	Analyze a dataset and notice a pattern that allows clustering of similar things or identification of outlying entities.	Discover how people use this site (usage mining) Discover unusual bank transactions (fraud detection) Discover relationships between drugs and disease (drug discovery)
Generate Make, Compose, Construct, Author	Generate something new (message, image, sound) based on knowledge of similar things.	Generate chat response (chat agent) Generate detail in image (photo retouching) Generate synthetic medical records (medical data)
Act Do, Execute, Play, Go, Fight, Learn, Operate	Execute a strategy to achieve a specific goal and continue to update the strategy based on advance towards the goal.	Act: Park the car (self park) Act: Play poker (gambling agent) Act: Fly drone to location (drone pilot)

Yildirim et al, DIS 23



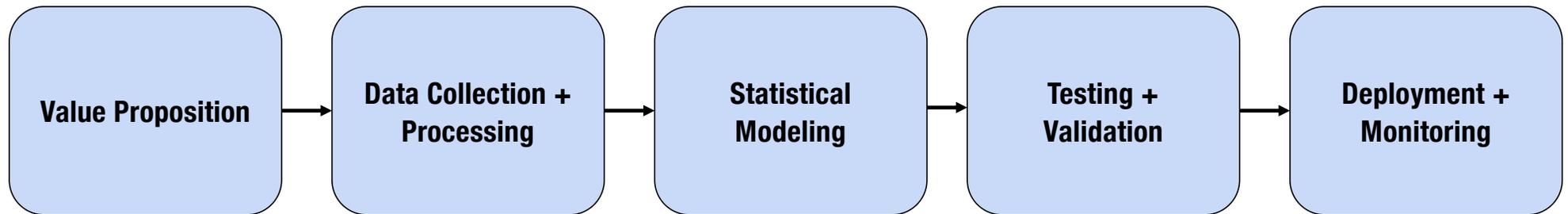
Taxonomy of privacy risks



Lee et al, CHI24



Tools for governance in the AI pipeline



- Organizational leaders (e.g., executives, team leaders)
- Designers (e.g., project managers, UX and AI designers)
- Developers (e.g., model engineers, data scientists)
- Deployers (e.g., evaluators, system integrators)
- Operators (e.g., tech support)
- End-users (e.g., front-line workers)
- Impacted communities



Stage/Stakeholder Matrix

Issues / Tools	Value Proposition	Data Processing	Statistical Modeling	Testing + Validation	Deployment + Monitoring
Leaders	Green	Grey	Grey	Grey	Light Green
Designers	Light Green	Light Green	Green	Green	White
Developers	Grey	White	White	White	Green
Deployers	Grey	Light Green	White	Light Green	Light Green
End-users	Light Green	White	White	White	Light Green
Impacted communities	White	White	White	Light Green	Light Green





