Design Science Research , June 1-3, 2022
https://www.usf.edu/business/desrist/

Human-Centered AI: Bringing Design Science to AI Applications

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Professor, Department of Computer Science

Member, National Academy of Engineering

UNIVERSITY OF MARYLAND

Photo: BK Adams

Interdisciplinary research community
- Computer Science & Info Studies
- Psych, Socio, Educ, Jour & MITH

hcil.umd.edu
vimeo.com/72440805

Designing the User Interface

Design Theories

Direct manipulation

Menus, speech, search

Social Media

Information Visualization

www.cs.umd.edu/hcil/DTUI6

Sixth Edition: 2016

What is Human-Centered AI?

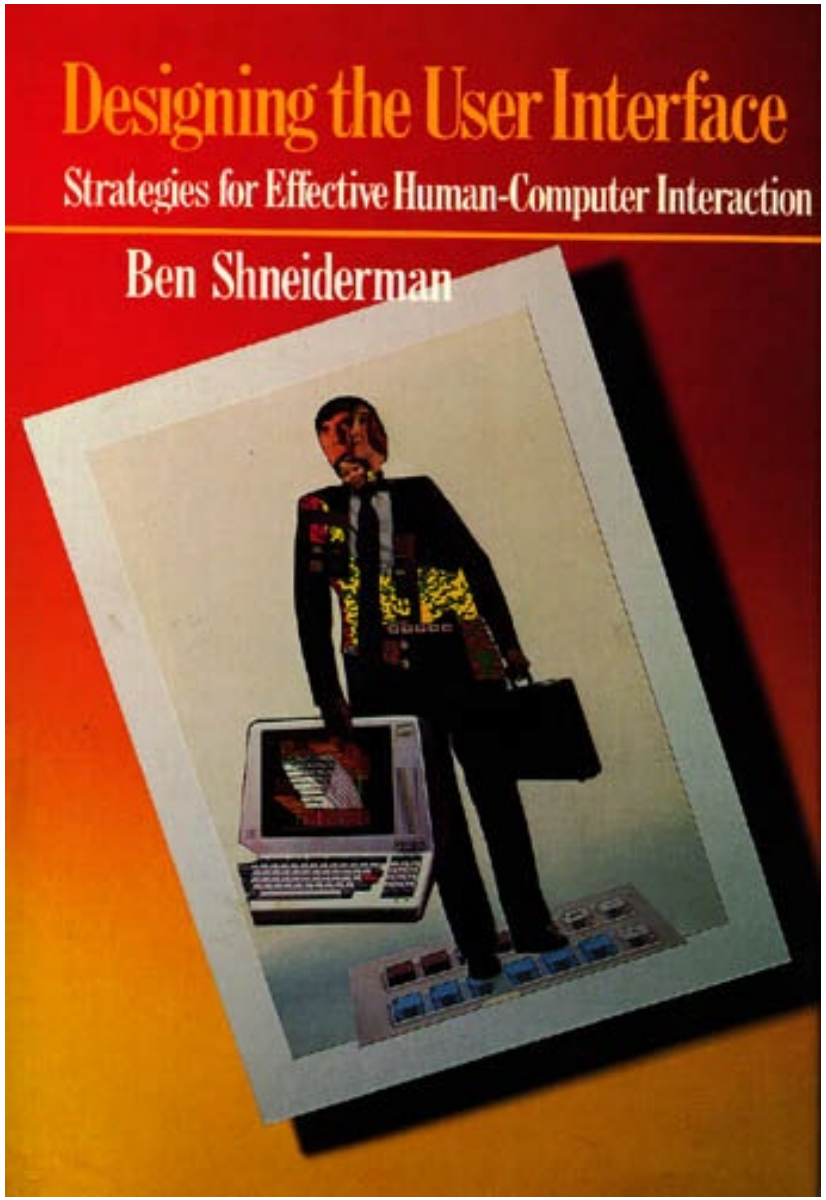
What is Human-Centered AI?

