Stanford CS-HCI: October 30, 2019

Human-Centered Artificial Intelligence:
Designing Next Generation User Experiences

Ben Shneiderman **@benbendc**

Founding Director (1983-2000), Human-Computer Interaction Lab
Professor, Department of Computer Science

Member, National Academy of Engineering

Photo: BK Adams

UNIVERSITY OF MARYLAND

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

Web links

The **University of Maryland, College Park** (often referred to as the **University of Maryland**, **Maryland**, **UM**, **UMD**, **UMCP**, or **College Park**) is a public research university[10] located in the city of College Park in Prince George's County, Maryland, approximately 4 miles (6.4 km) from the northeast border of Washington, D.C. Founded in 1856, the university is the flagship institution of the University System of Maryland. With a fall 2010 enrollment of more than 37,000 students, over 100 undergraduate majors, and 120 graduate programs,

Tiny touchscreen keyboards

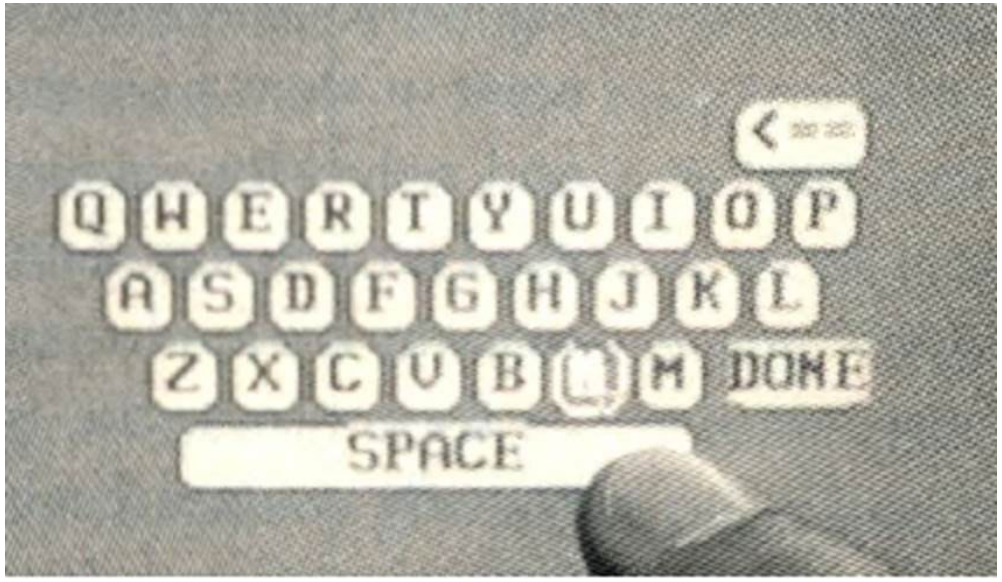
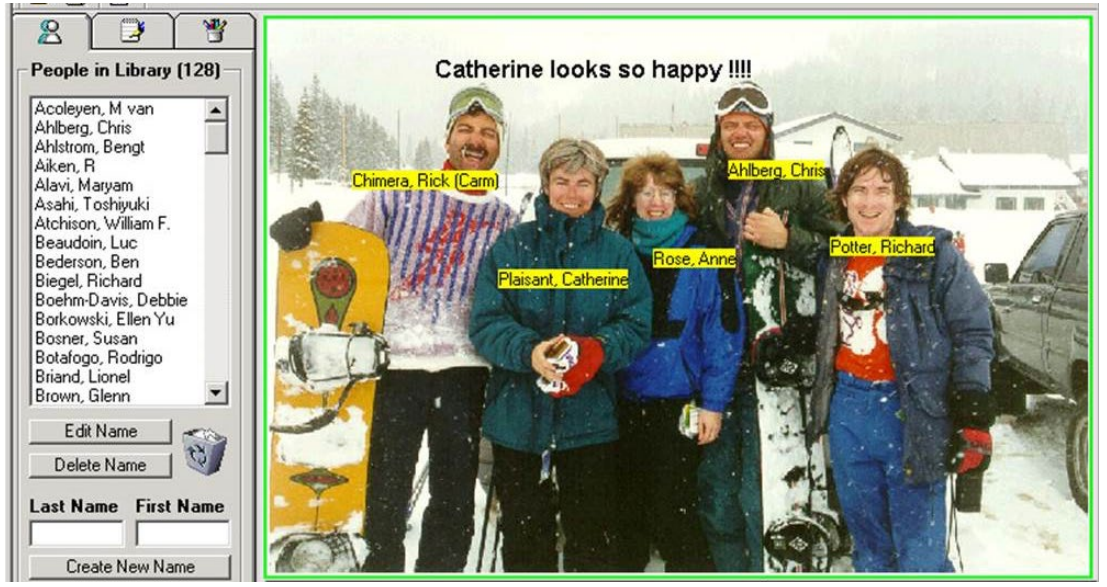
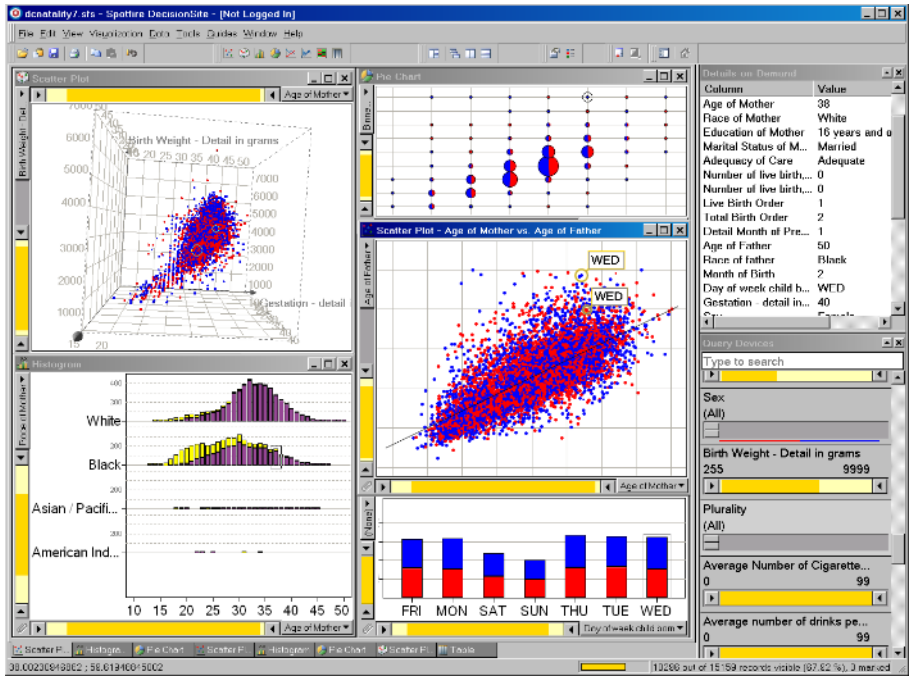