AI and automation in the hospitality industry

Jodi Forlizzi
Carnegie Mellon University

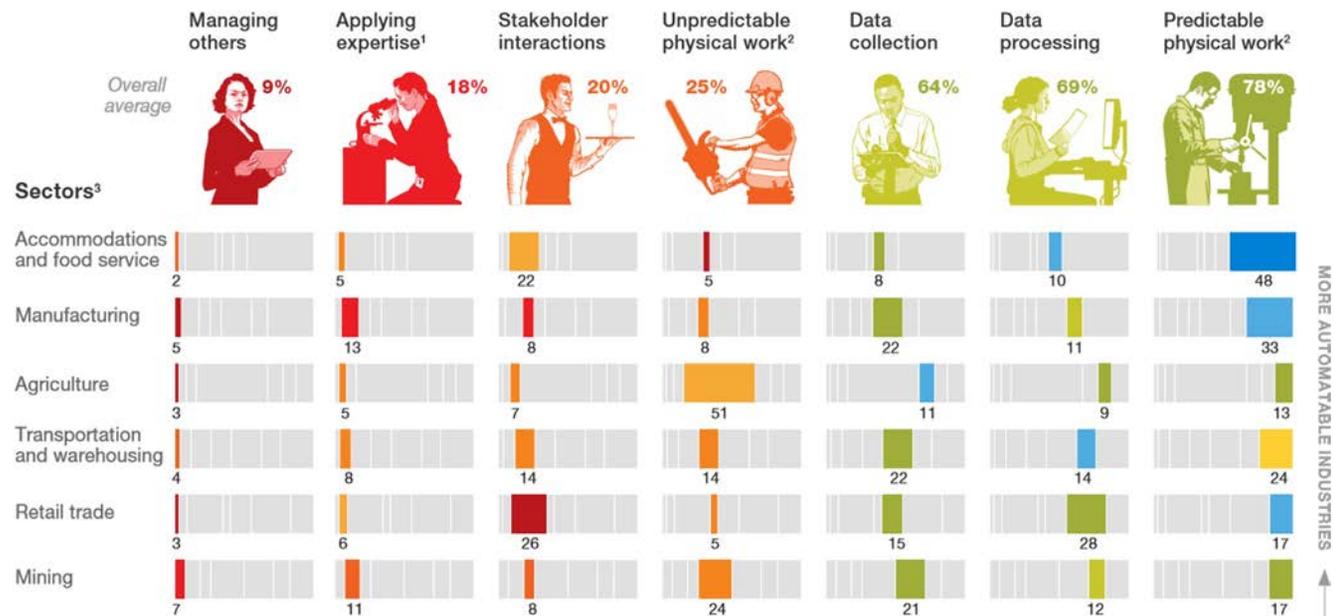


Hospitality in danger of automation

The technical potential for automation in the US

Many types of activities in industry sectors have the technical potential to be automated, but that potential varies significantly across activities.

Technical feasibility: % of time spent on activities that can be automated by adapting currently demonstrated technology



Robots and automation in the hospitality industry



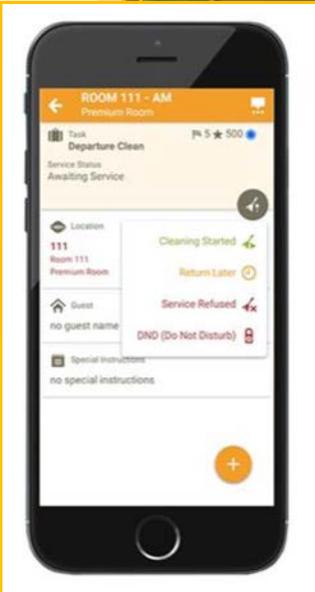
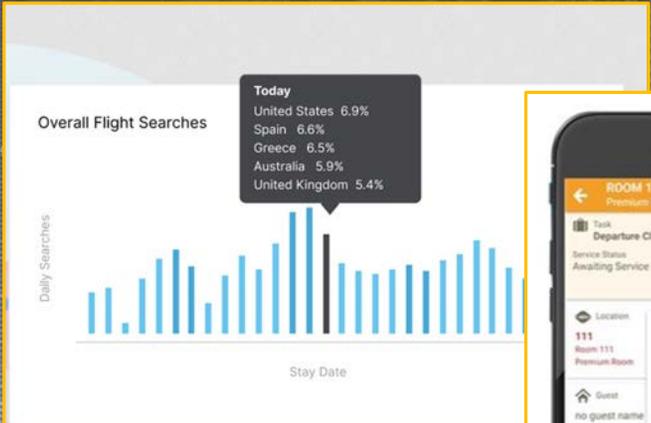
Meet Flippy, Chippy, Sally, and Sippy