Amplify, Augment, Empower & Enhance People

HCAI Framework

Designing the User Interface

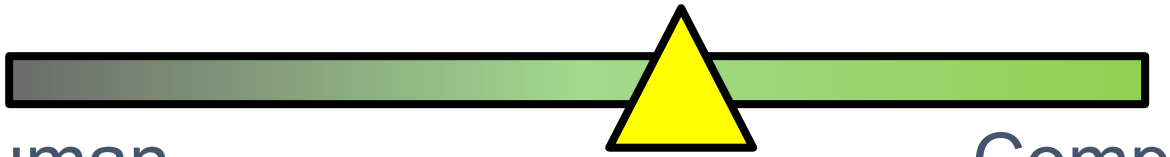
Balancing automation & human control



First Edition: 1986

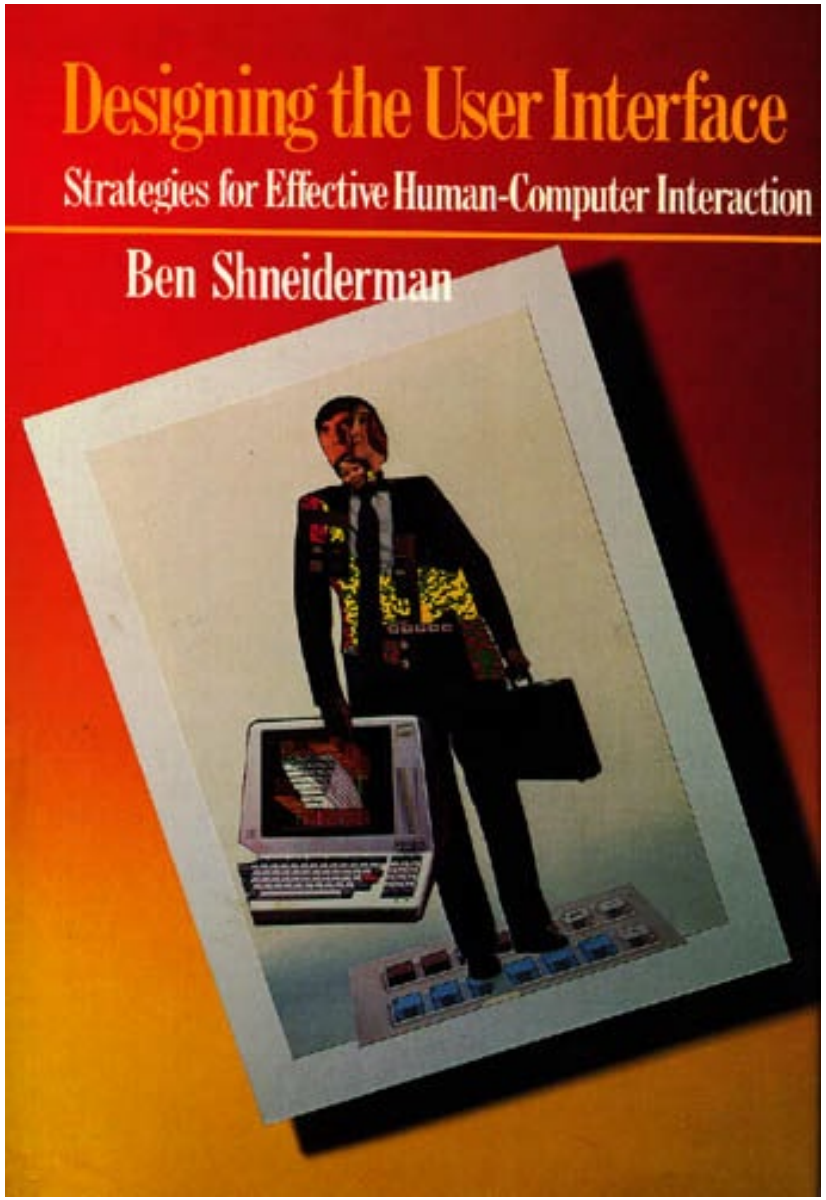
Designing the User Interface

Balancing automation & human control



Human control

Computer automation



First Edition: 1986

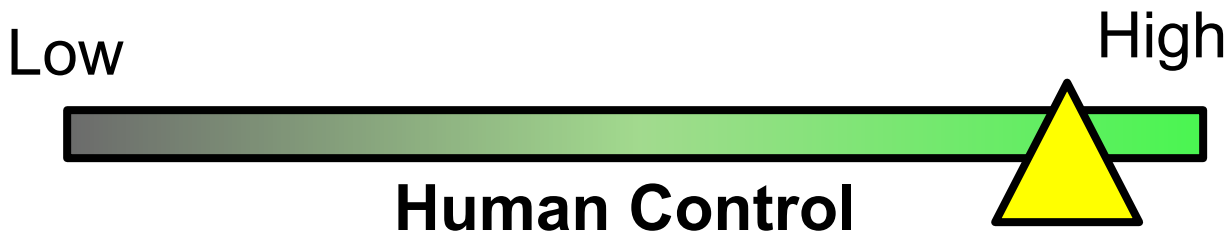
Designing the User Interface

Ensuring human control
while increasing automation

Sixth Edition: 2016

Designing the User Interface

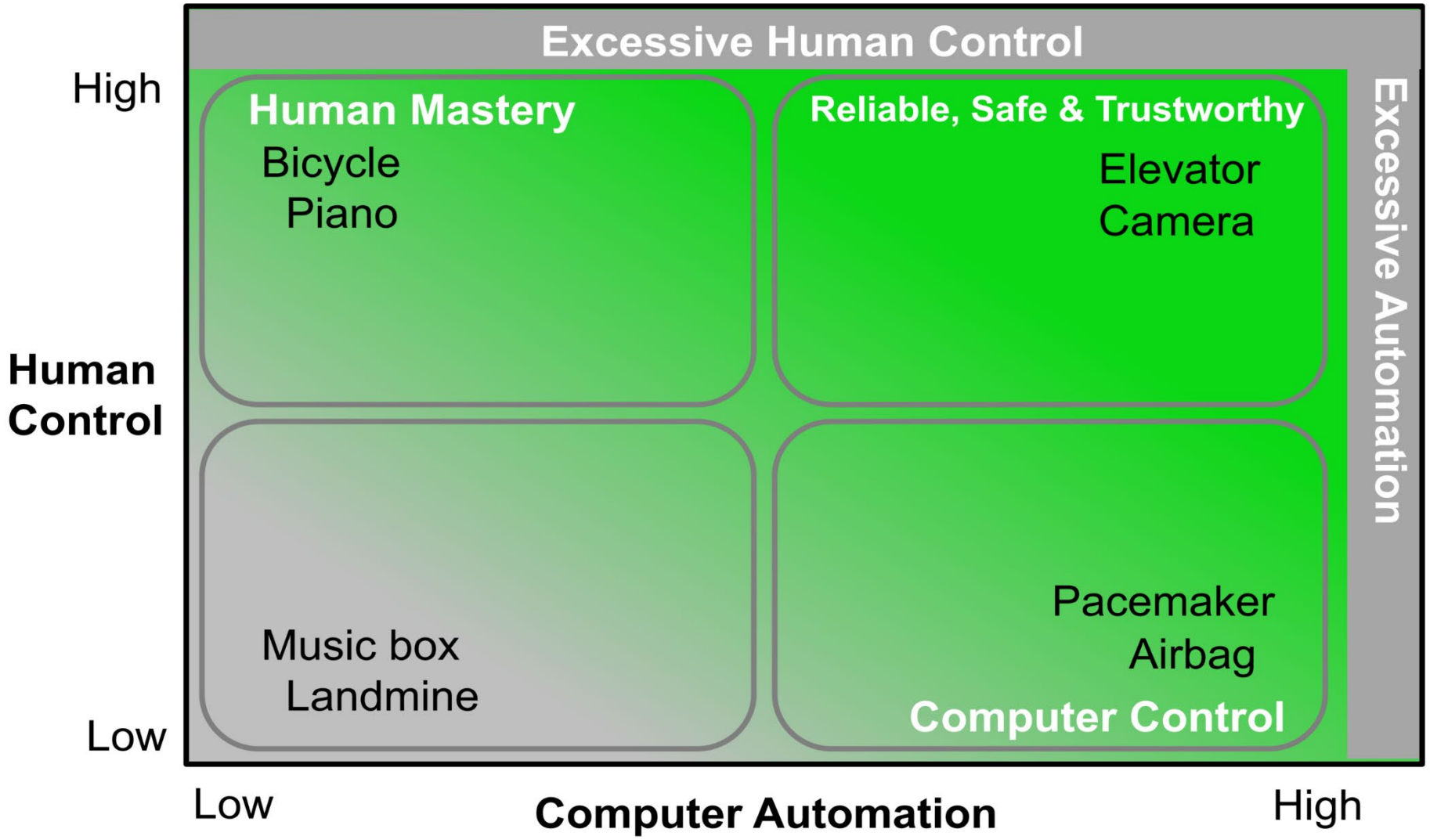
Ensuring human control
while increasing automation



Sixth Edition: 2016

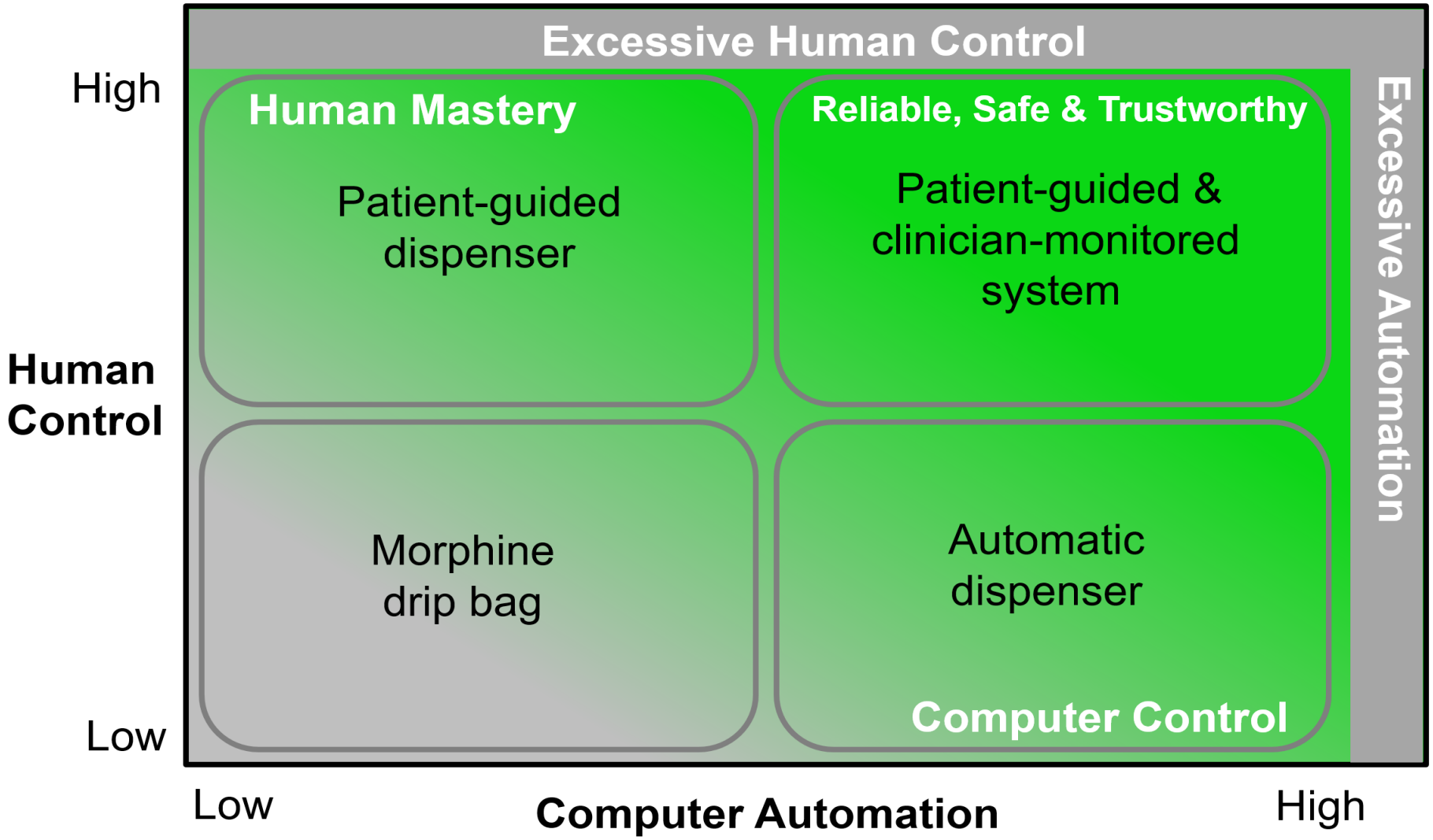
IJHCI (2020) **https://doi.org/10.1080/10447318.2020.1741118**