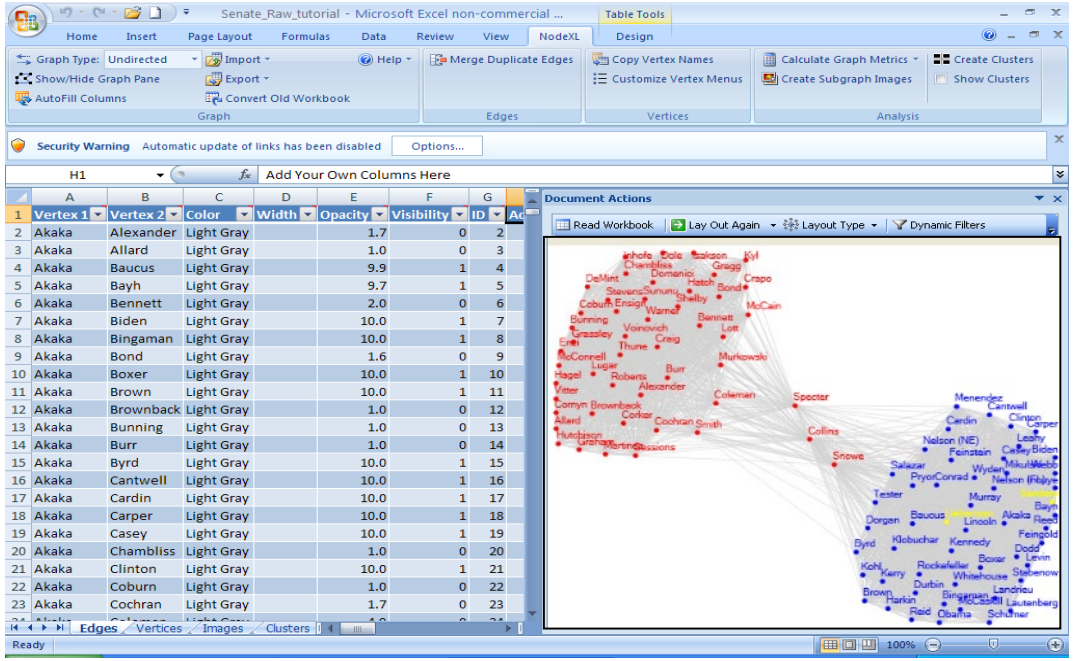
Photo tagging



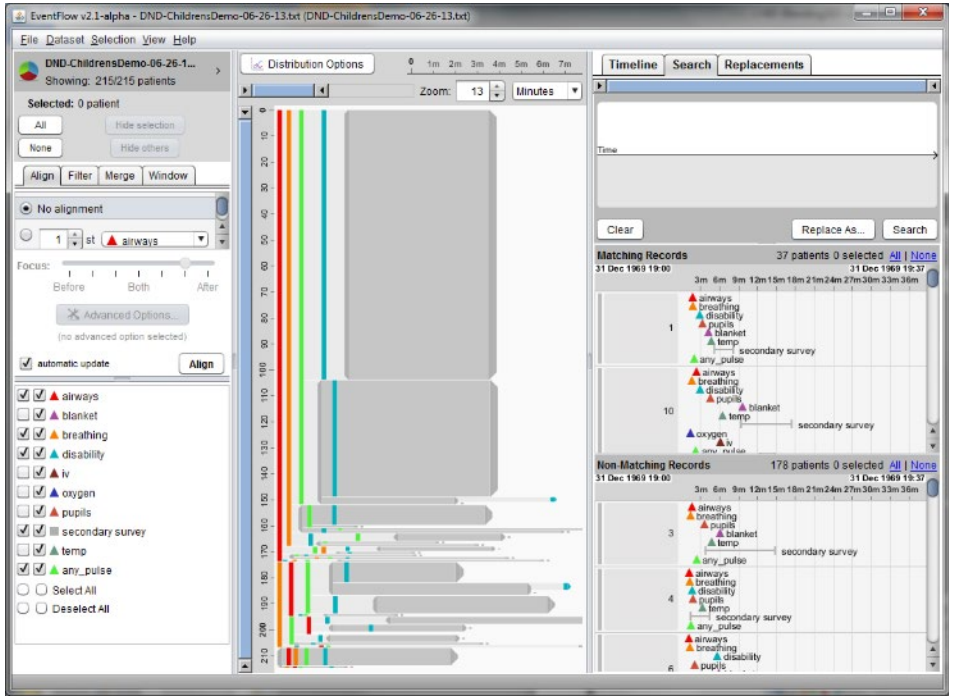


Spotfire

Treemaps
FinViz



NodeXL



EventFlow

Rationalism vs Empiricism

Rationalism: logical perfectability of human endeavors

Aristotle, Descartes, Spinoza & Kant

Empiricism: need to continuously refine our beliefs based on our experiences

Leonardo, Galileo, Locke & Hume

Rationalism vs Empiricism

Rationalism: logical perfectability of human endeavors

Aristotle, Descartes, Spinoza & Kant ... Ronald Fisher

Empiricism: need to continuously refine our beliefs based on our experiences

Leonardo, Galileo, Locke & Hume ... John Tukey

Rationalism vs Empiricism

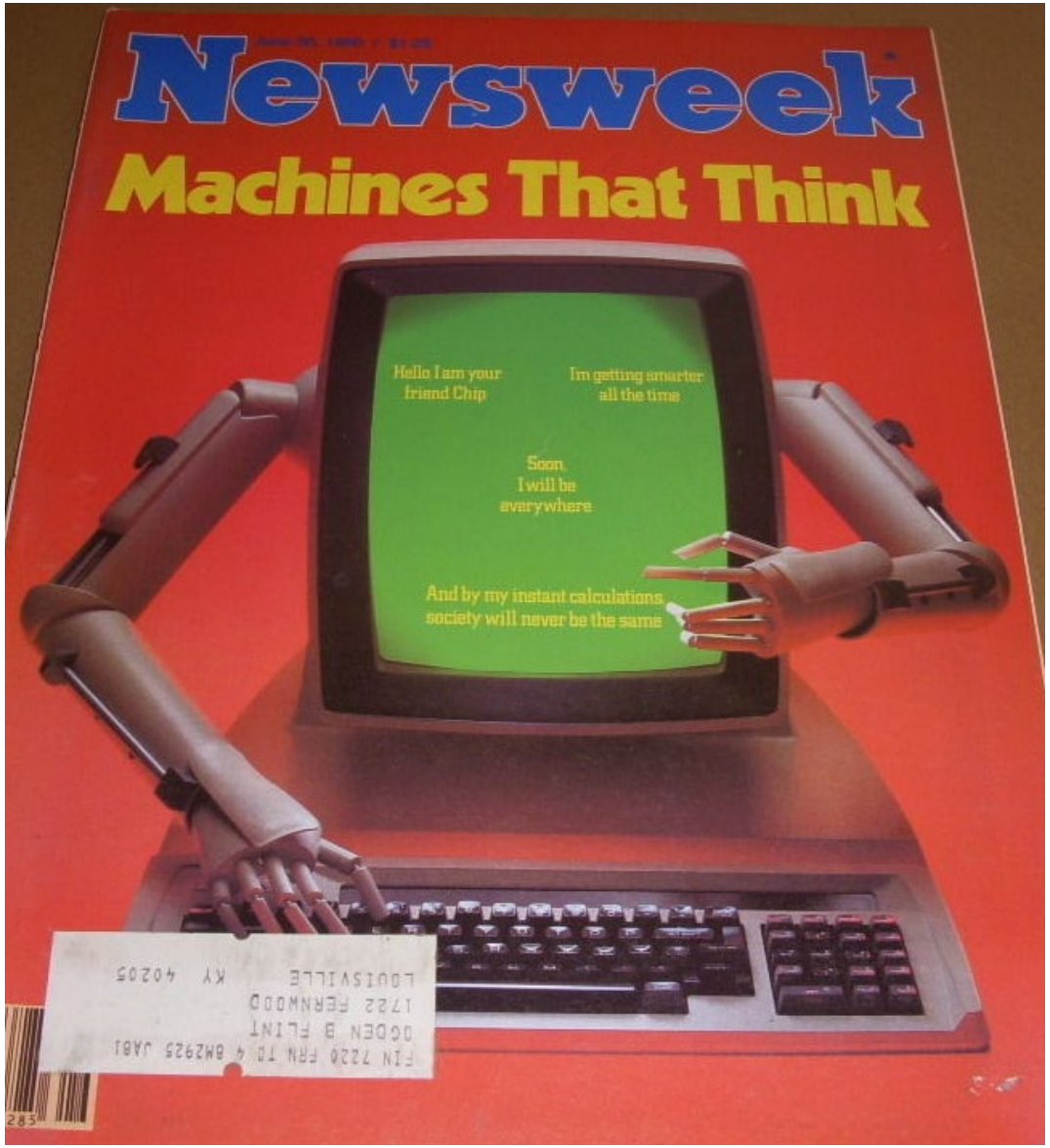
Rationalism: logical perfectability of human endeavors

Aristotle, Descartes, Spinoza & Kant ... AI

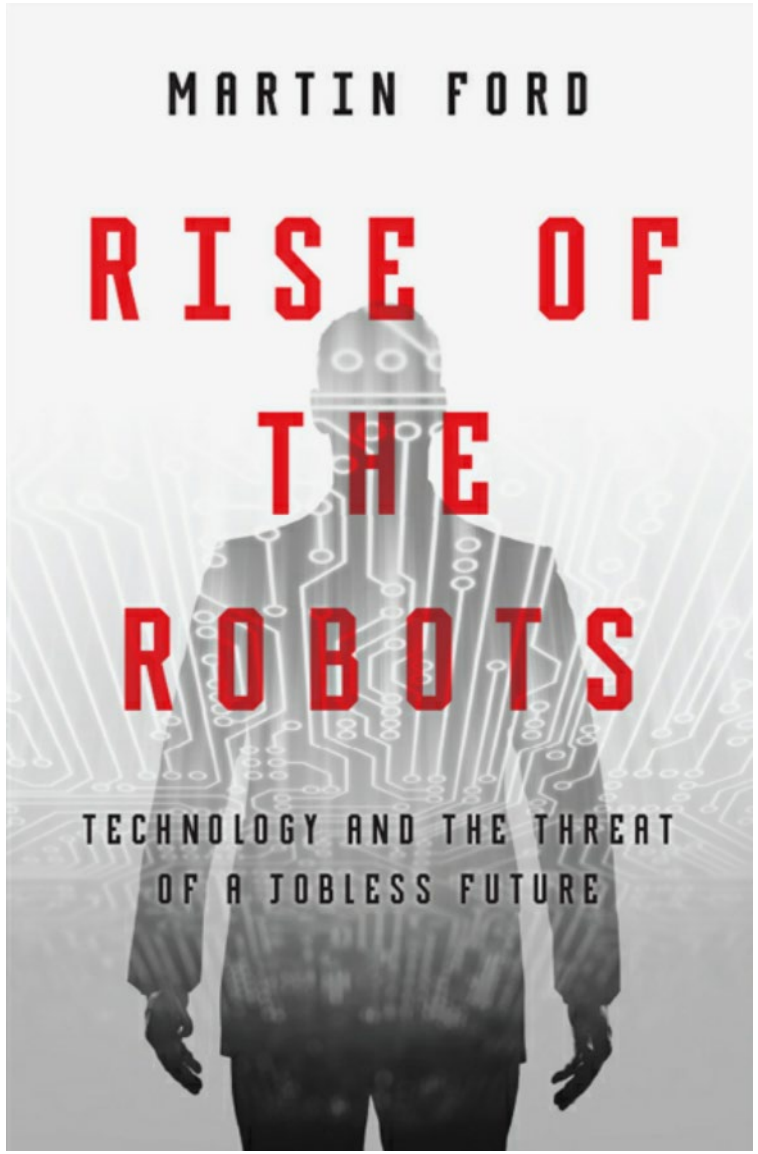
Empiricism: need to continuously refine our beliefs based on our experiences