Jodi Forlizzi
Carnegie Mellon University

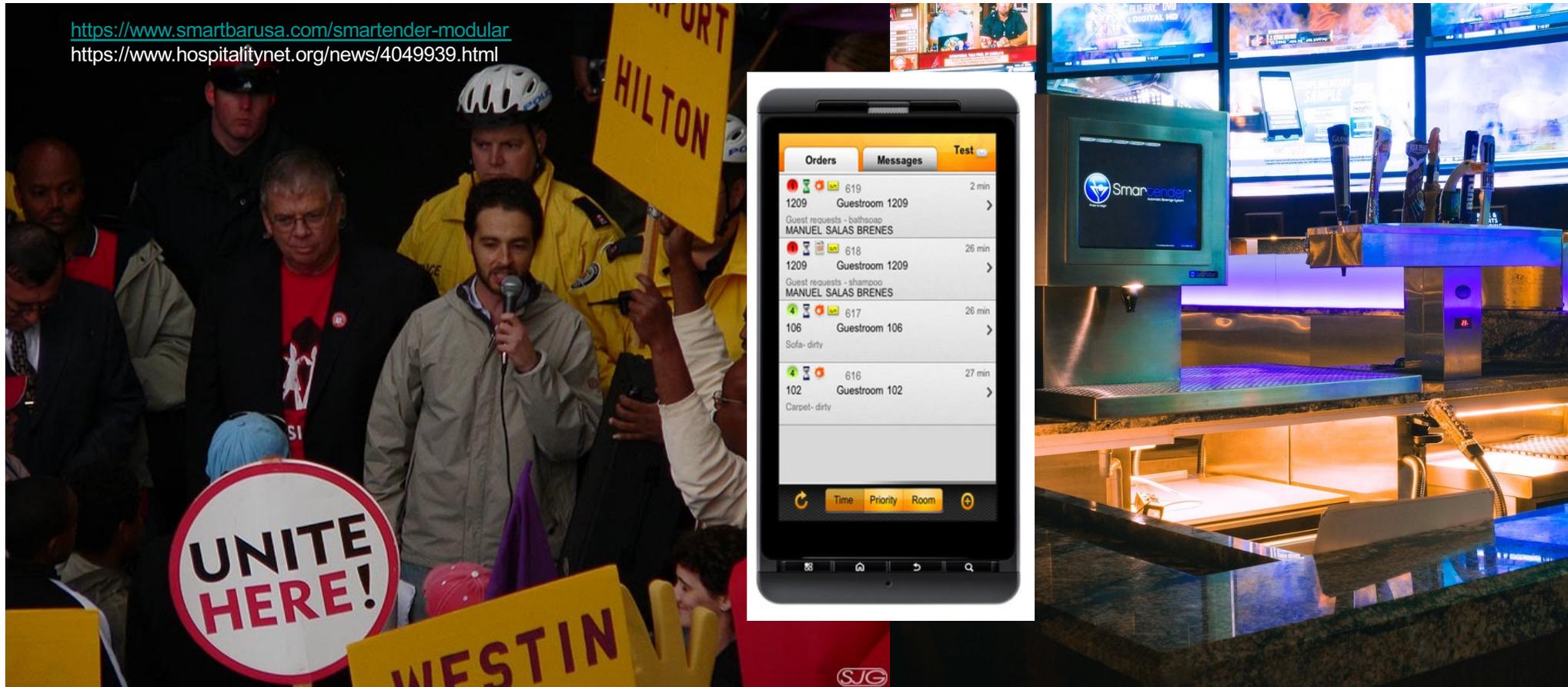


A variety of technologies



Preparing workers for a future of automation

<https://www.smartbarusa.com/smartender-modular>
<https://www.hospitalitynet.org/news/4049939.html>





Jodi Forlizzi
Sarah Fox
Franchesca Spektor
Human-Computer Interaction Institute



MICHIGAN STATE
UNIVERSITY

Hye Jin Rho
Dasom Jang
*School of Human Resources and
Labor Relations*



STOCKTON
UNIVERSITY

Deborah Figart
Ellen Mutari
Department of Economics

**UNITE
HERE!**

Ben Begleiter
Edward Wytkind



UNIVERSITY OF
ILLINOIS
URBANA - CHAMPAIGN

Christine Riordan
Yeaseul Hur
Patricia Tabarani
*School of Labor and Employment
Relations*



Betsy Stringam
*School of Hotel, Restaurant, and
Tourism Management*



Hospitality, invisible work



- A physically demanding job done by women who are largely immigrants and women of color
- As employers move from daily housekeeping, their work is becoming harder