HCAI Framework

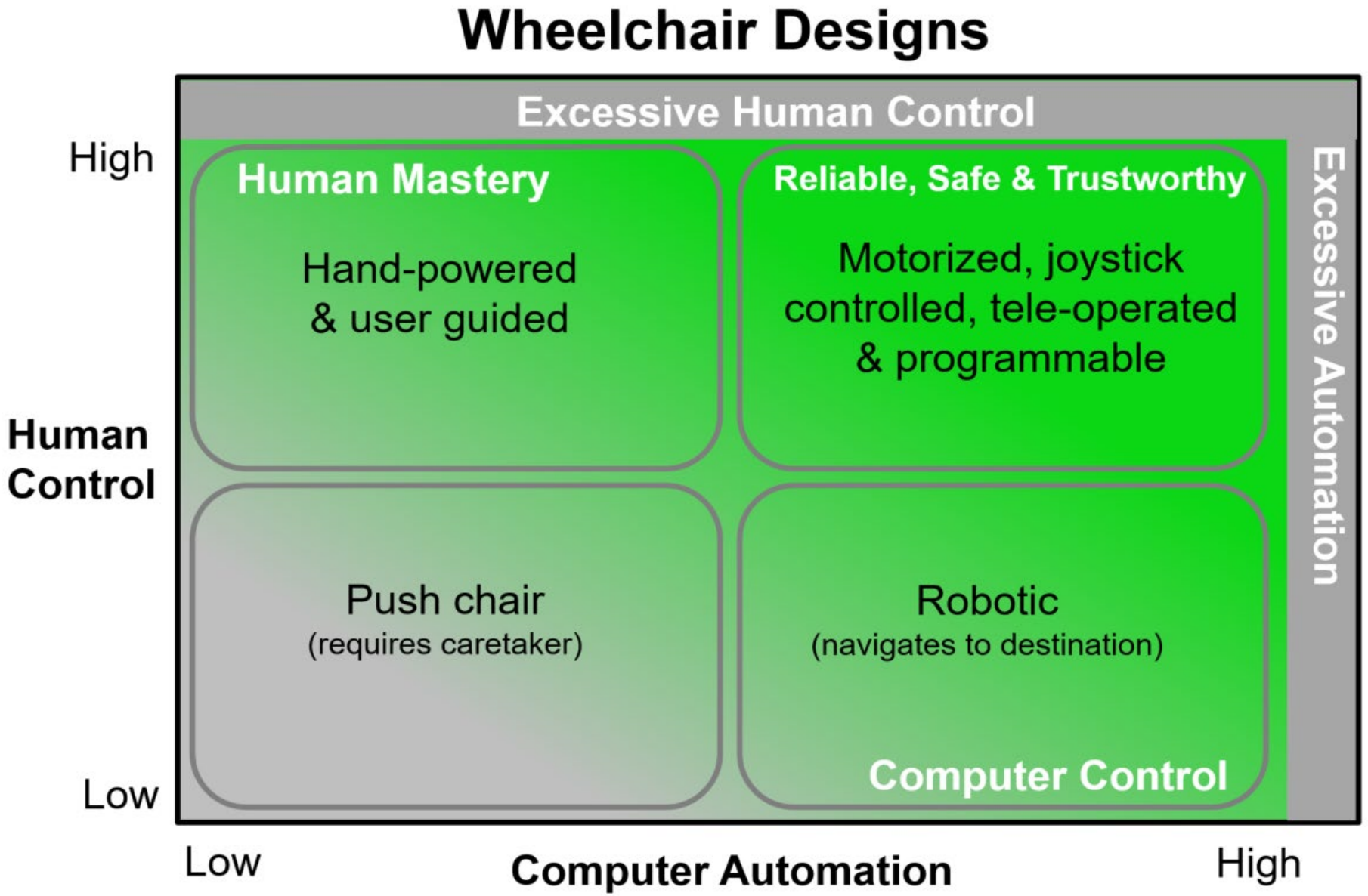


HCAI Framework

Pain Control Designs



HCAI Framework

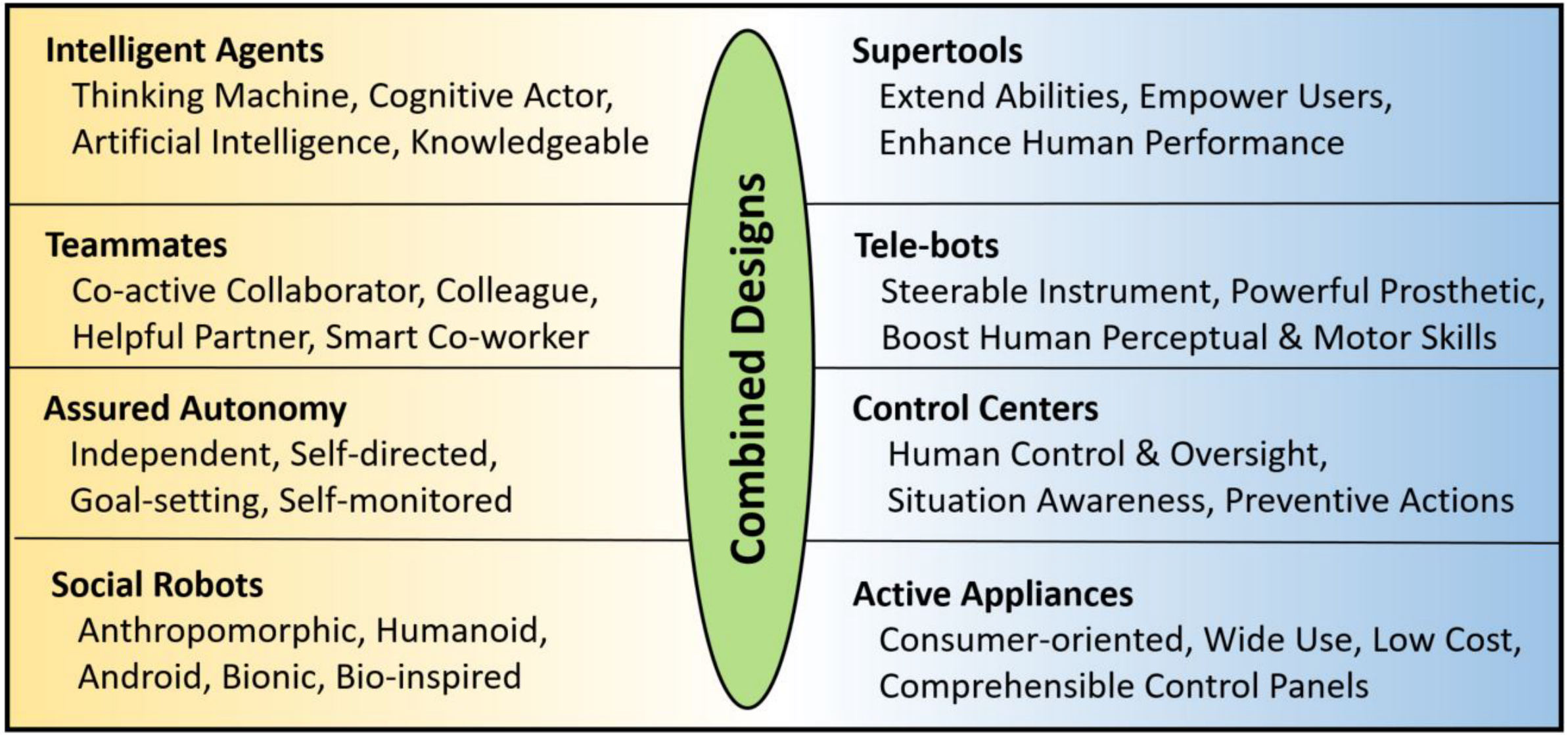


Design Metaphors

“Robots are simply not people”: Margaret Boden
“Humans, not robots, are responsible agents”: Joanna Bryson

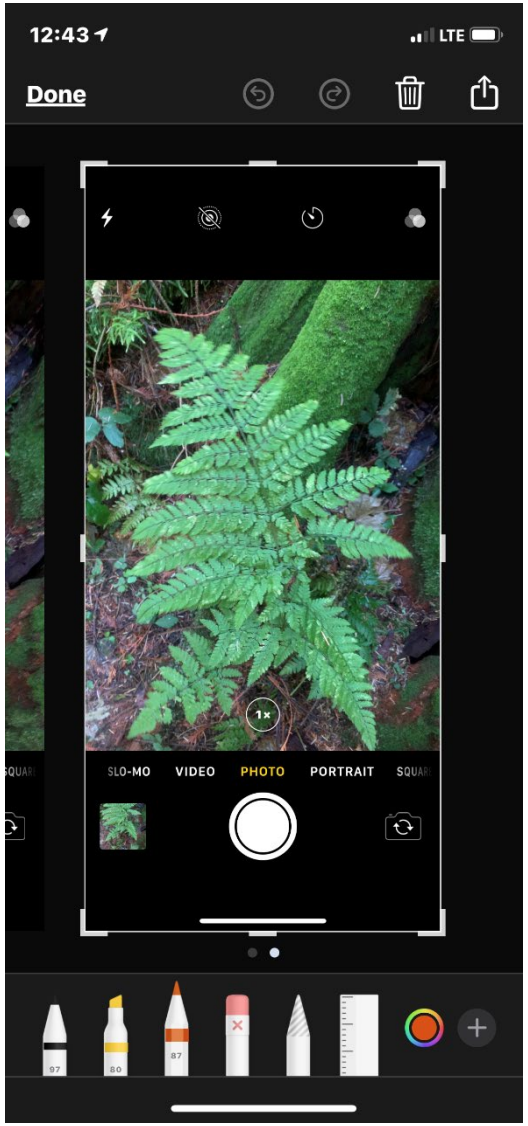
- **Responsibility:** Only humans are liable, legally and morally
- **Distinctive capabilities of computers:** sophisticated algorithms, huge databases, superhuman sensors, information abundant displays, & powerful effectors
- **Human creativity:** passion, empathy, humility & intuition