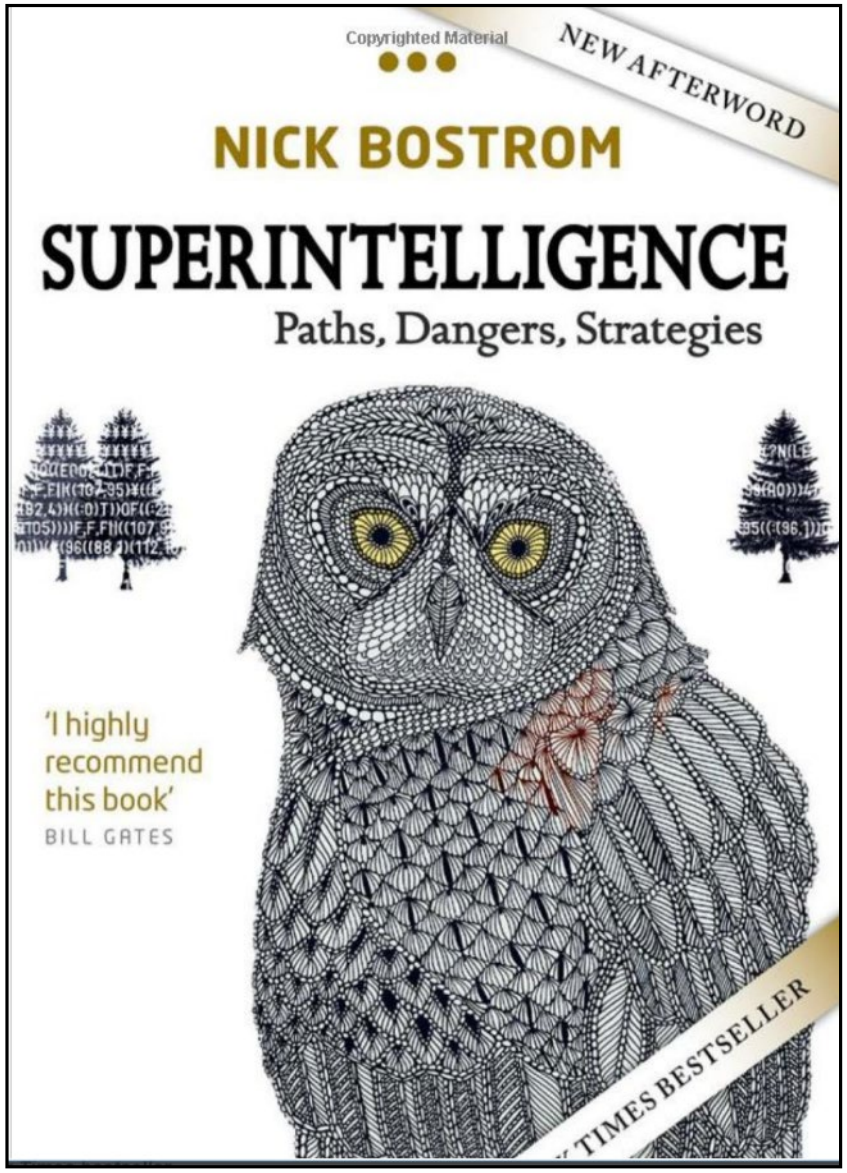
Leonardo, Galileo, Locke & Hume ... HCI

Machines That Think
June 30, 1980



Can Machines Think?
March 25, 1996


MARTIN FORD
RISE OF THE ROBOTS
TECHNOLOGY AND THE THREAT OF A JOBLESS FUTURE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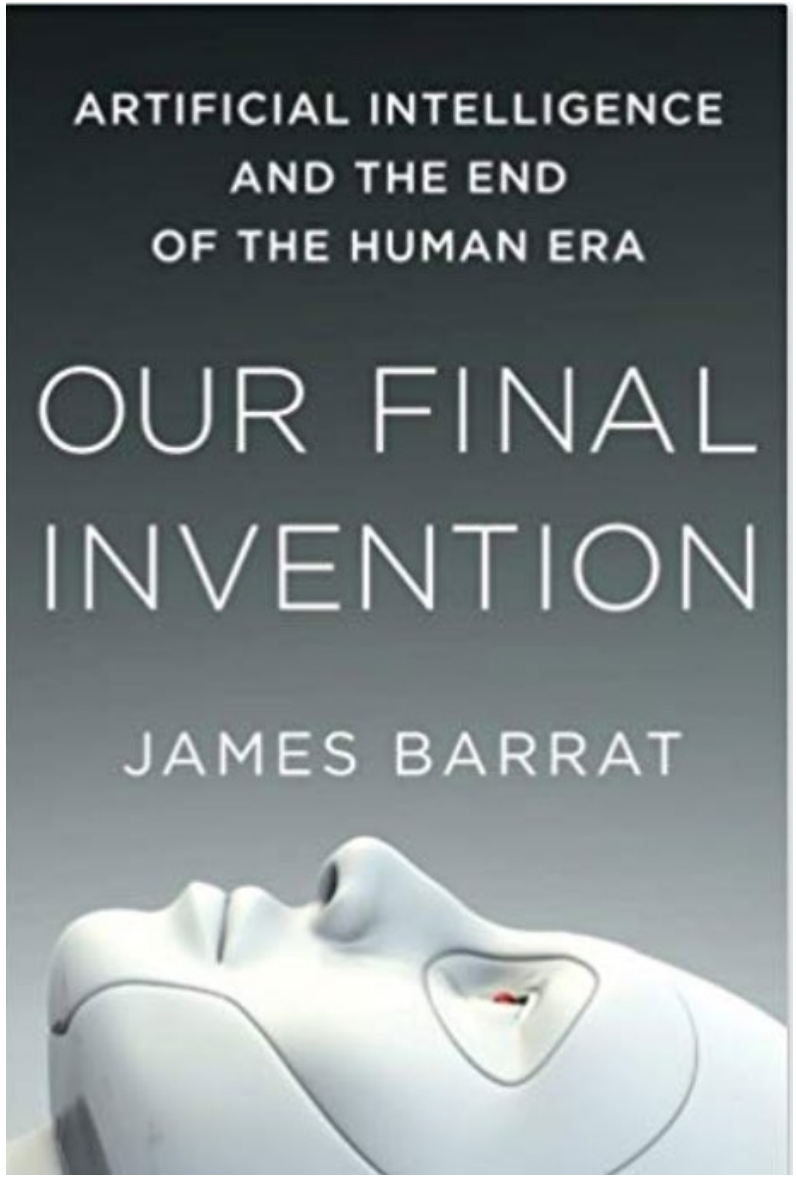
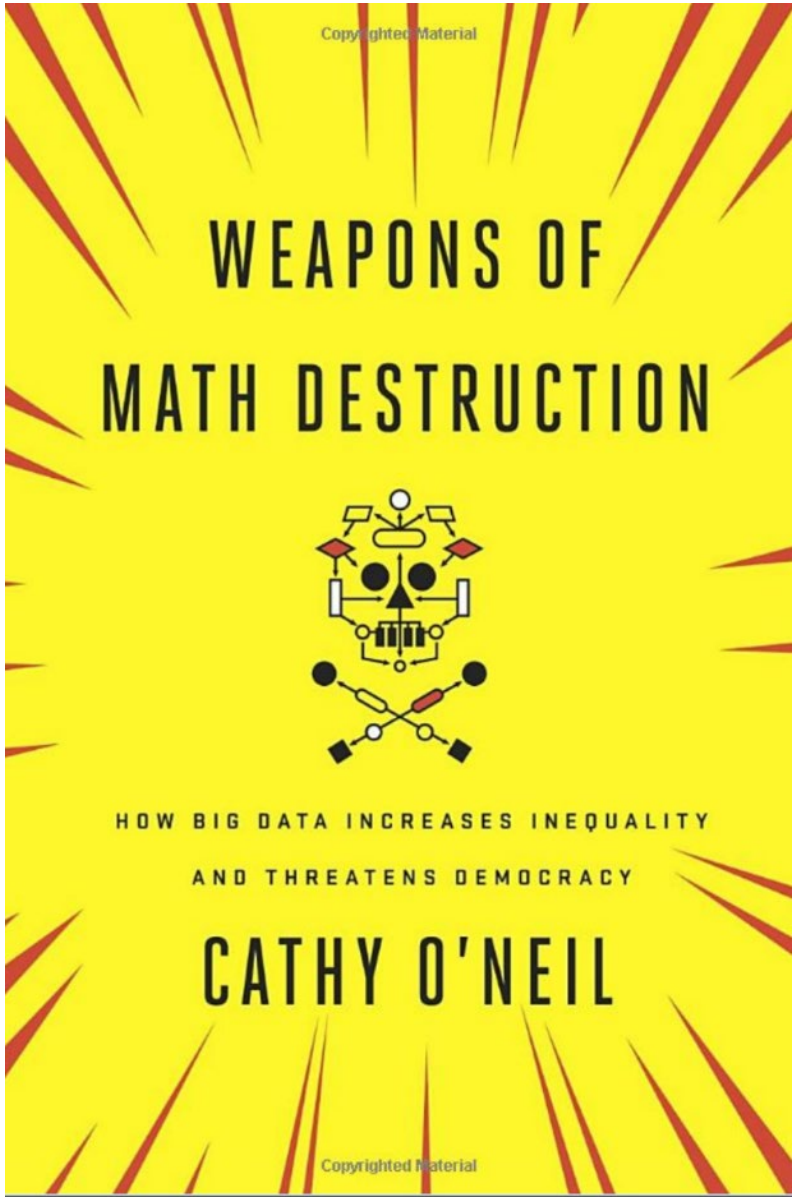
Paths, Dangers, Strategies
'I highly recommend this book'
BILL GATES
TIMES BESTSELLER