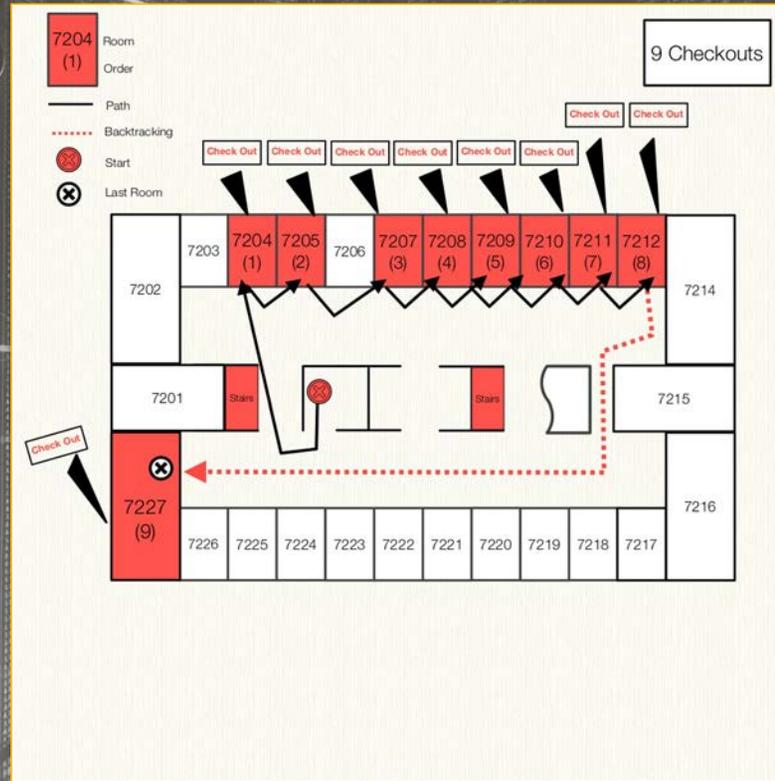
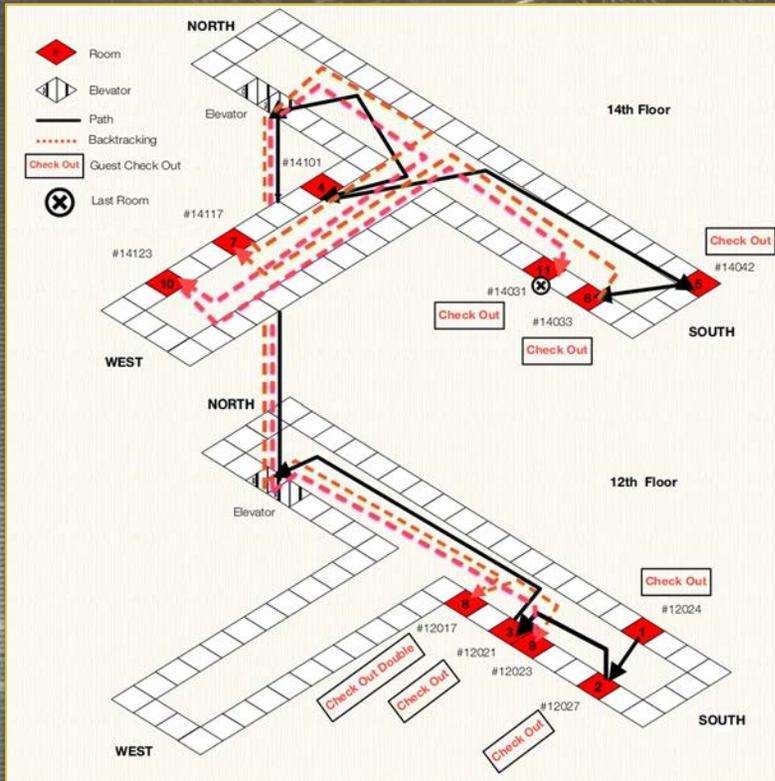
Digitalizing hospitality



- Deprives housekeepers of autonomy
- Enables faster communication between housekeepers and other operations — managers, engineering, etc.