Design Metaphors

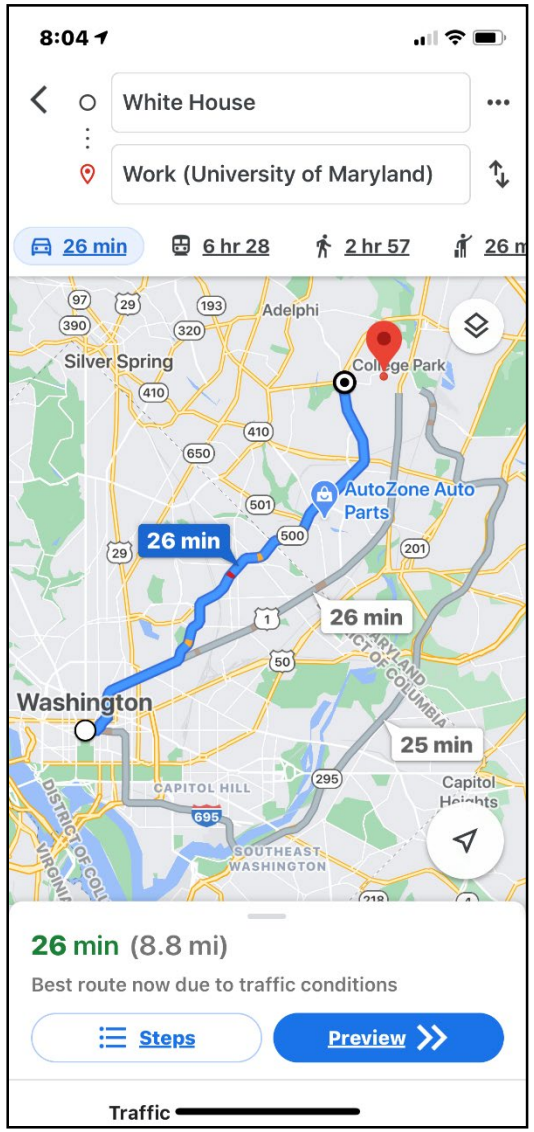


Supertools

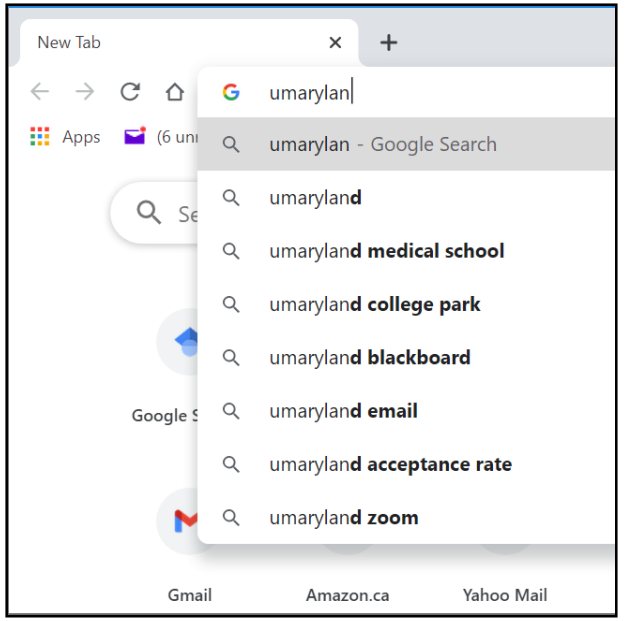
Digital Camera Controls



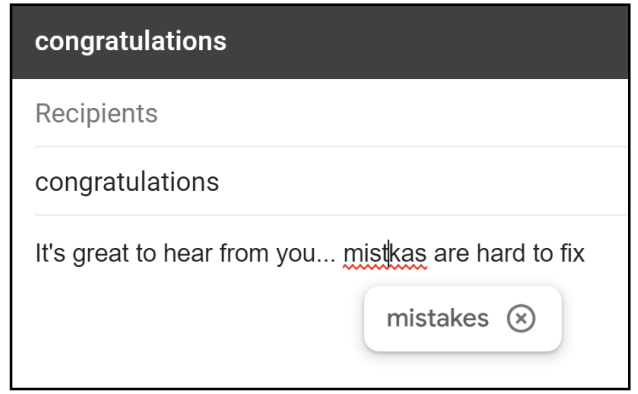
Navigation Choices



Texting/Search Autocompletion



Spelling correction



Supertool: Bloomberg Terminal

Active Appliances

Thermostat, Coffee maker, Rice cooker, Roomba

Google Nest

Panasonic Rice Cooker

Cusinart Coffee Maker

iRobot Roomba

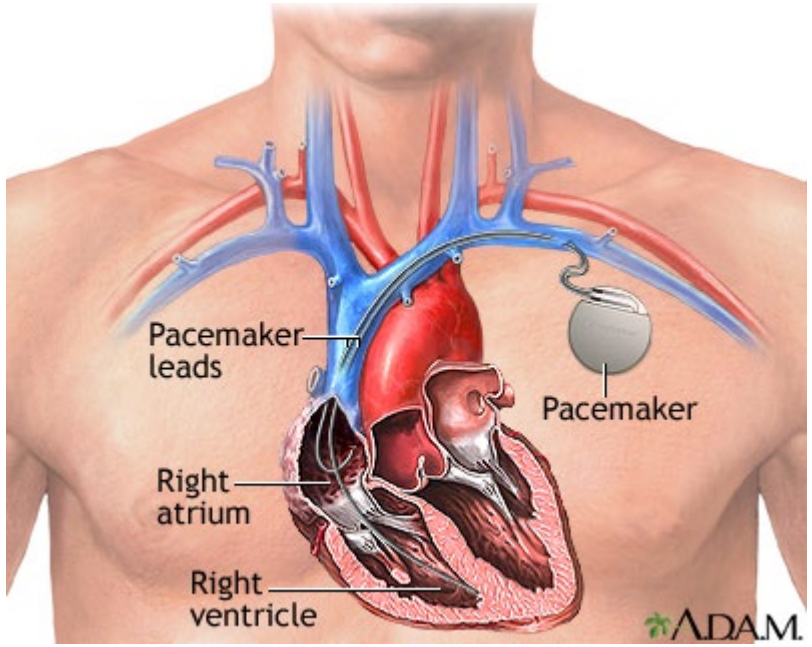
Dishwasher, Clothes Washer/Dryer

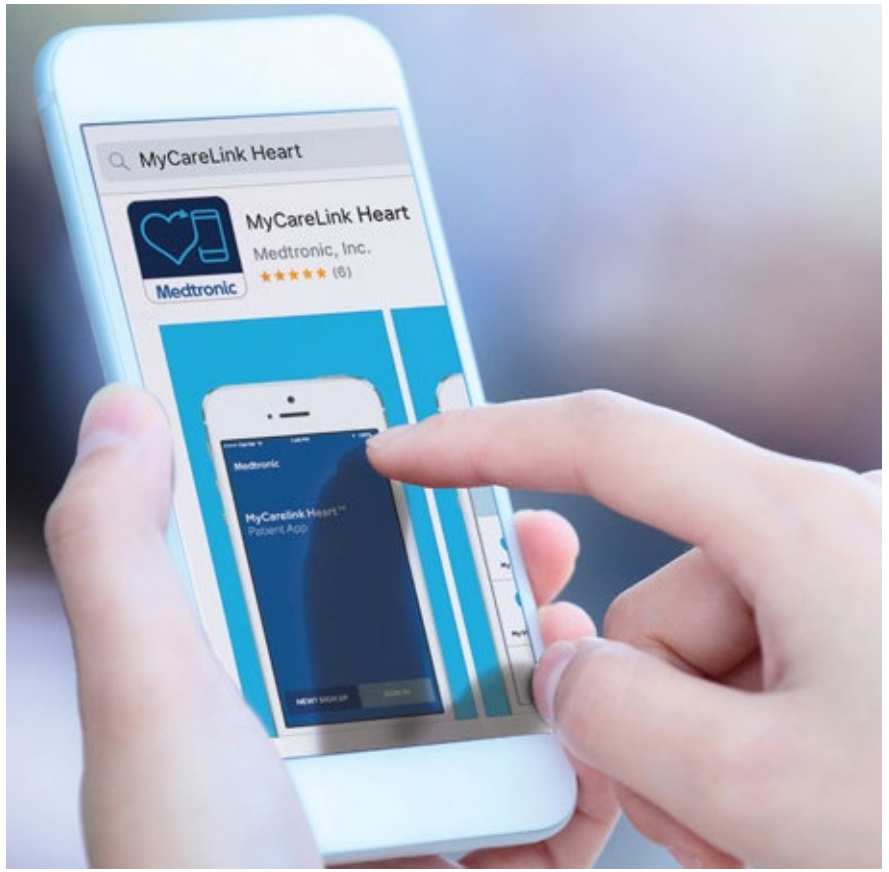
Miele Dishwasher

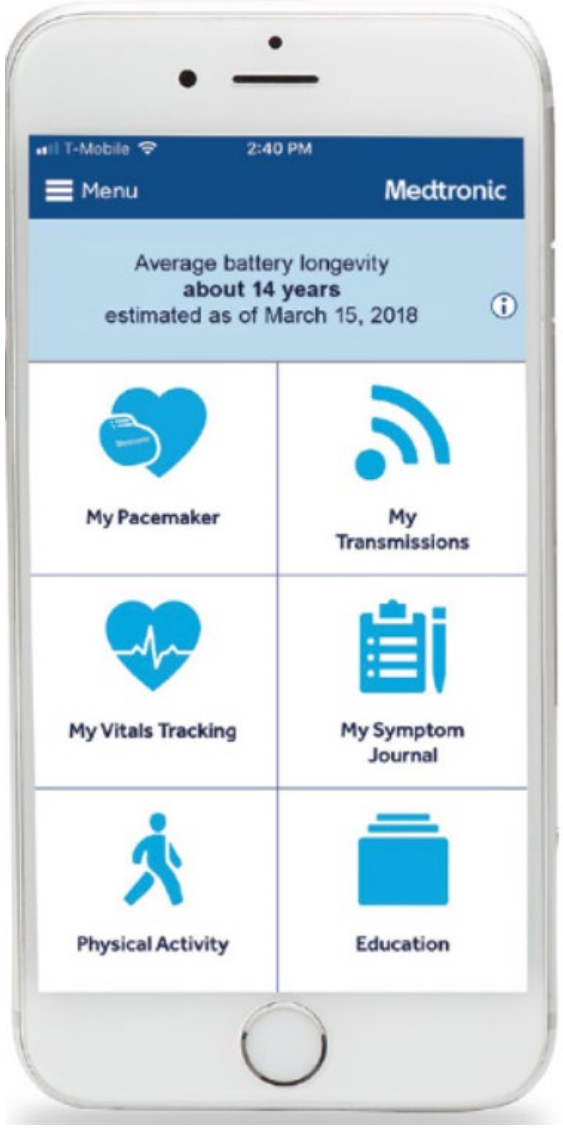
General Electric Washer

General Electric Dryer

Active Appliance: Implanted Cardiac Pacemakers

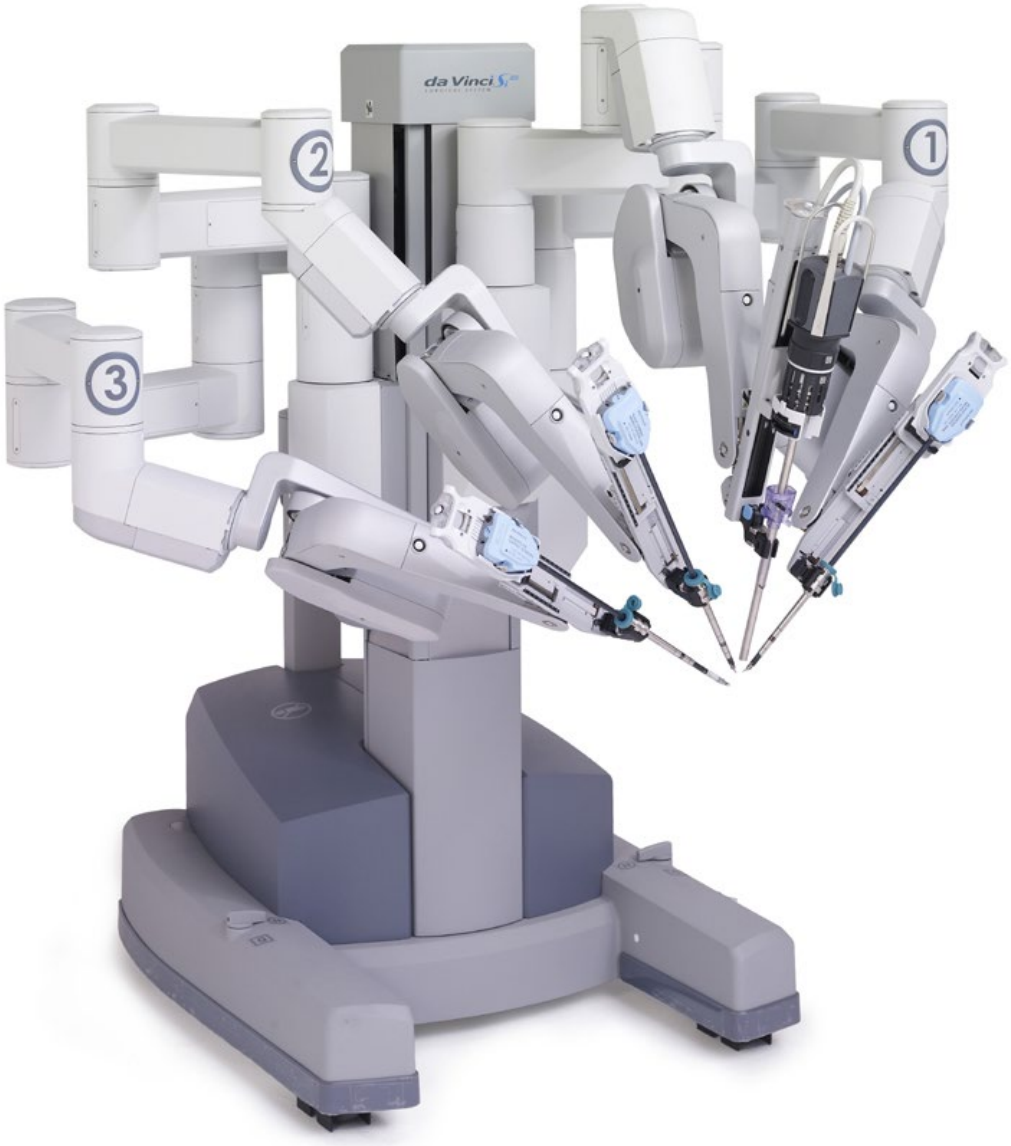






Tele-Bot: NASA Mars Rovers

Tele-Bot: Da Vinci Surgical System



“Robots don’t perform surgery. Your surgeon performs surgery with da Vinci by using instruments that he or she guides via a console.”