ARTIFICIAL INTELLIGENCE AND THE END OF THE HUMAN ERA
OUR FINAL INVENTION
JAMES BARRAT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MATH DESTRUCTION
HOW BIG DATA INCREASES INEQUALITY
AND THREATENS DEMOCRACY
CATHY O'NEIL
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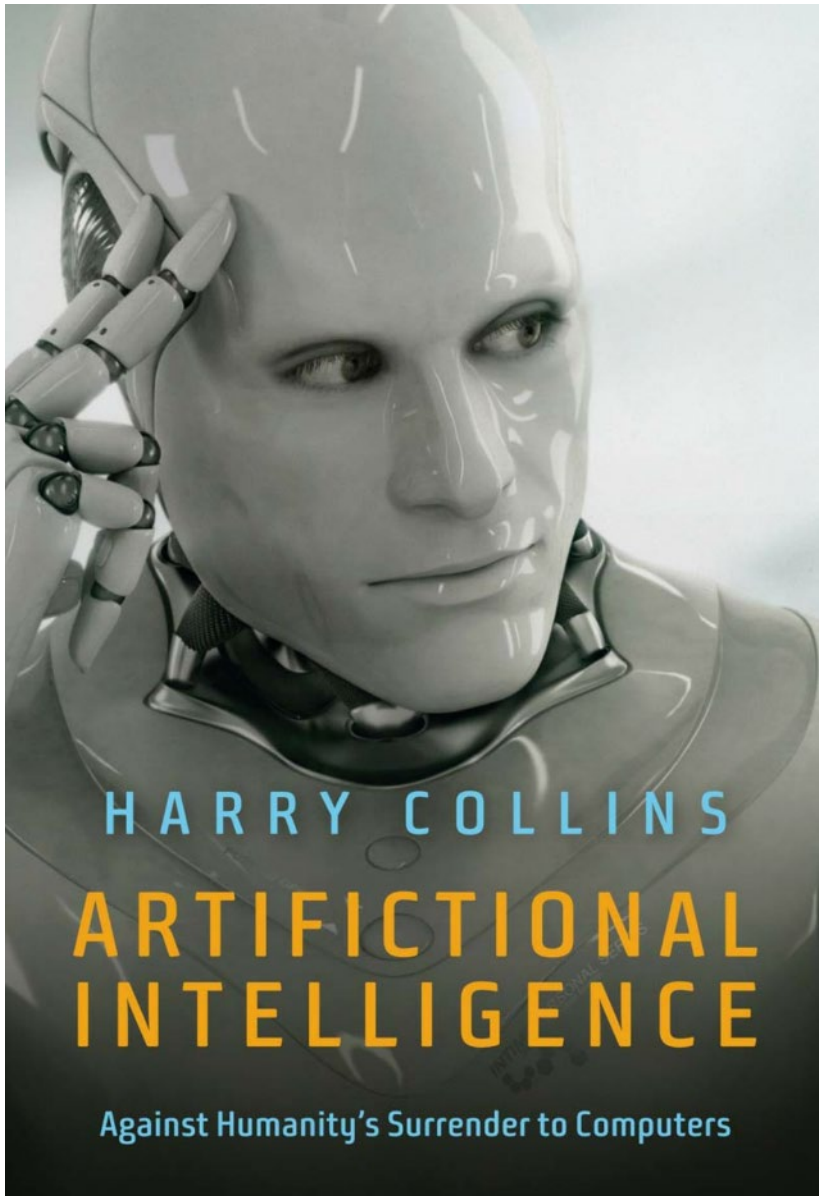
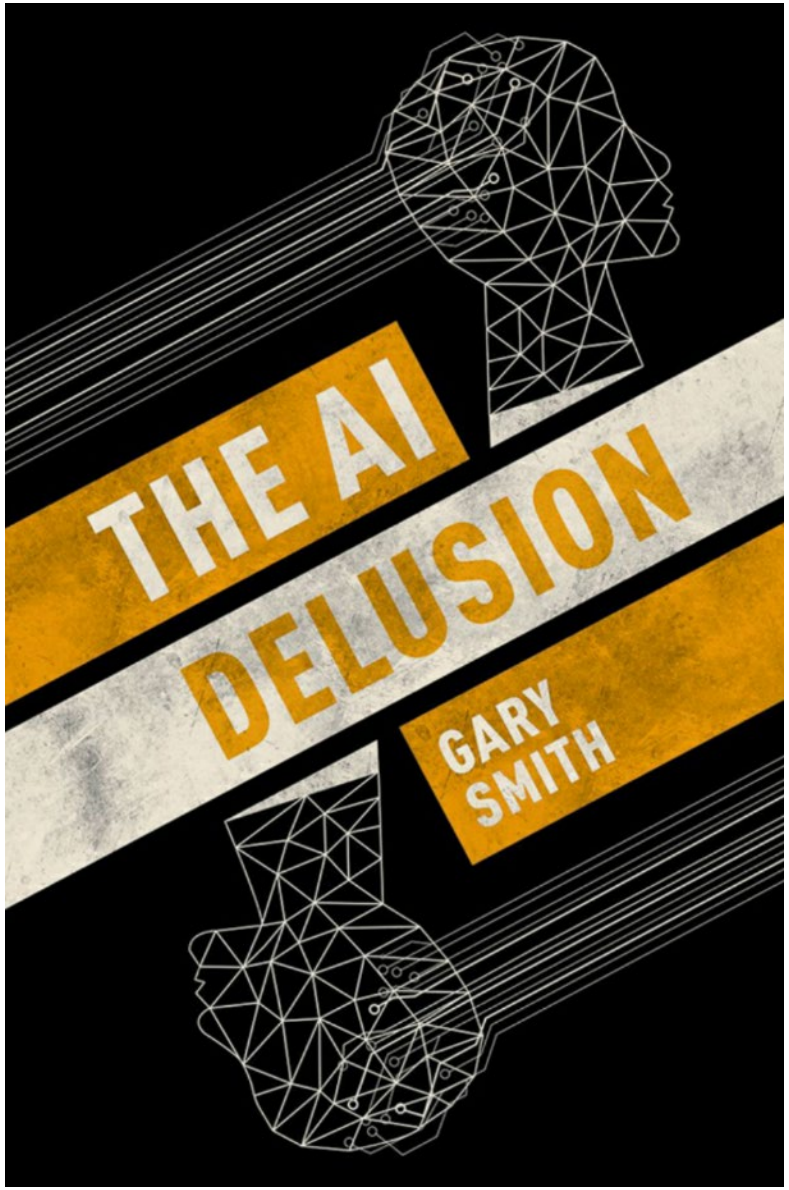
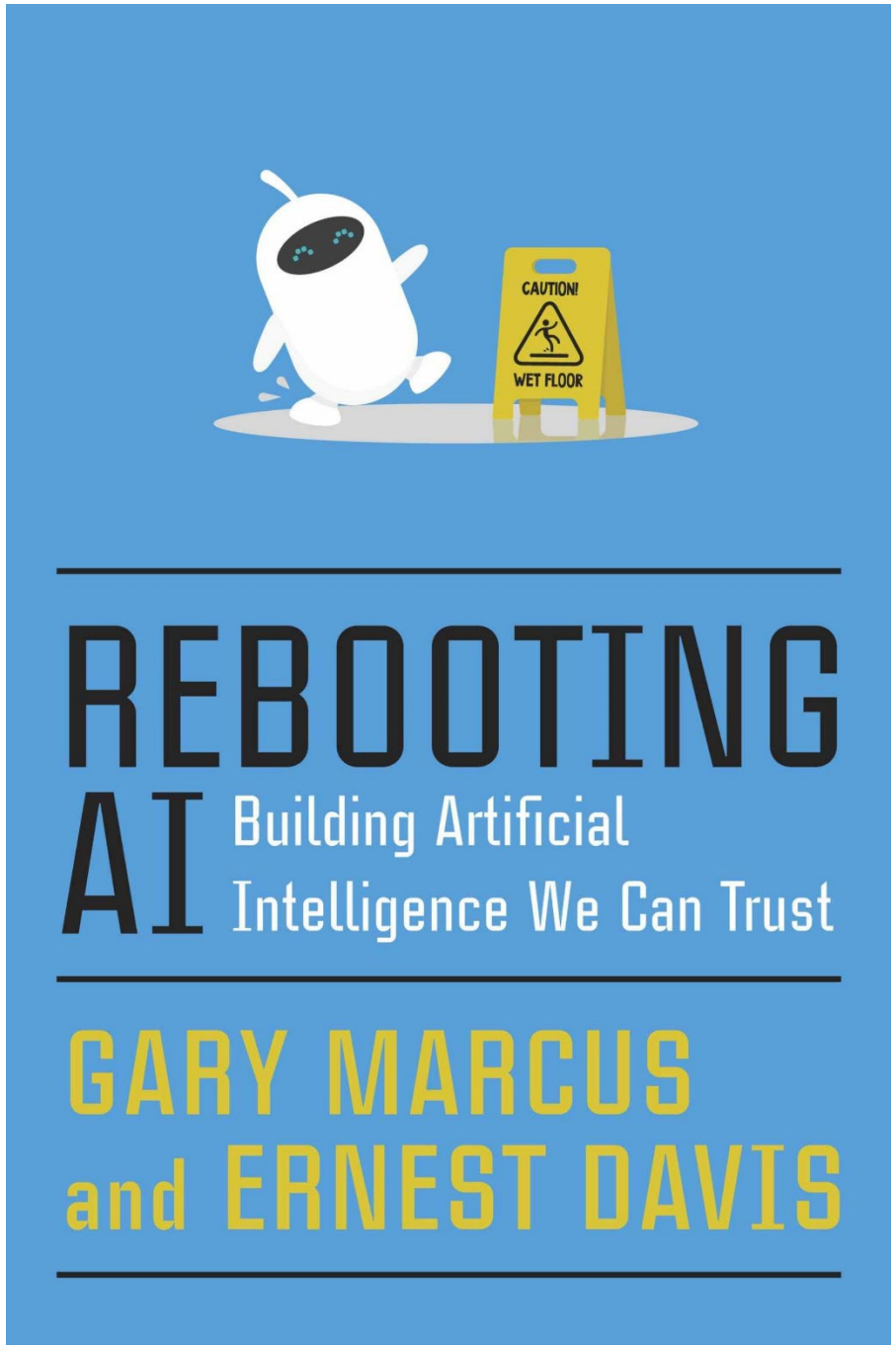

HARRY COLLINS
ARTIFICTIONAL
INTELLIGENCE
Against Humanity's Surrender to Computers


THE AI
DELUSION
GARY
SMITH



“so much of what we read about AI strikes us as pure fantasy, predicated on a confidence in AI’s imagined strengths that bears no relation to current technological capabilities”

HCI Pride: Serving 6 Billion Users

Mobile, desktop, web, cloud

Diverse users:	**include everyone**
Diverse applications:	**real problems, users, data**
Diverse interfaces:	**theories, principles, guidelines**

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Apple Design Guidelines

User Control

… people - not apps - are in control

Flexibility

… (give) users complete, fine-grained control over their work

AI design principles, which I want to change

- **Humanoid robots**
- **Excessive automation**

- Insufficient feedback
- Hidden features
- Restrictions on creativity
- Limits on collaboration
- Missing audit trails

What I want to achieve

Amplify, Augment, Enhance & Empower People

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→ 1000-fold improvements in capabilities

Information	Photography
Search	Navigation
Email & Text	Business Formation

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→ More people, more creative, more often