Irrational room sequencing and extreme workload

CA92E8DDEE997



Jodi Forlizzi
Carnegie Mellon University



Research Roadmap



Workshops
25 GRAs

Participatory Prototyping
Sessions
5 GRAs



Observation
Hotel X, Illinois

GRA and Manager Intercept
Interviews



Observation and Interviews
Hotel Y, California

GRA and Manager Intercept
Interviews

Literature Review



Workshops with union workers

- Conducted online with housekeepers, bartenders and cocktail servers
- Focus on their work, what has changed with automation, and what they prioritize and value



Impact of automation on worker well-being

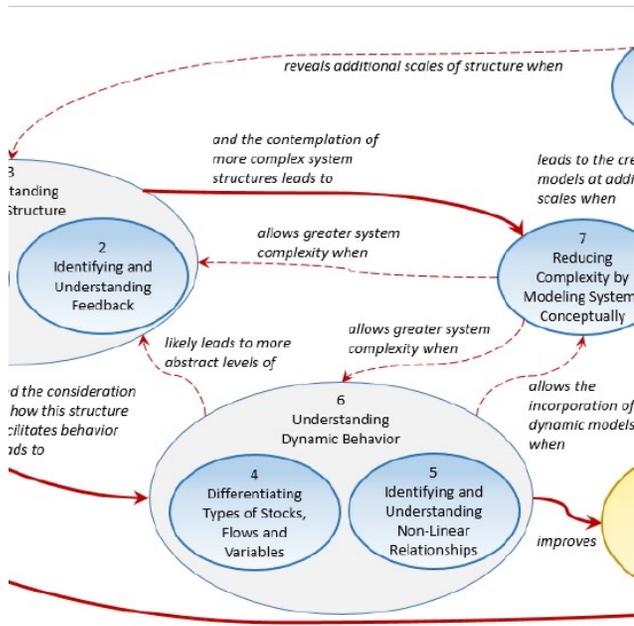
- Social science literature on automation traditionally focused on job displacement
- Recent literature highlights complexity, especially in service sector
 - Specific skills challenging to automate
 - Work processes and job content change



Enter design research...



Systems design and systems thinking

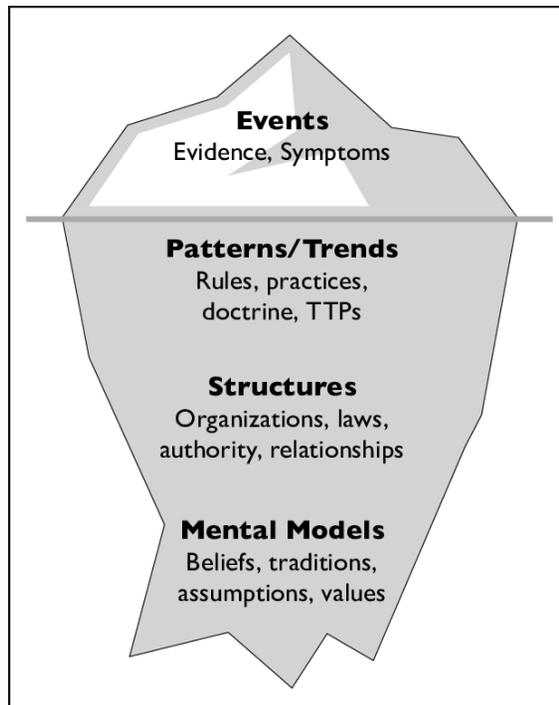


https://ackoffcenter.blogs.com/ackoff_center_weblog/2024/01/a-definition-of-systems-thinking-a-systems-approach-.html

- A system is not the sum of its parts but the product of interactions of those parts [Ackoff]
- Designing systems in complex situations, not creative problem solving, or design thinking [Nelson]



Systemic design and “the iceberg”