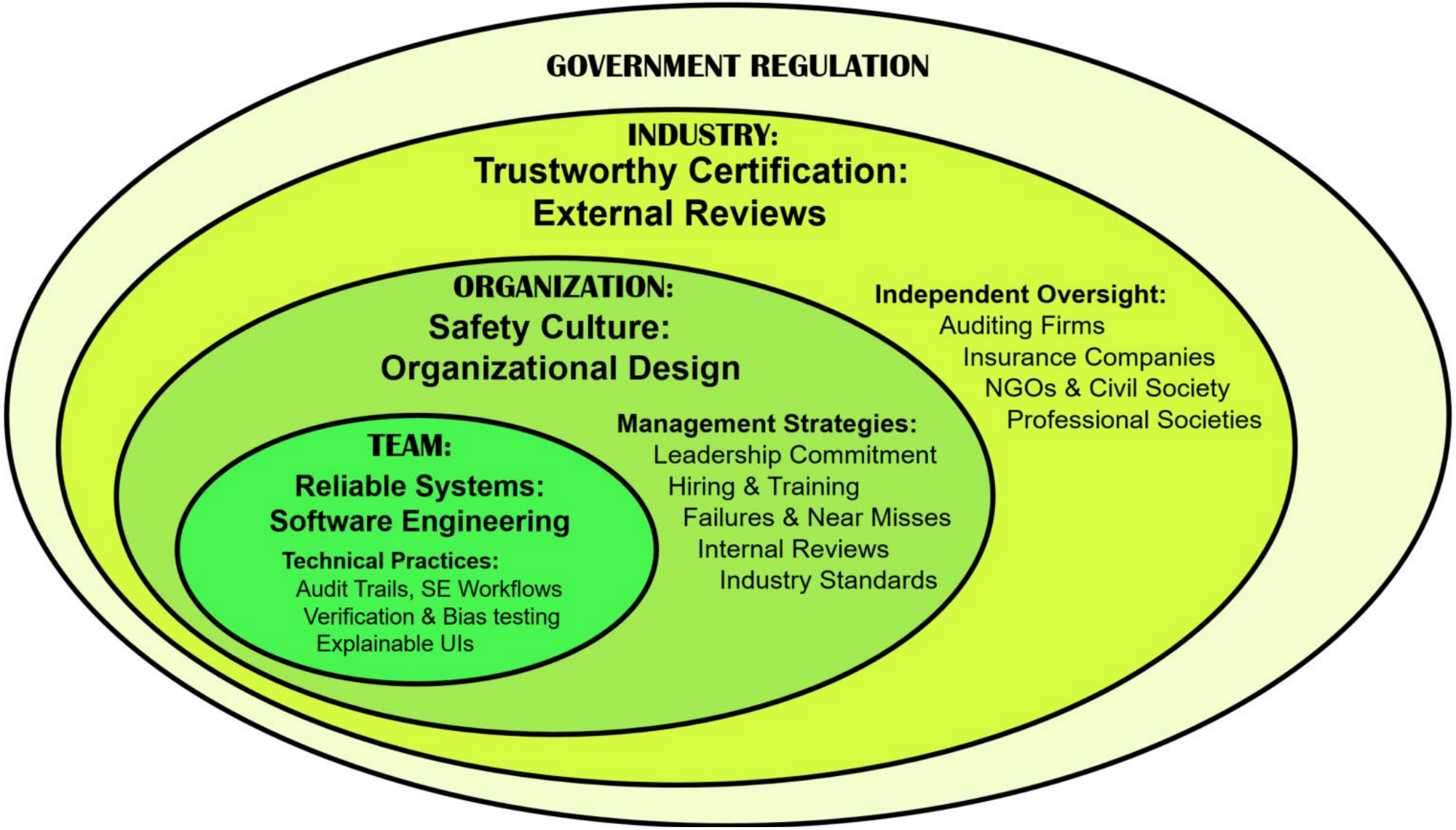
https://www.davincisurgery.com/

Control Center: Hospital

Control Center: Counter Terrorism

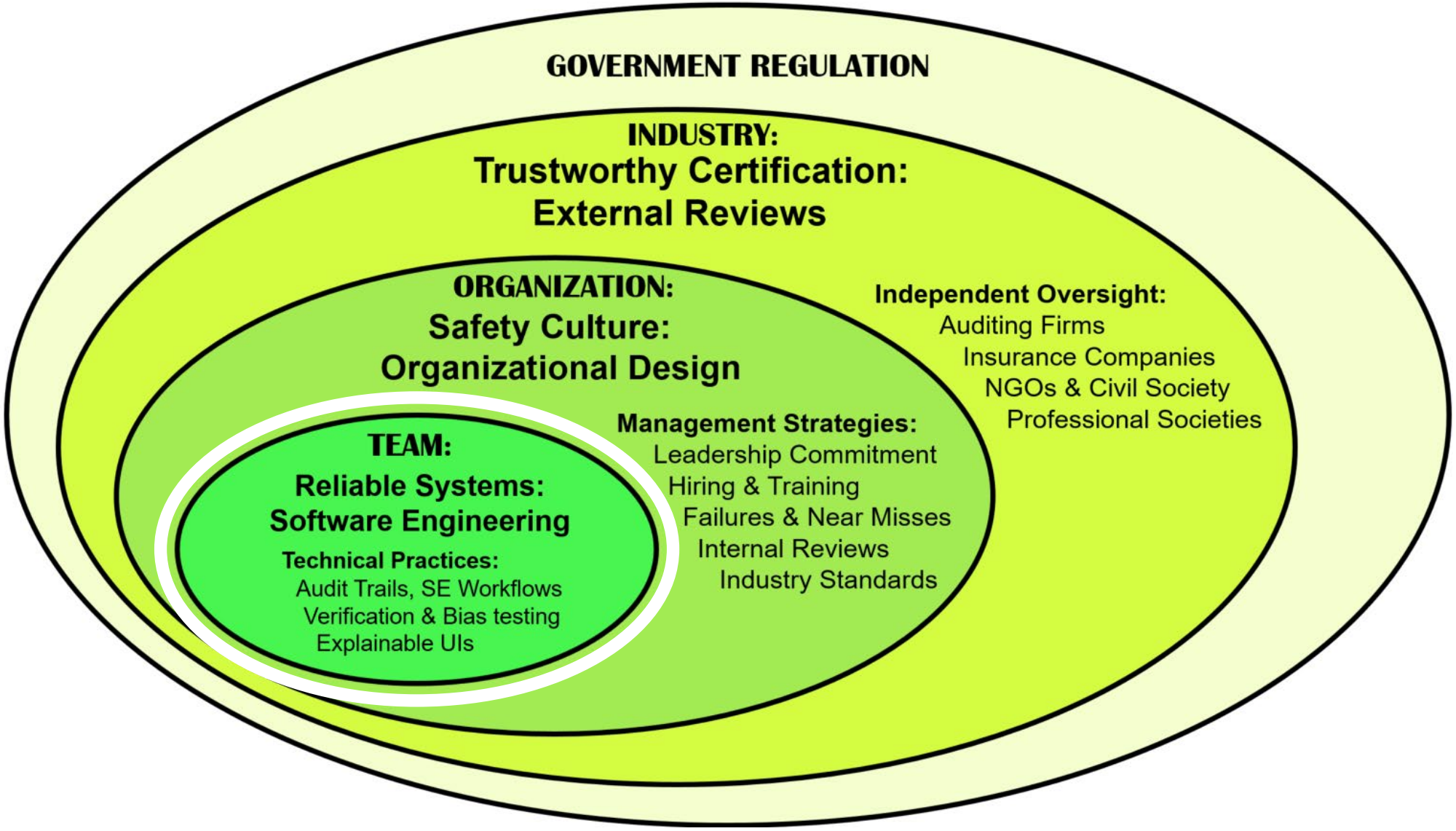
Governance Structures

Governance Structures for Human-Centered AI



ACM TIIS (Oct 2020) **https://dl.acm.org/doi/10.1145/3419764**

Governance Structures for Human-Centered AI



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TEAM

Reliable systems based on software engineering practices

1) Audit trails and analysis tools
2) Software engineering workflows
3) Verification & validation testing
4) Bias testing to improve fairness
5) Explainable user interfaces

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Reliable systems based on software engineering practices

1) Audit trails and analysis tools
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Reliable Systems

Software engineering practices for a TEAM

5) Explainable user interfaces

- Retrospective explanations (local & global)

New Goal: **Prevent** confusion and surprise

- Prospective user interfaces
- Interactive, visual, exploratory

Mortgage Loan Explanations

Post-hoc Report

Enter amounts to request mortgage:

Mortgage amount requested	375000
Household monthly income	7000
Liquid assets	48000

Submit

Mortgage Loan Explanations

Post-hoc Report

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Enter amounts to request mortgage:

Mortgage amount requested	375000
Household monthly income	7000
Liquid assets	48000

Submit

We're sorry, your mortgage loan was not approved. You might be approved if you reduce the Mortgage amount requested, increase your Household monthly income, or increase your Liquid assets.

Done

Mortgage Loan Explanations

Post-hoc Report

Enter amounts to request mortgage:

Mortgage amount requested 375000

Household monthly income 7000

Liquid assets 48000

Submit

Enter amounts to request mortgage:

Mortgage amount requested 375000

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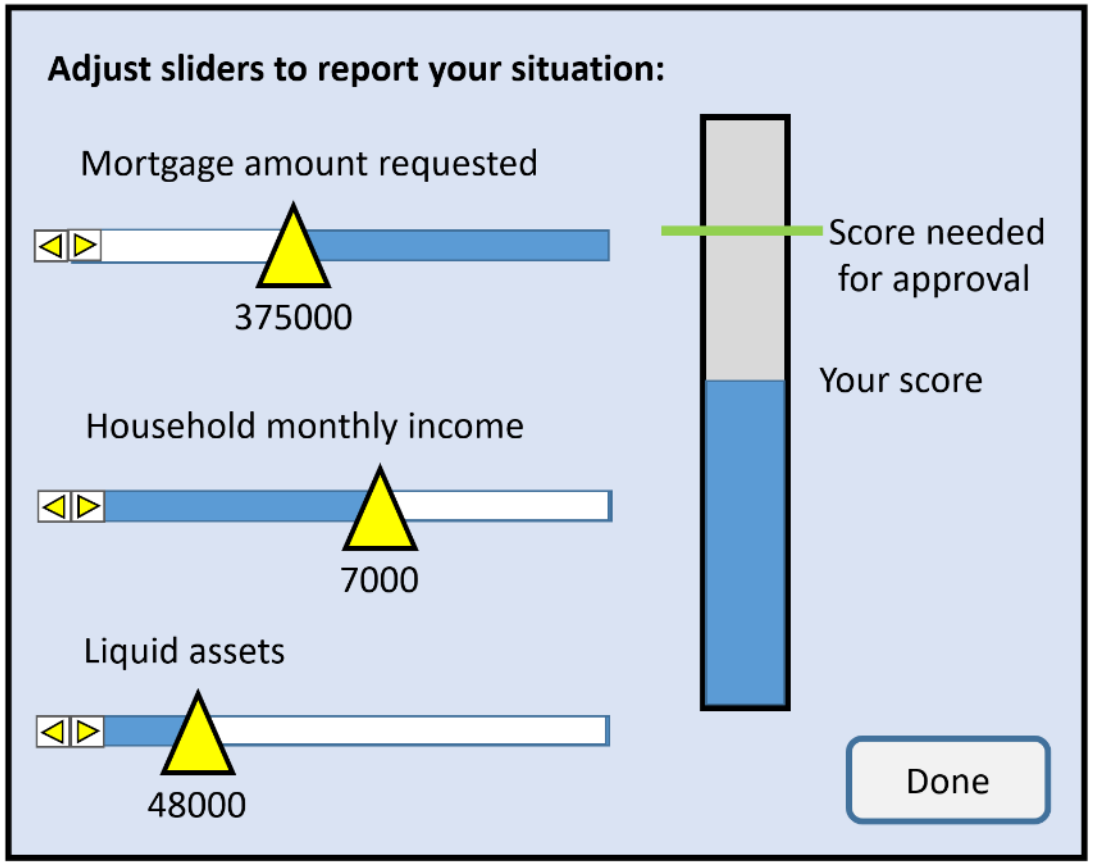
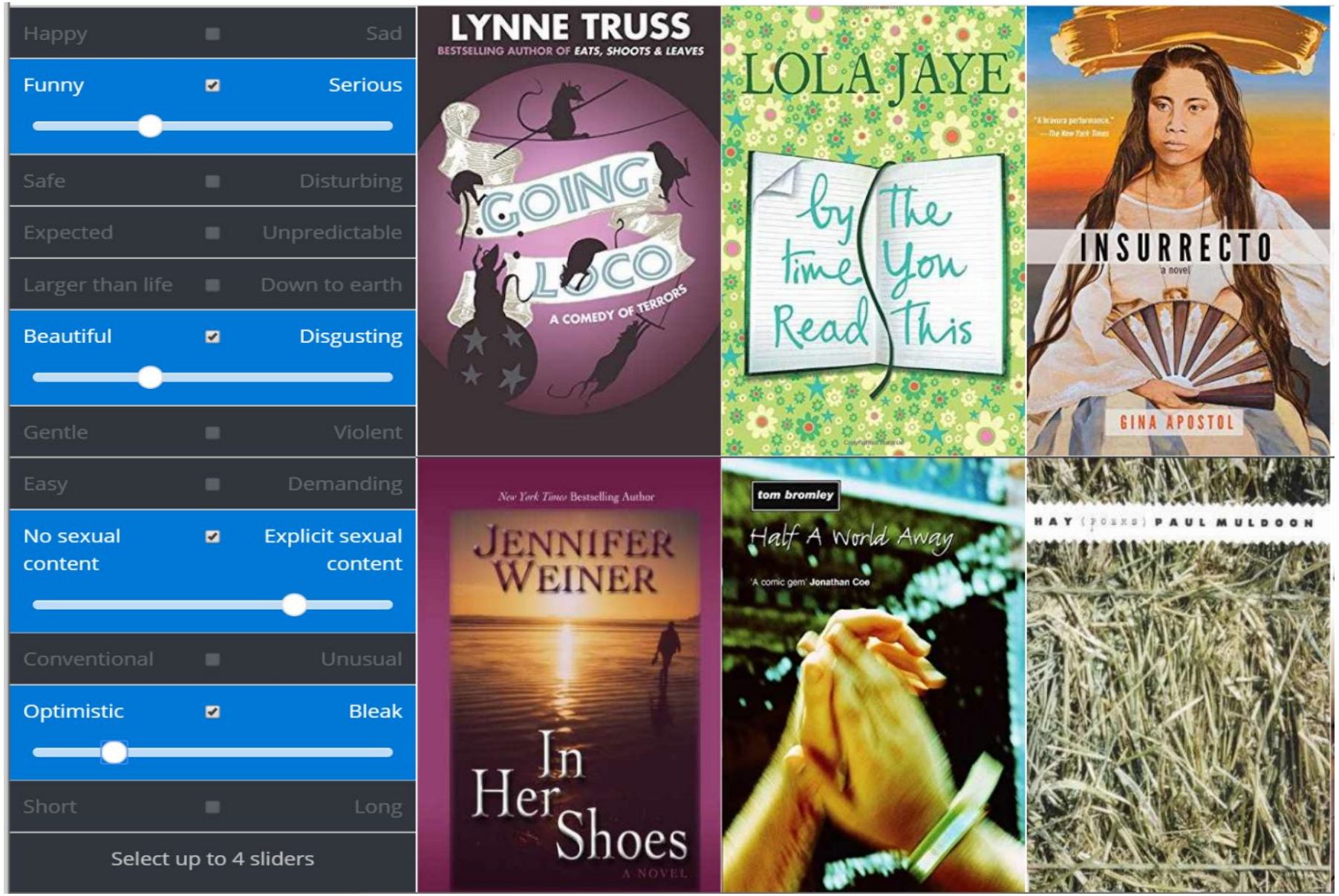
We're sorry, your mortgage loan was not approved. You might be approved if you reduce the Mortgage amount requested, increase your Household monthly income, or increase your Liquid assets.

Done

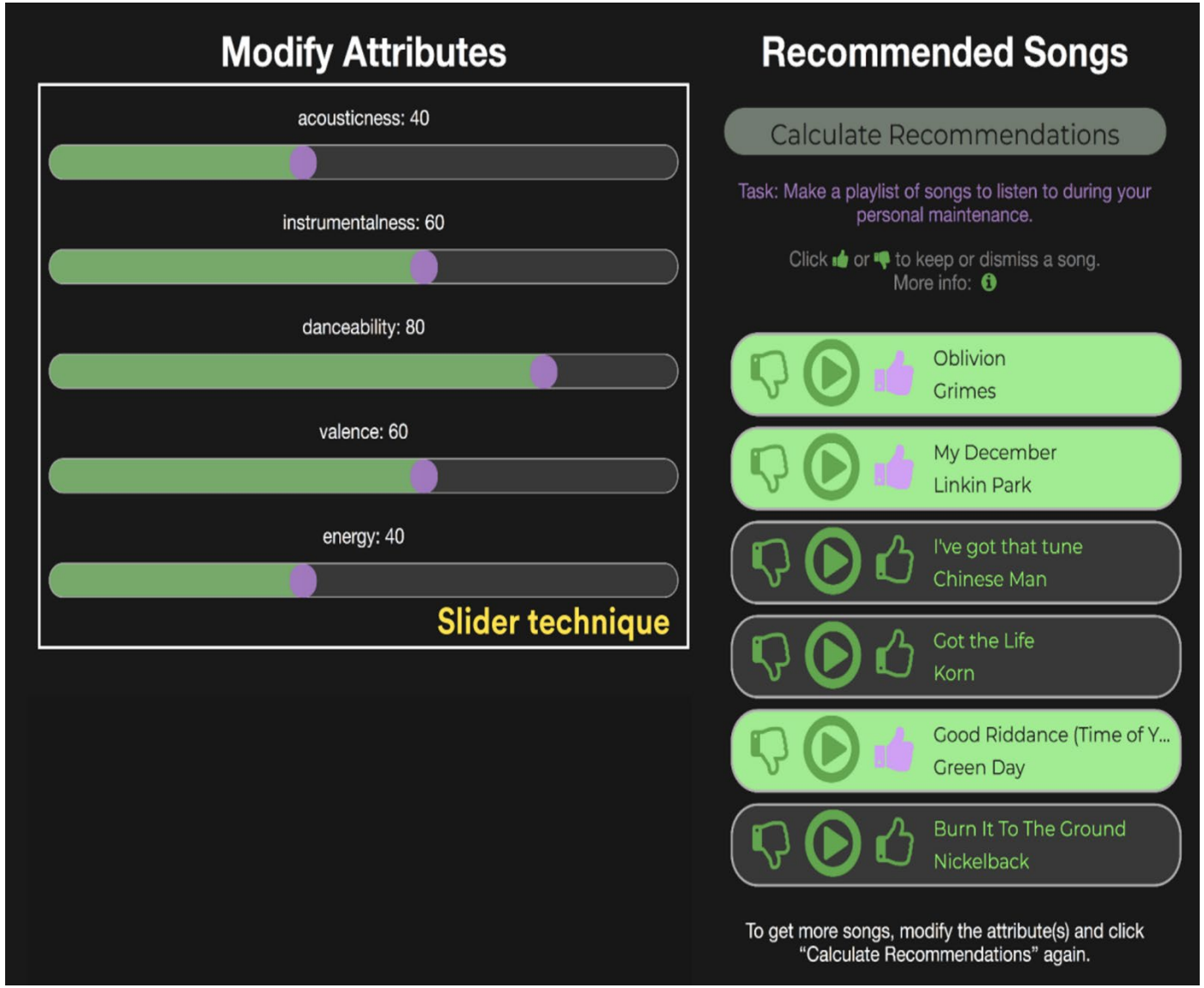
Prospective User Interface



Recommenders: Whichbook.net



Recommender Control Panels



ORGANIZATION

Safety Culture through Business Management Strategies

6) Leadership Commitment to Safety
7) Hiring and Training Oriented to Safety
8) Extensive Reporting of Failures & Near Misses
9) Internal Review Boards for Problems & Future Plans
10) Alignment with Industry Standard Practices