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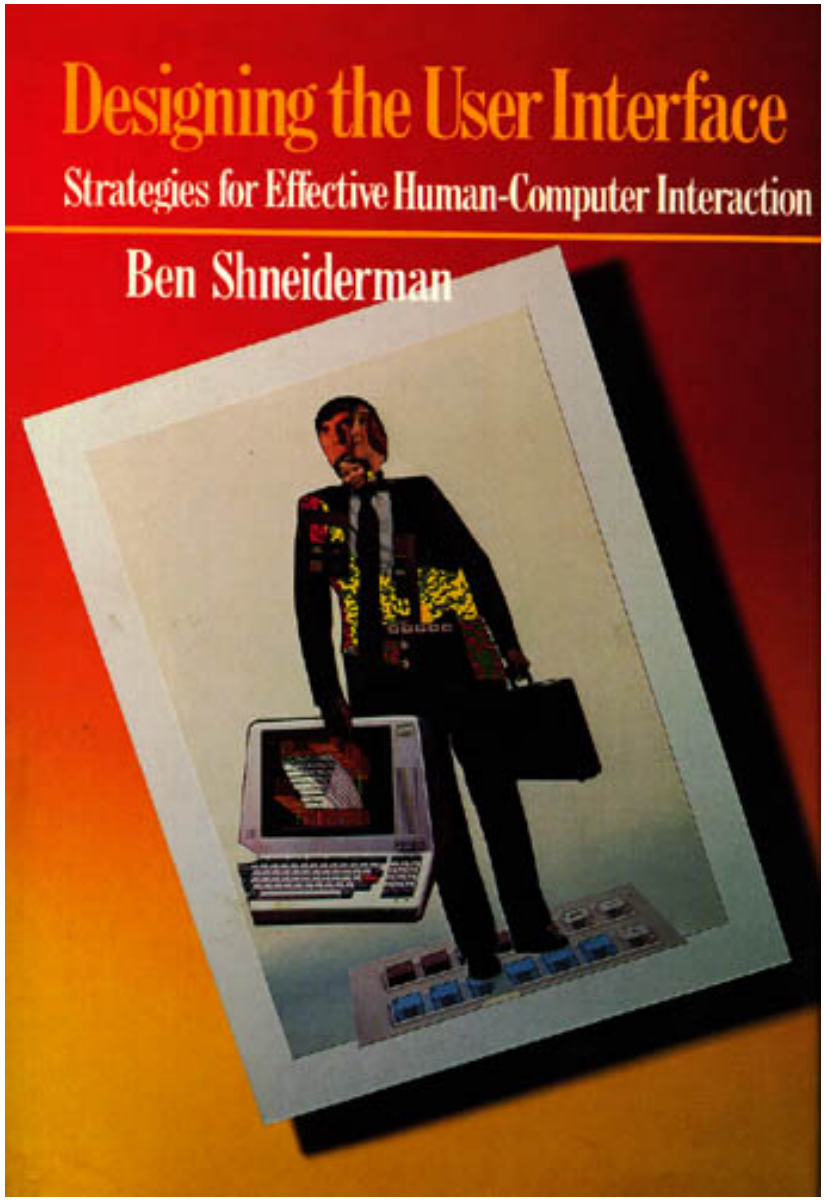
→ TRS: Trusted, Reliable & Safe

→ More people, more creative, more often

→ Self-efficacy & societal benefits

Designing the User Interface

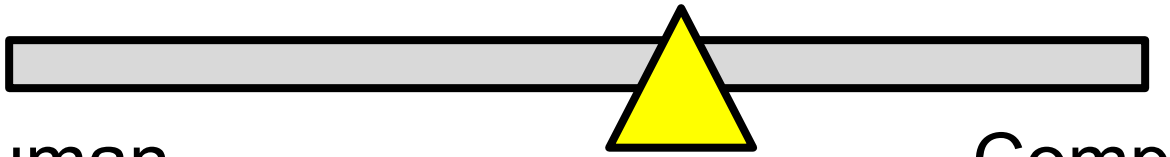
Balancing automation & human control



First Edition: 1986

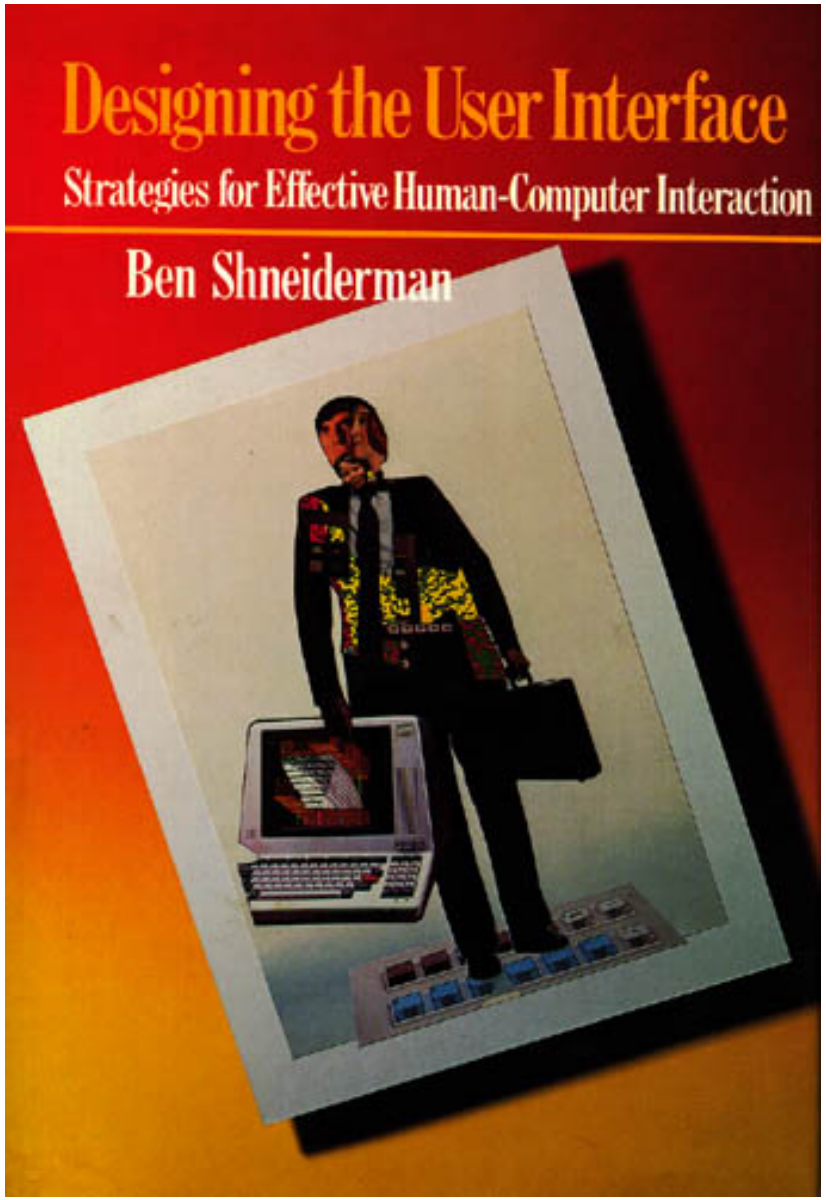
Designing the User Interface

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
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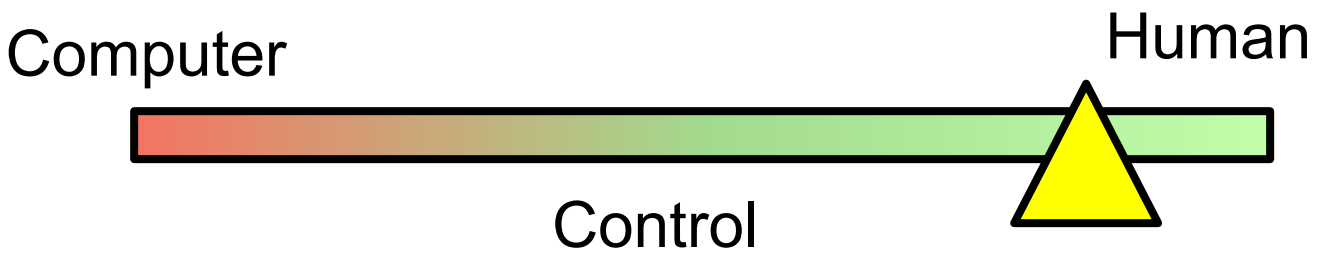

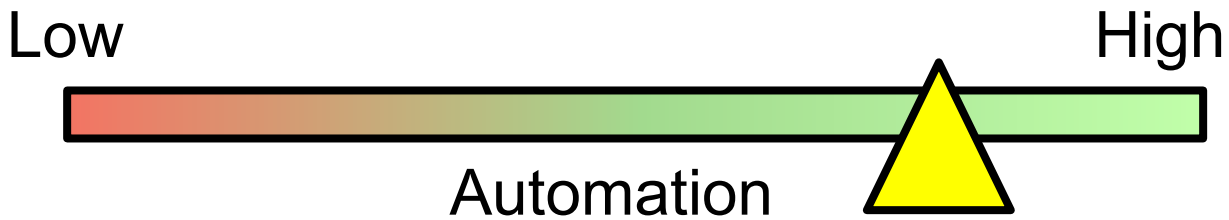

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Designing the User Interface