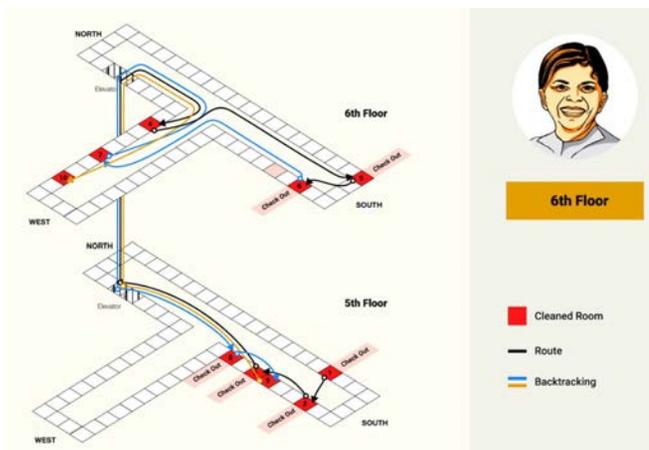


Donella Meadows, Iceberg Model

- Analyze current state
- Understand the system around the problematic situation
- Problem, behaviors, systems and structures, what cognitive models are driving these



Need to surface voices of multiple stakeholders



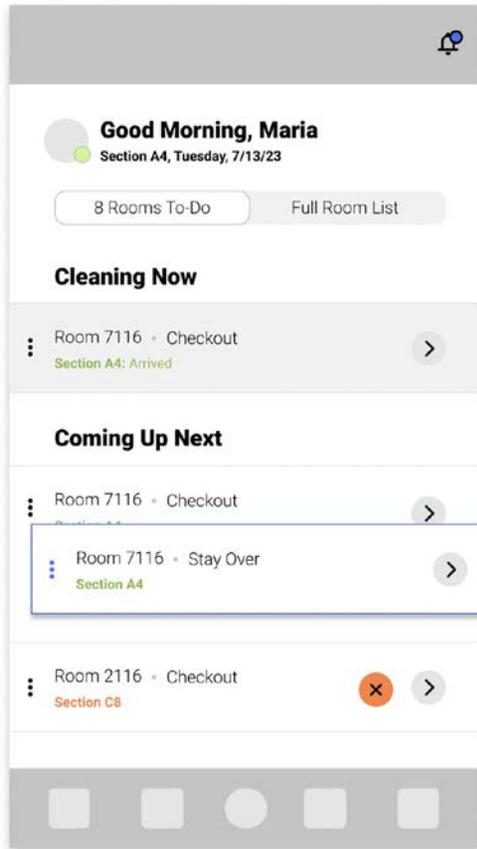
- Talking to GRAs gave an individual perspective
- Talking to managers gave an organizational perspective
- Talking to the manufacturer of the software revealed additional (conflicting) perspectives
- Talking to hotel management revealed additional perspectives



A case of reframing



Participatory prototyping sessions



- Workshops and interviews to understand how AMs impact daily work
- Researchers collaborate with workers to sketch new designs
- Worker participation increases self-efficacy and transparency and reduces workload

Spektor et al, DIS24



Effect of self-sequencing



- Las Vegas Culinary Union Local 226
- Gather issues and report to union stewards asking for the ability to self-sequence rooms



Digital and AI literacy study



<https://www.reviewjournal.com/local/education/>

- First of a kind collaboration between a culinary training academy, our research team, and a software developer
- Explore modifications to software design to enable self-sequencing, digital literacy, and AI literacy training



Systemic design and the AFL-CIO



Systemic design and the AFL-CIO



- AFL-CIO Tech Institute: Bringing Worker Voice into the Innovation Process
 - Improve technology development through worker engagement and collaboration, provide equitable access to jobs and career paths
 - Bring worker voice and labor organizations into the innovation process
 - Create a model of labor-academic engagement across sectors and communities



Systemic design and the AFL-CIO

THE WHITE HOUSE



[Administration](#) [Priorities](#) [The Record](#) [Briefing Room](#) [Español](#) [MENU](#)



OCTOBER 30, 2023

Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence

 [BRIEFING ROOM](#) [PRESIDENTIAL ACTIONS](#)

By the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:



Final points

- Designers are moving from product to service and systems design.
- Products and services are blending and are data animated.
- Designing with AI and ML is different.
- The role of design is broadening in AI research and design processes.



Final points

- We need a broader, systemic investigation of technology in service domains.
- Reframing, getting to the assumption behind the assumption, is critical.



In closing...



The role of design in socially responsible AI

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HCII, Carnegie Mellon University
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Thanks to my students and collaborators.

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Jodi Forlizzi
Carnegie Mellon University