INDUSTRY

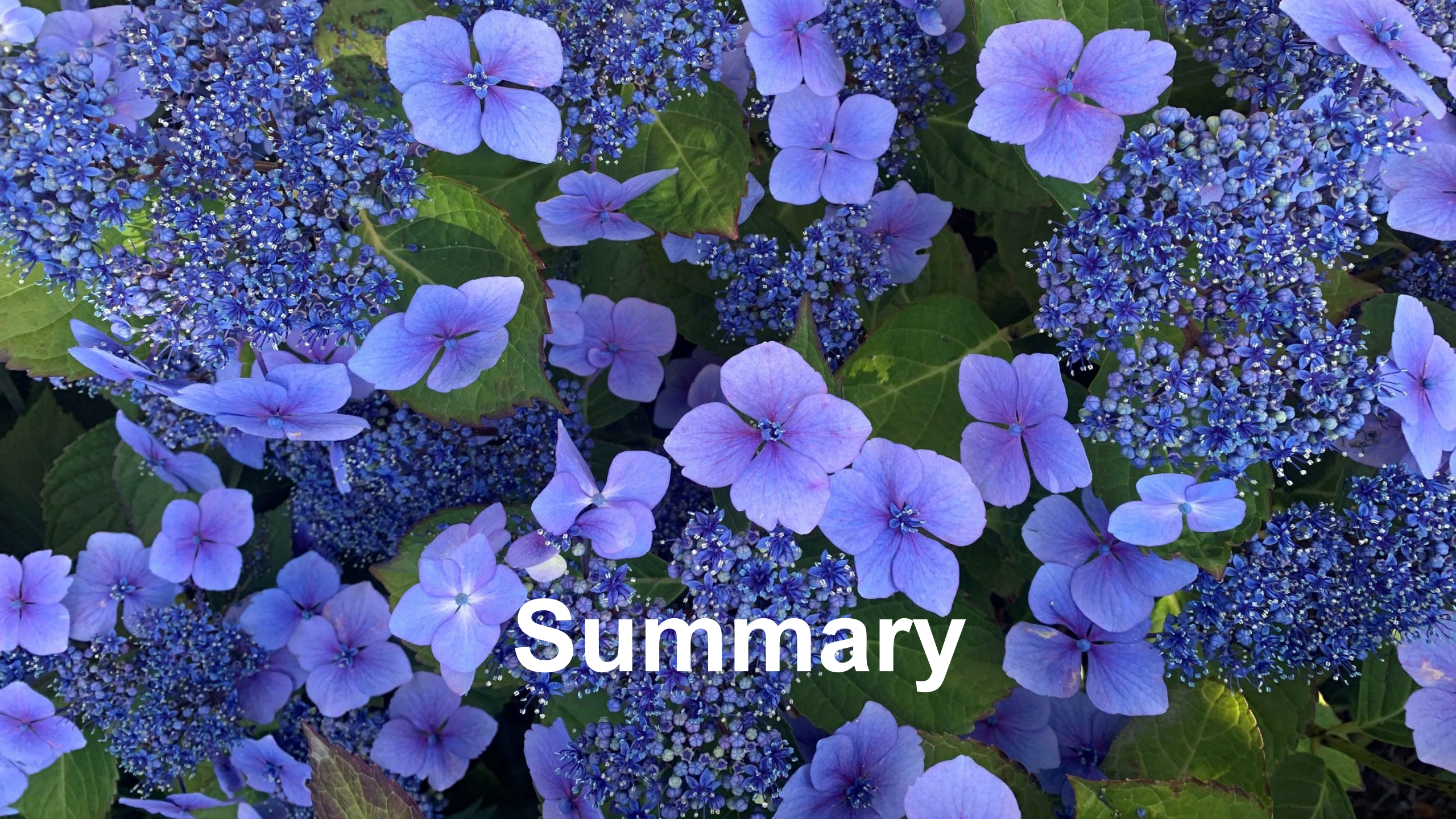
Trustworthy Certification by Independent Oversight

11) Accounting Firms Conduct External Audits for HCAI Systems
12) Insurance Companies Compensate for Failures
13) Non-governmental & Civil Society Organizations
14) Professional Organizations & Research Institutes

GOVERNMENT

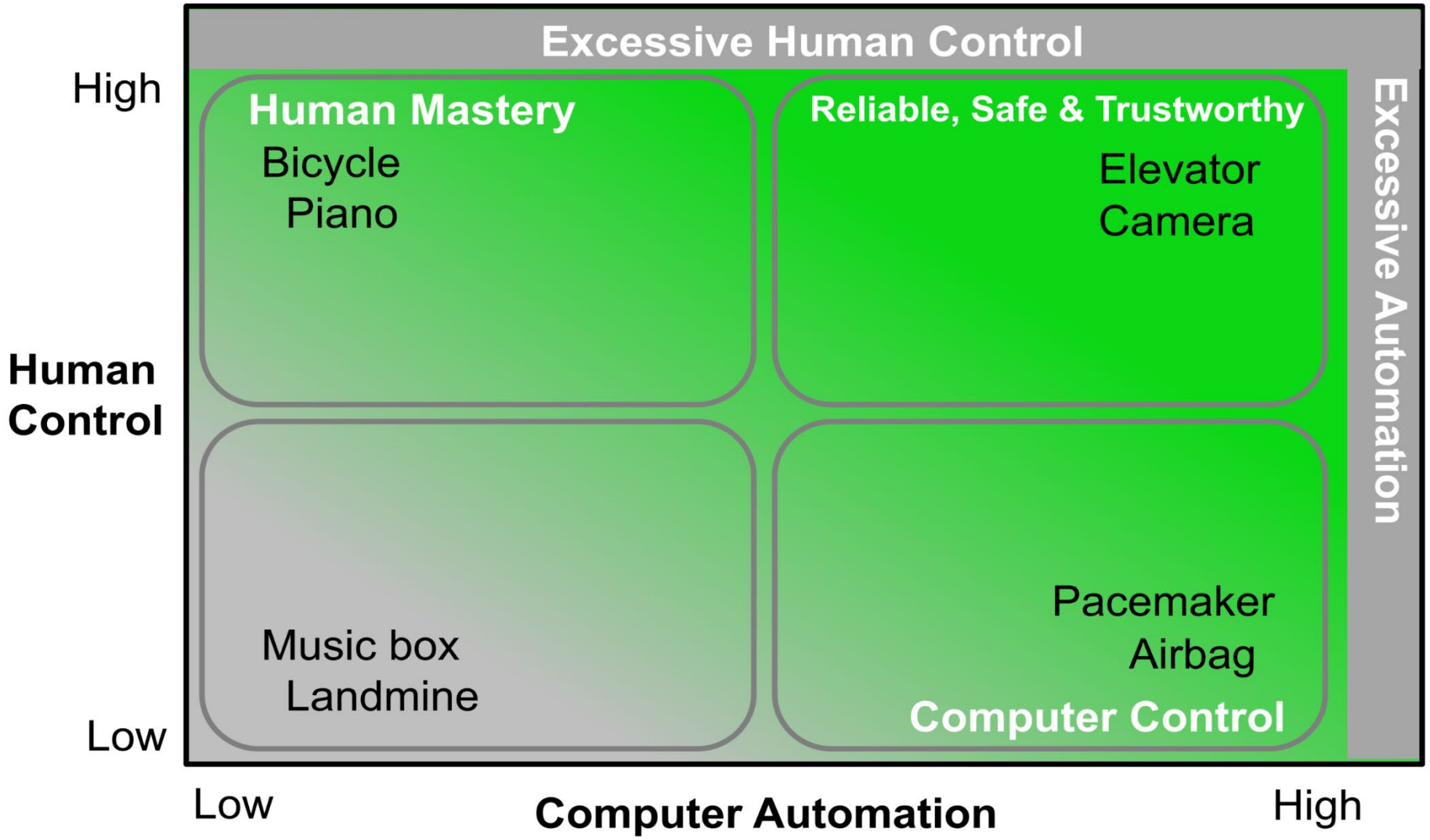
Policies, Interventions, and Regulations