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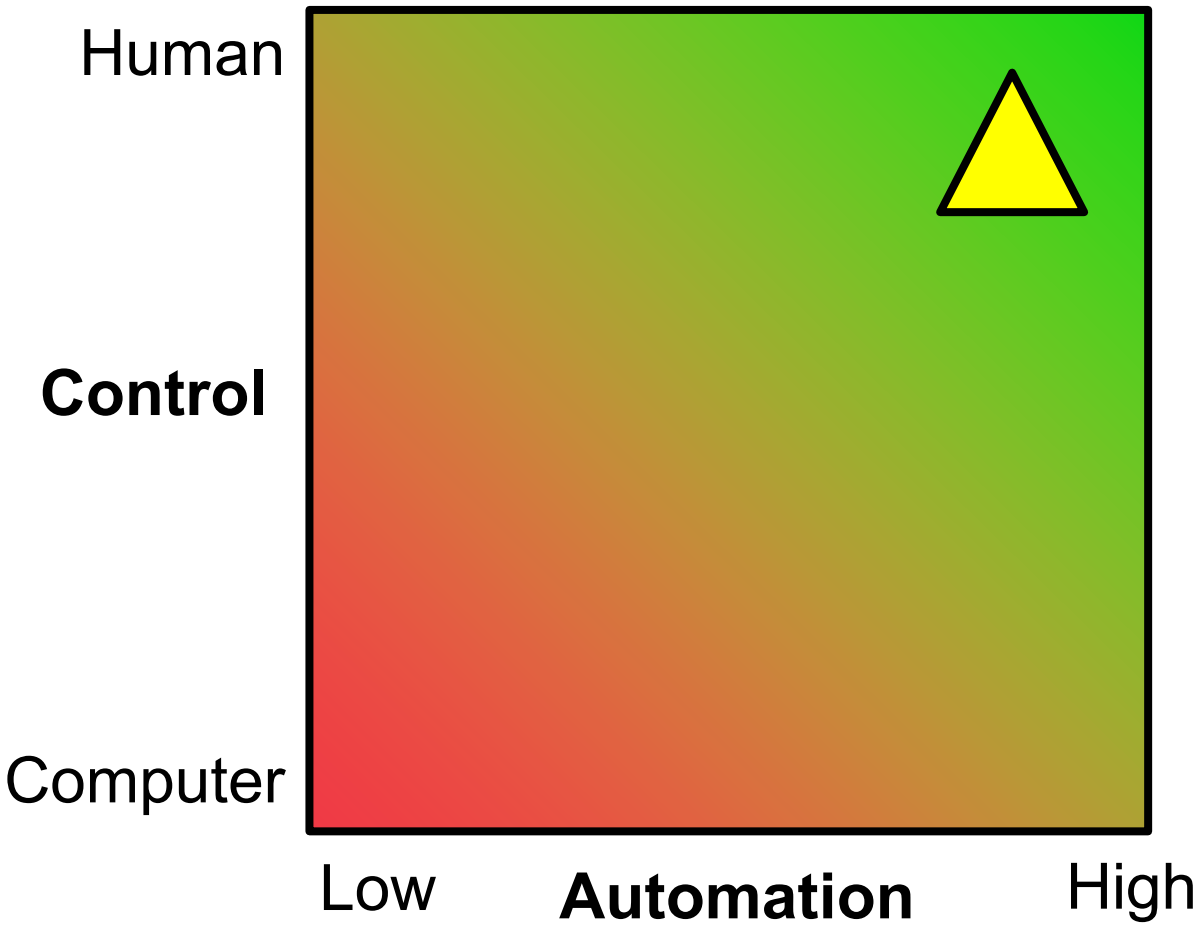
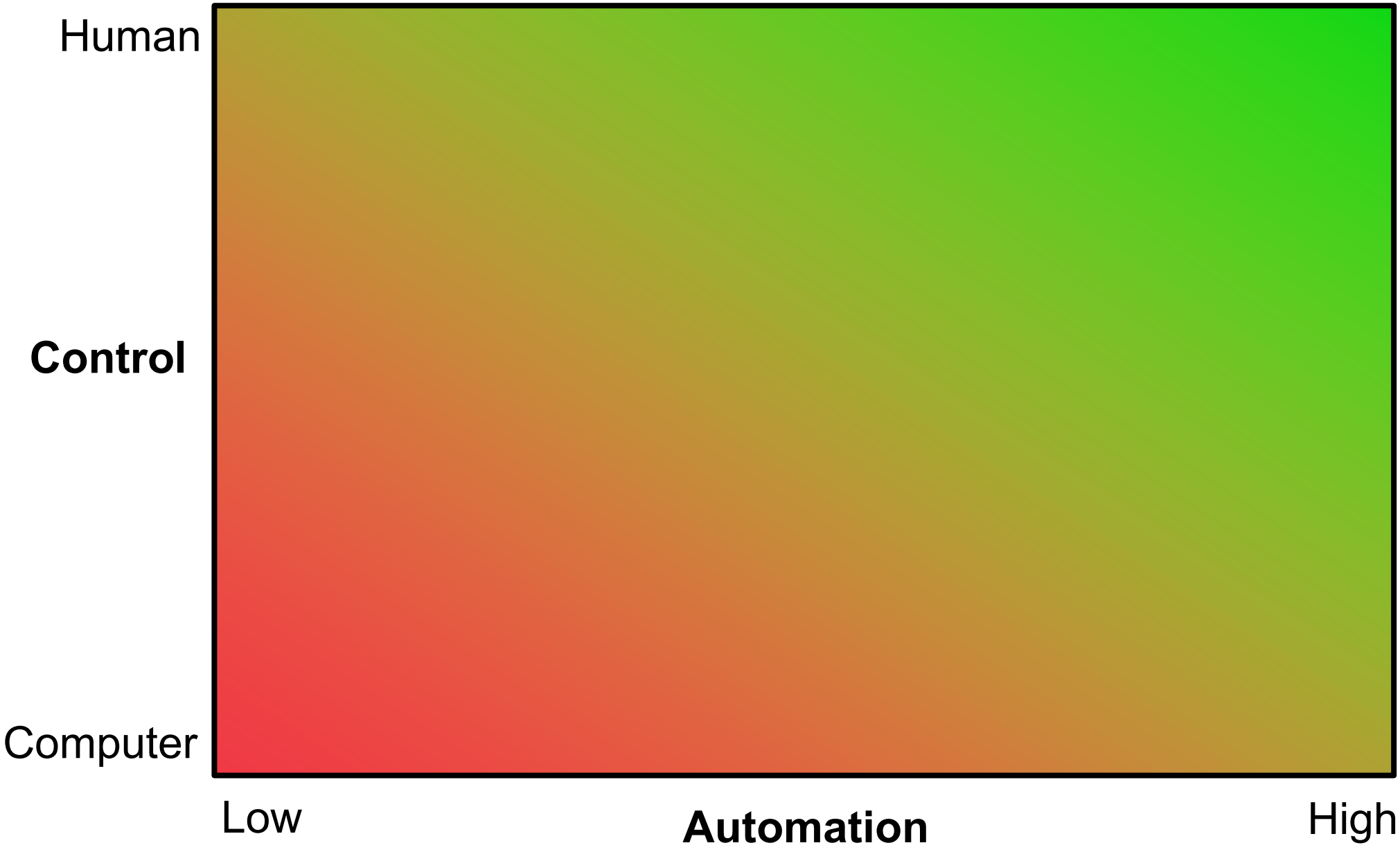


Sixth Edition: 2016

Landscape of Automation



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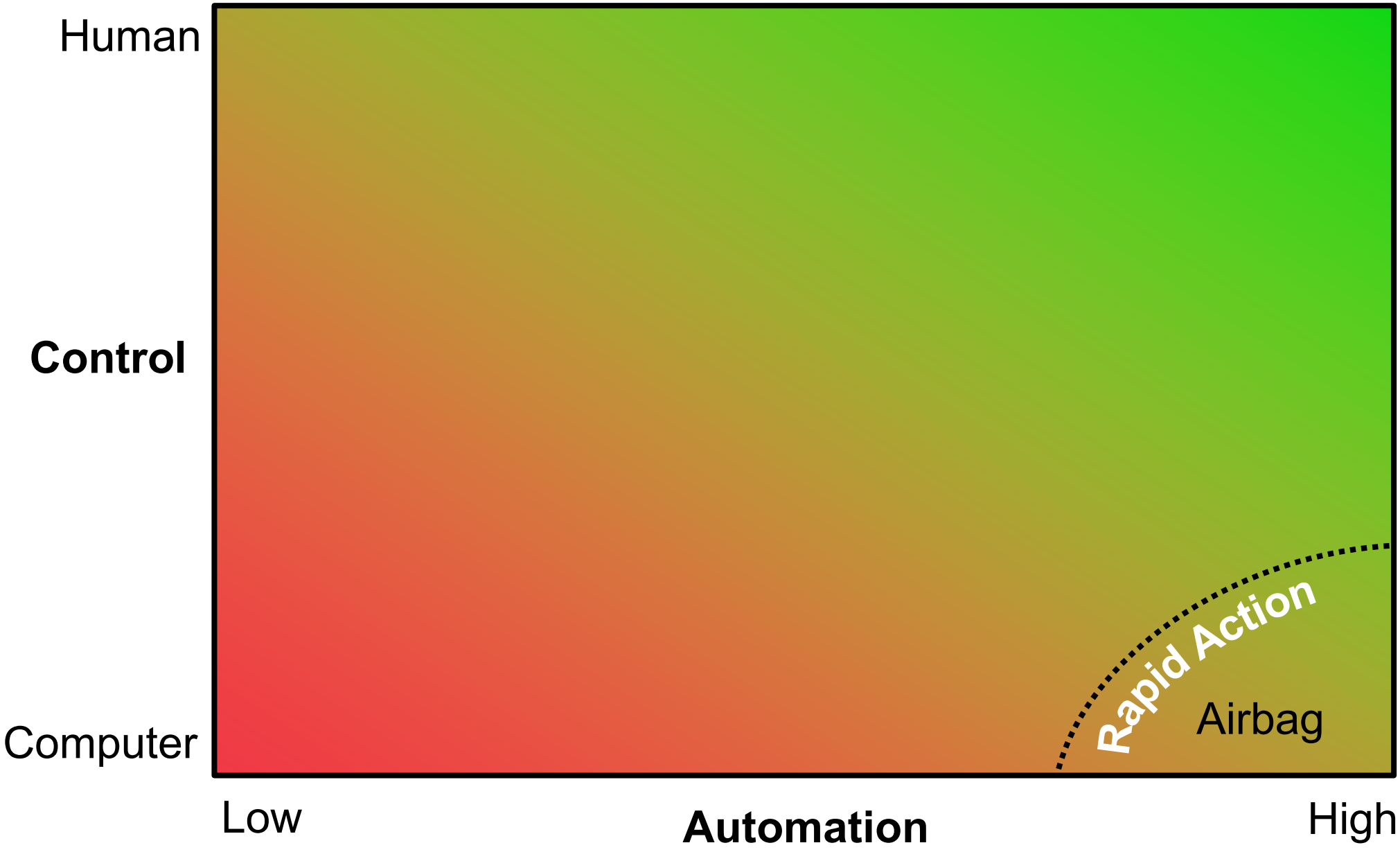