15) Regional, National, Local & Industry Specific Agencies



Summary

HCAI Framework



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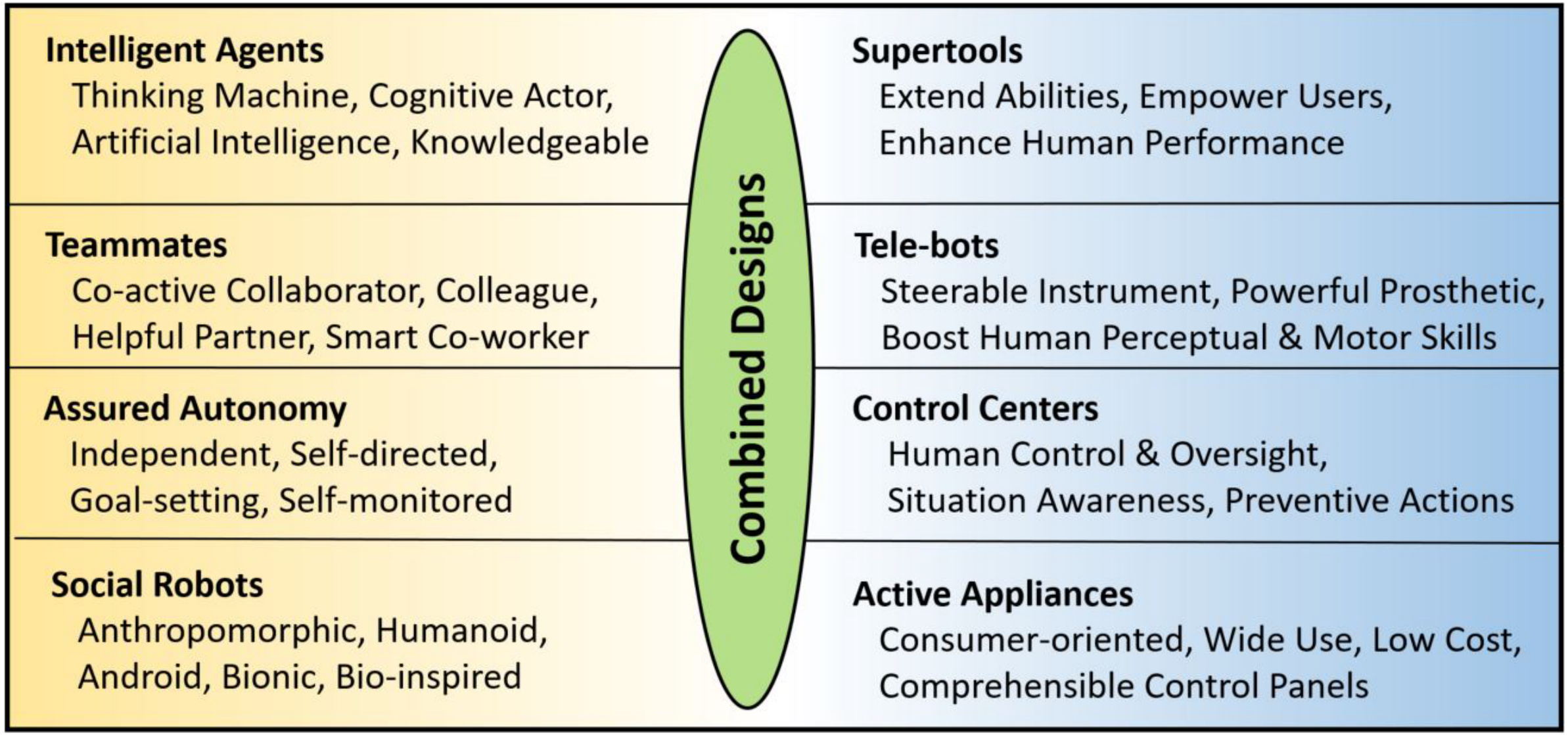
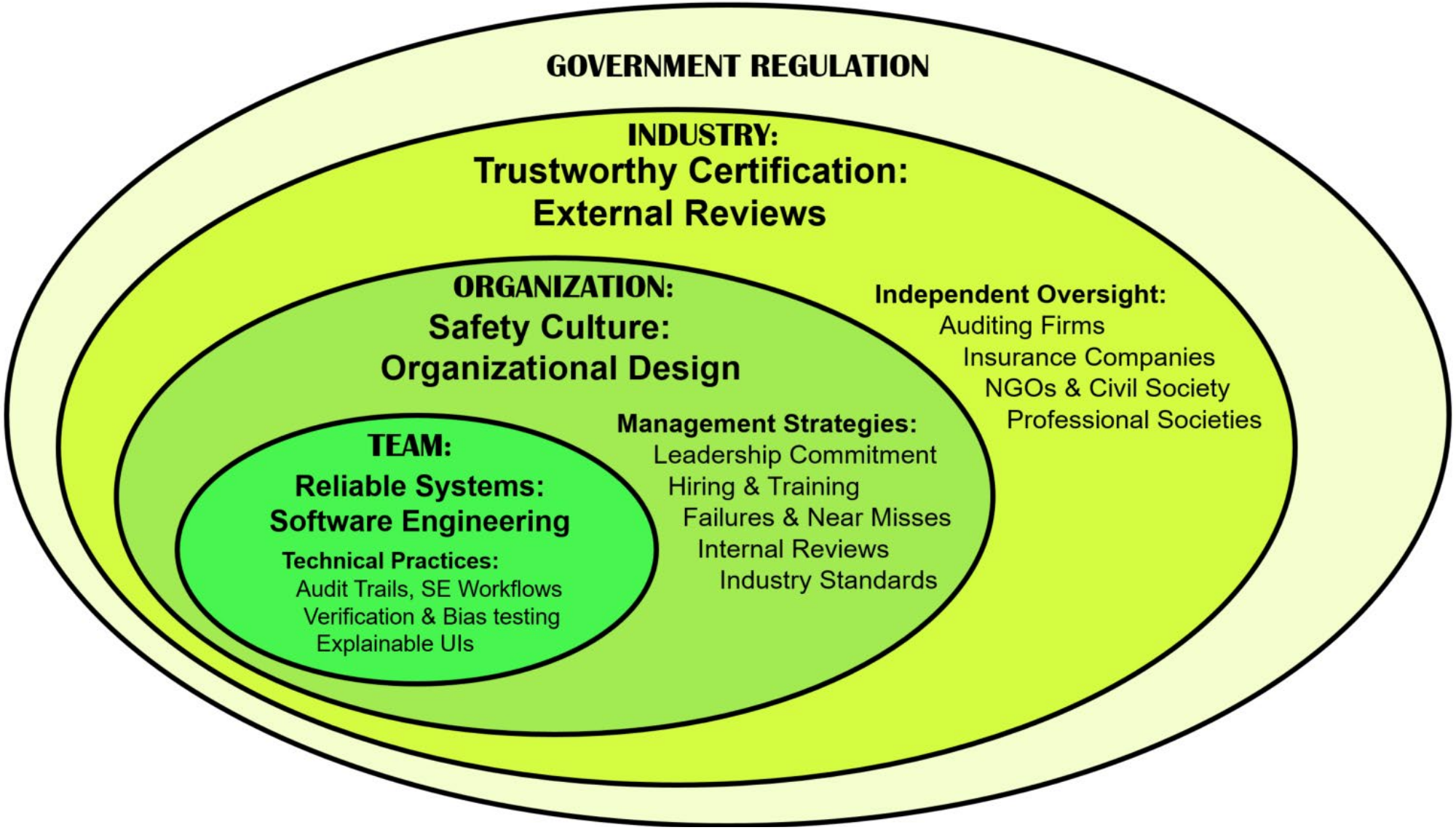


Governance Structures for Human-Centered AI



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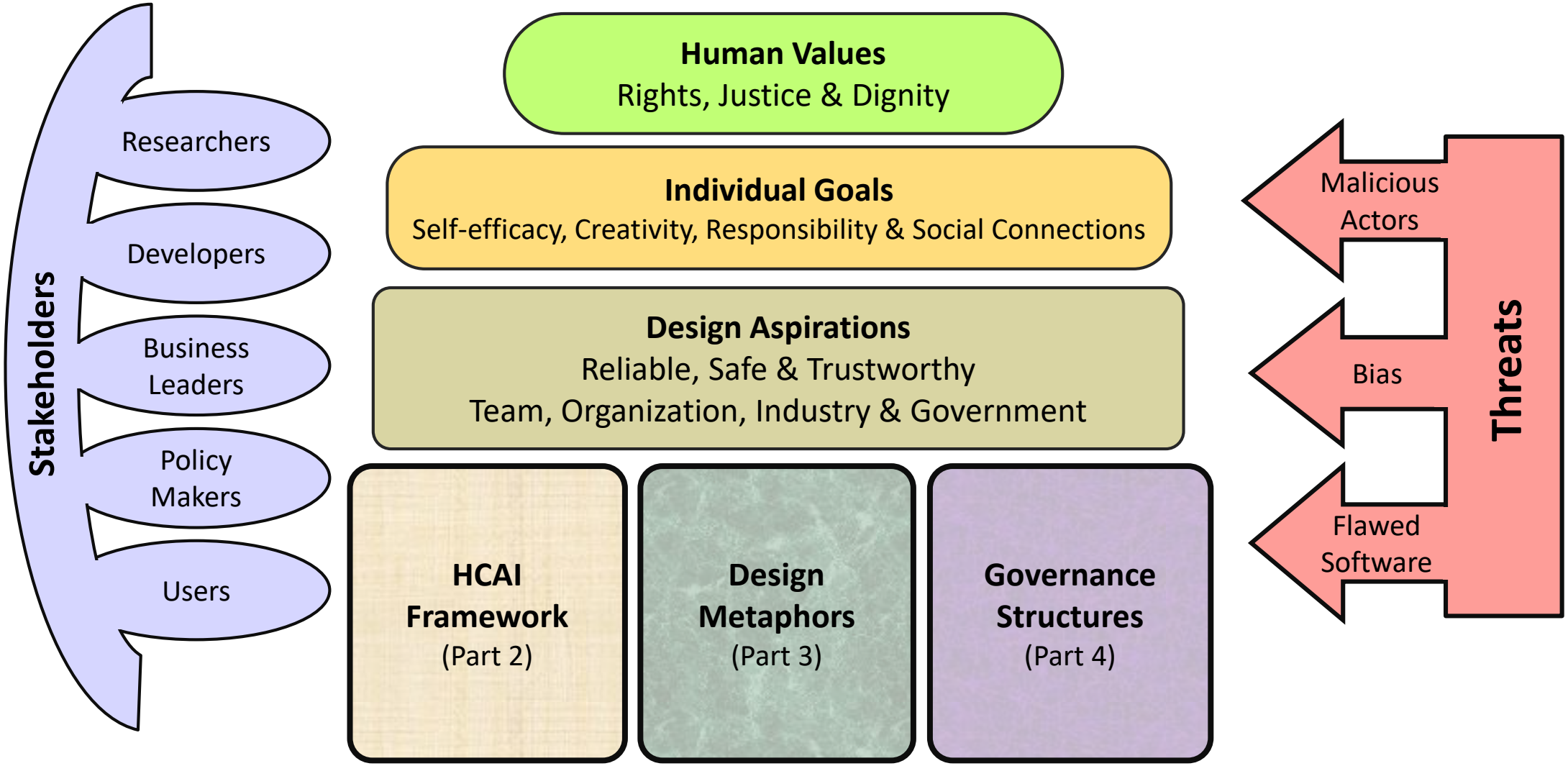
Human-Centered AI



Oxford University Press (January 2022) **https://hcil.umd.edu/human-centered-ai/**

Human-Centered AI

Oxford University Press (2022)

“it is one of the most important AI books in the last few years”
— *Brian Clegg, UK Popular Science*

“excellent introduction…valuable to management who need to both understand how to better direct AI development and to require appropriate AI to solve market and social challenges.”
— *David Teich, Forbes Magazine*

“a tour de force into the increasingly important topic of human-centred AI. A must read.”
— *Virginia Dignum, Umeå University*

The Future is Human-Centered

Google Group

`https://groups.google.com/g/human-centered-ai`

Twitter Account

`@HumanCenteredAI`

Website

`https://hcai.site`

The Future is Human-Centered

Human-Centered Artificial Intelligence: Reliable, safe & trustworthy, *International Journal of Human-Computer Interaction 36,* 6 (March 2020). https://doi.org/10.1080/10447318.2020.1741118

Design lessons from AI's two grand goals: Human emulation and useful applications, *IEEE Transactions on Technology & Society 1,* 2 (June 2020). https://ieeexplore.ieee.org/document/9088114

Bridging the gap between ethics and practice: Guidelines for reliable, safe, and trustworthy Human-Centered AI systems, *ACM Trans. on Interactive Intelligent Systems 10,* 4 (Oct 2020). https://dl.acm.org/doi/10.1145/3419764

Human-Centered Artificial Intelligence: Three fresh ideas, *AIS Trans. on Human-Computer Interaction 12,* 3 (Oct 2020). https://aisel.aisnet.org/thci/vol12/iss3/1/

Human-Centered AI, *NAS ISSUES 37, 2* (Winter 2021). https://issues.org/human-centered-ai/

Summary & resources: https://hcil.umd.edu/human-centered-ai/

Human-Centered AI

Oxford University Press

- January 2022

The book is well-structured and a delight to read. The coverage is comprehensive. But it will be controversial.

— *Alan Mackworth, University of British Columbia*

From design metaphors to the much needed governance structures, this new book by Ben Shneiderman is a tour de force into the increasingly important topic of human-centred AI. A must read.

— *Virginia Dignum, Umeå University"*

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https://global.oup.com/academic/product/human-centered-ai-9780192845290

The Future is Human-Centered