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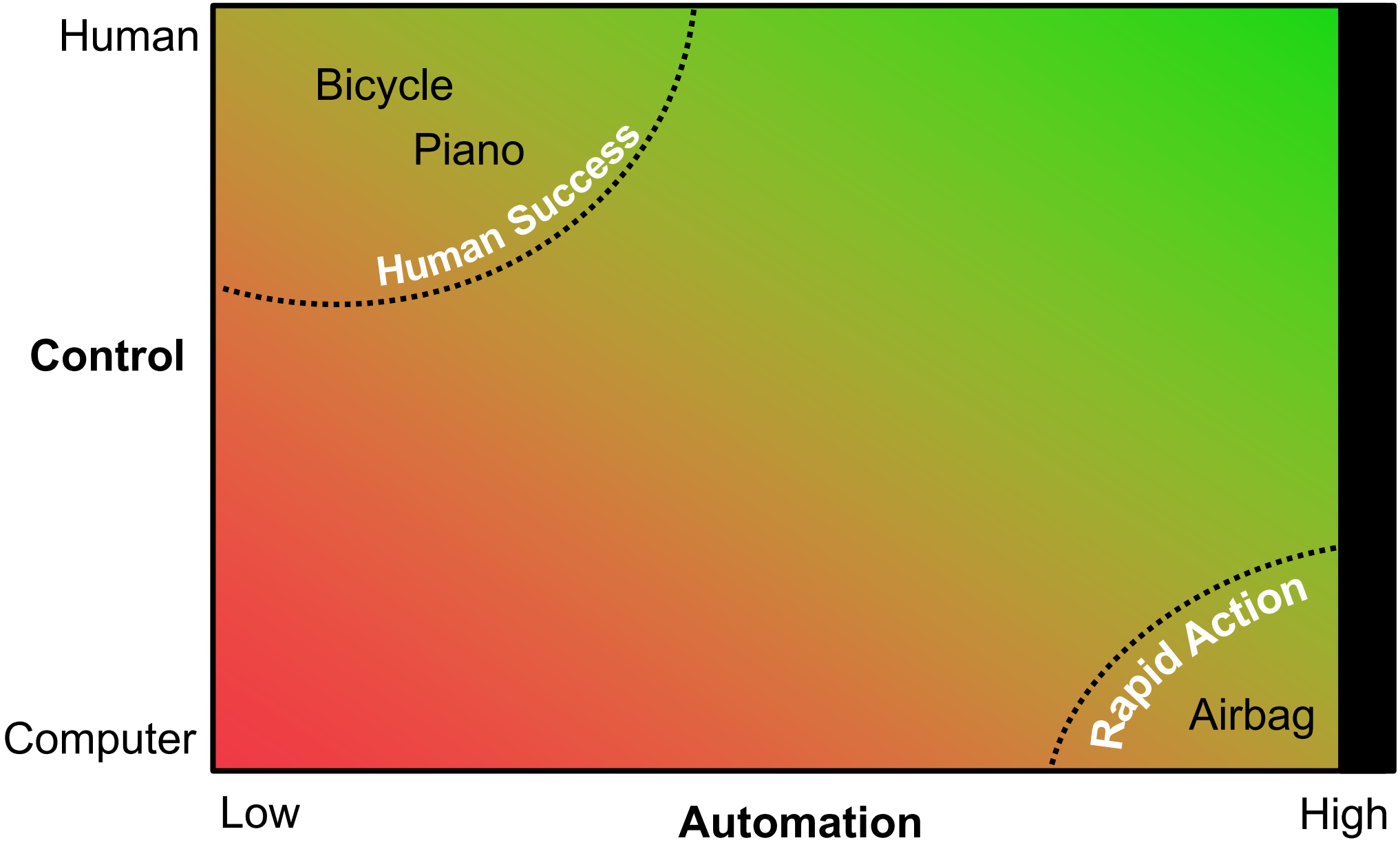

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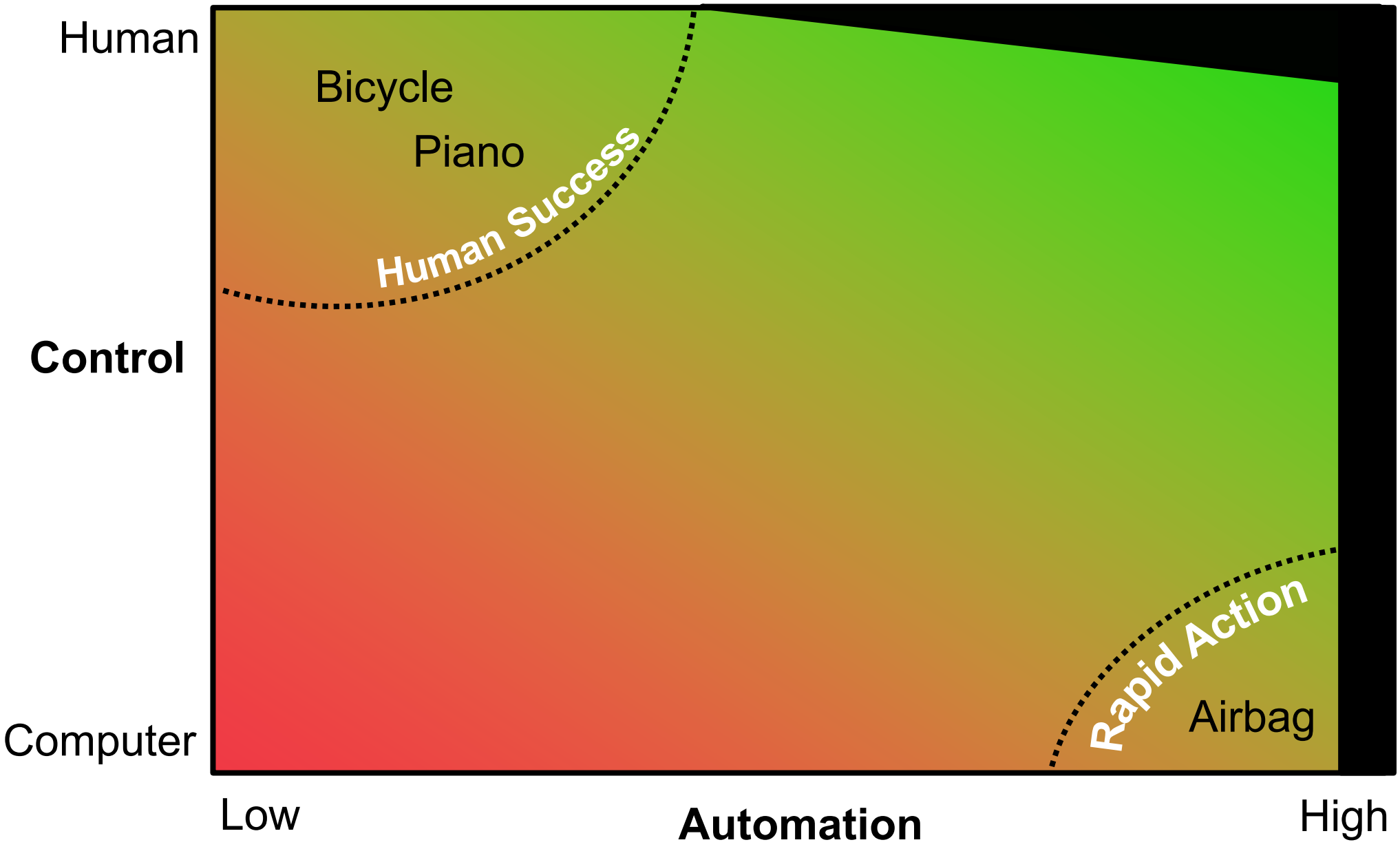

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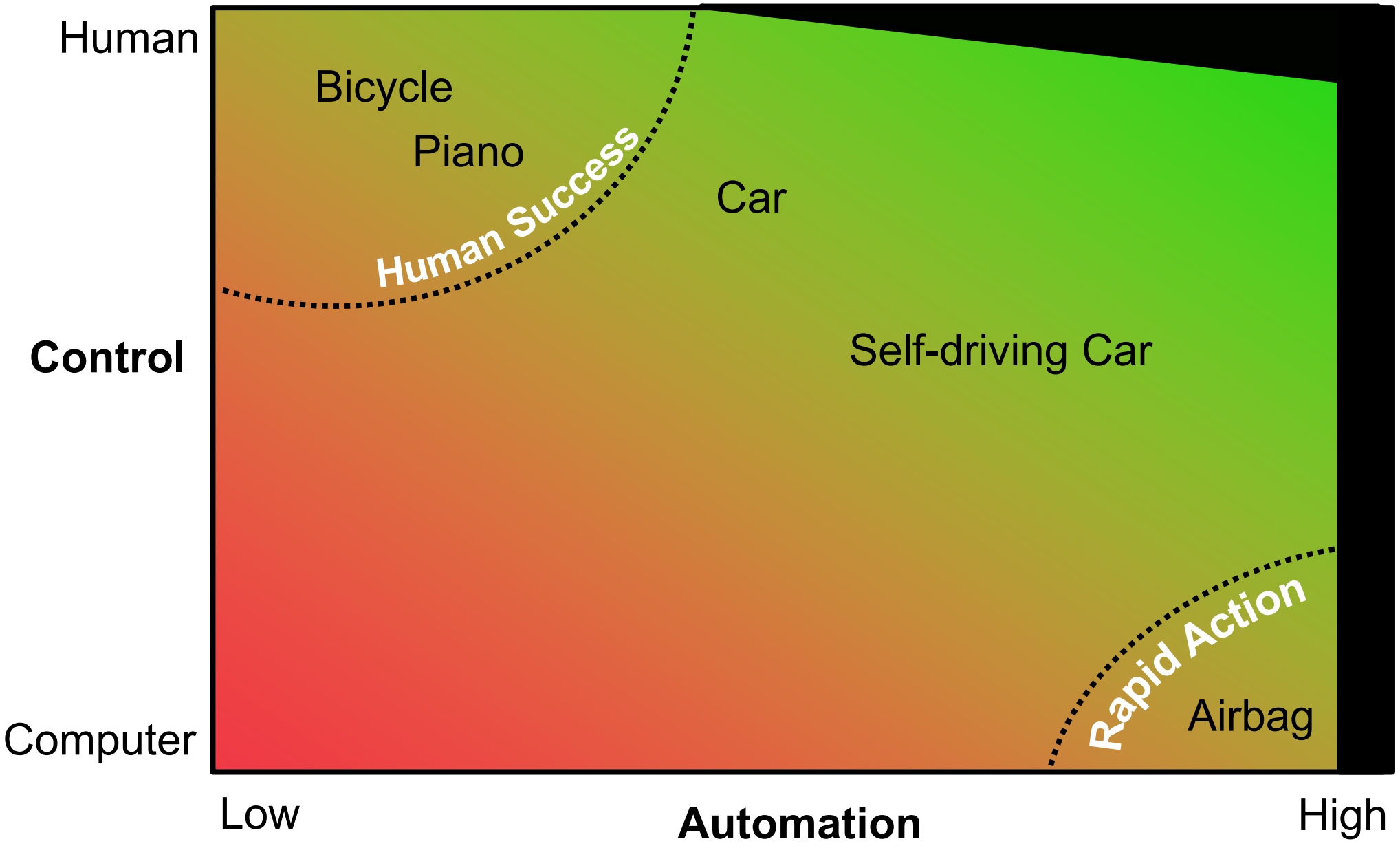

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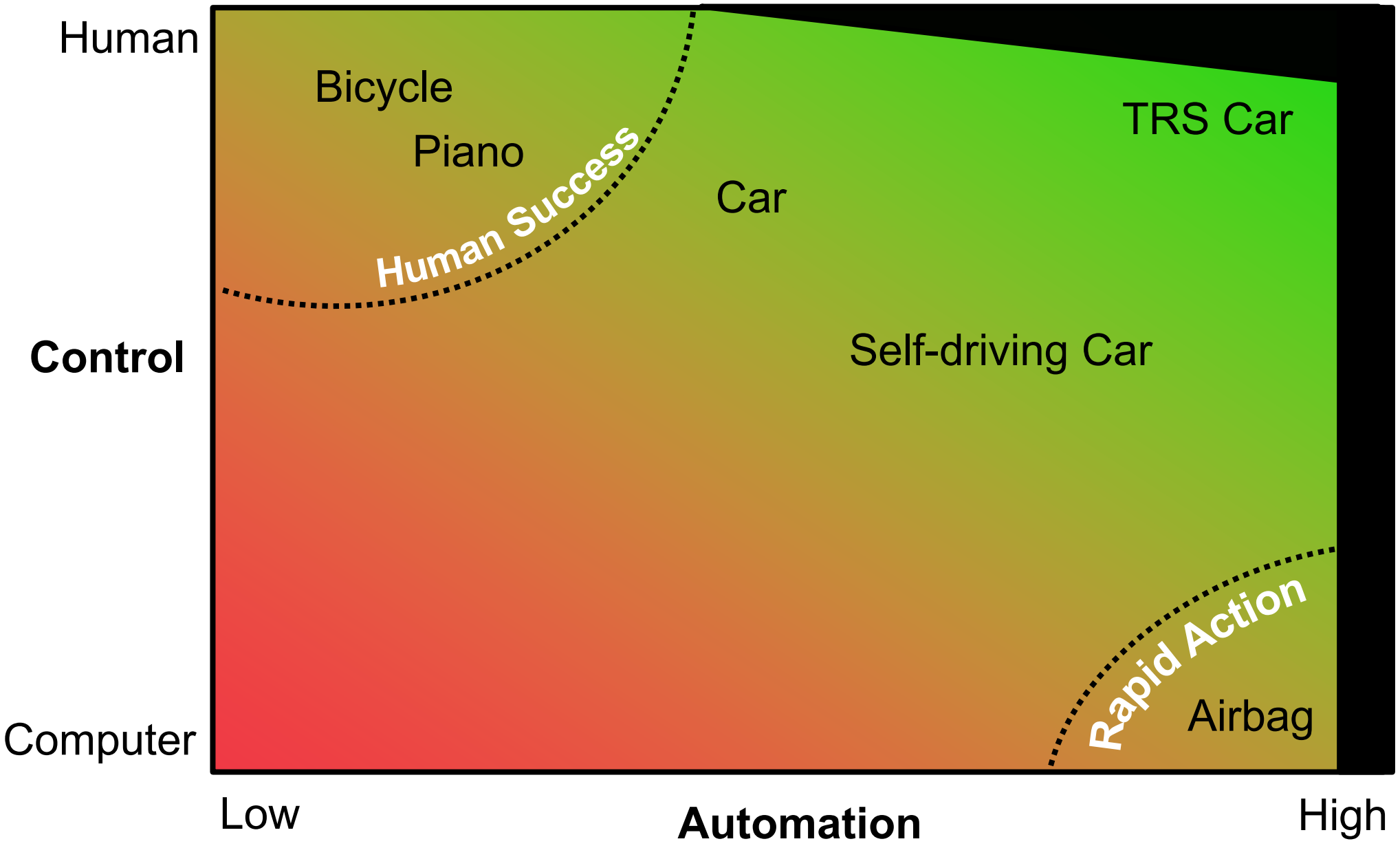

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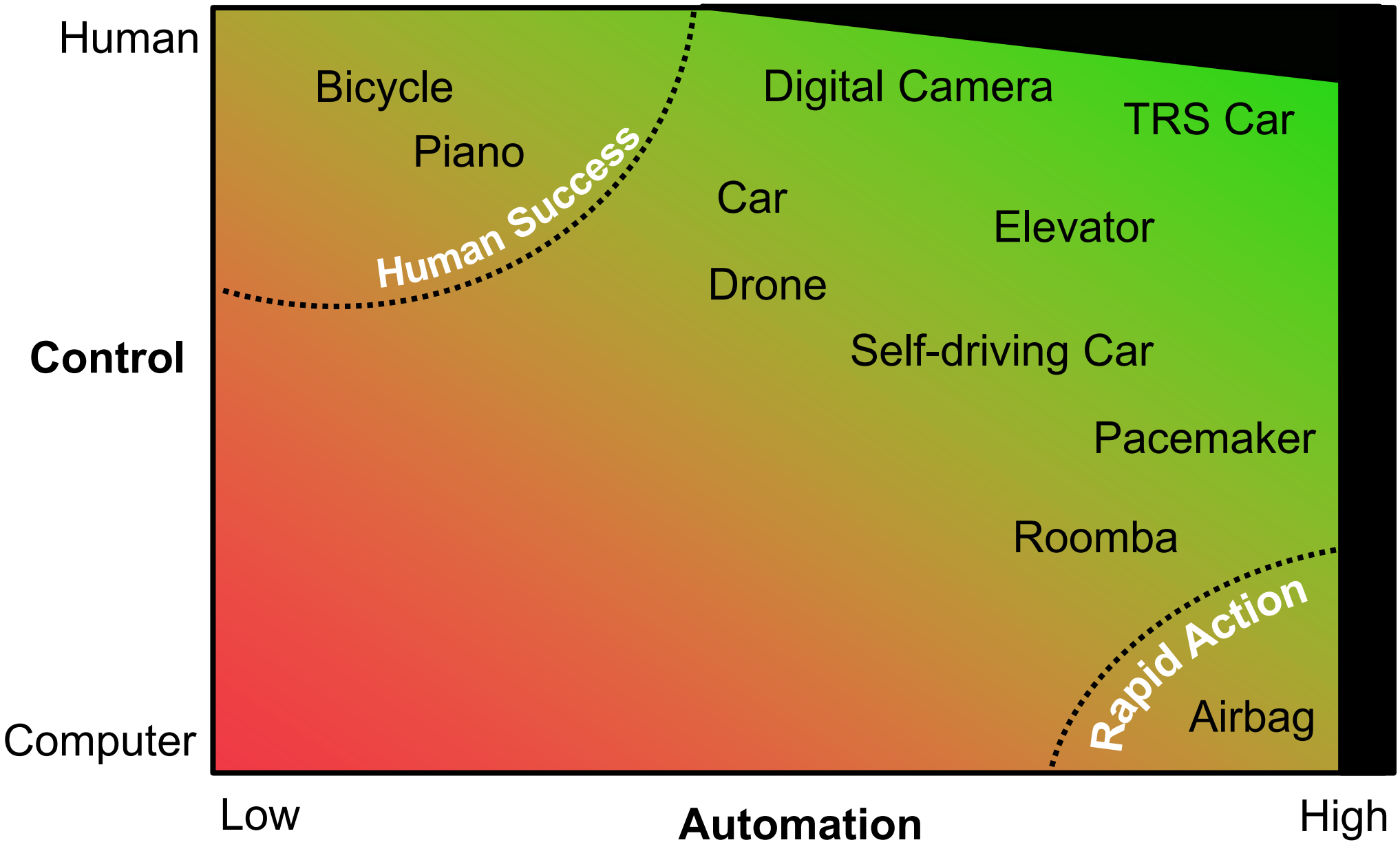


Take Away Message

Goal: High level of human control & automation

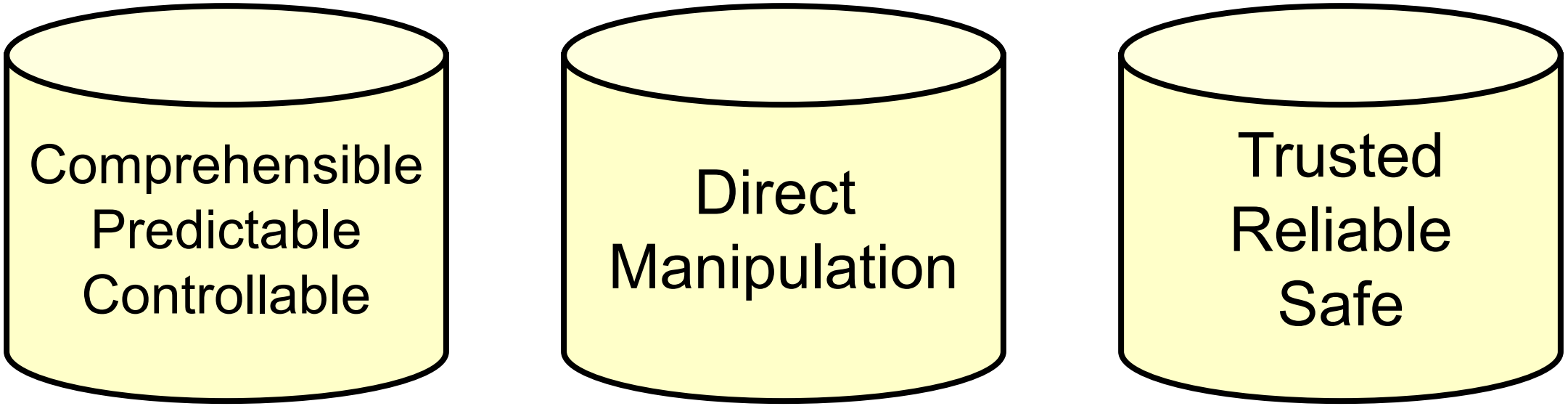
→ TRS: Trusted, Reliable & Safe

→ Comprehensible, predictable & controllable

→ Continuous display of status

→ Informative feedback

Design Principles for Powerful Tools



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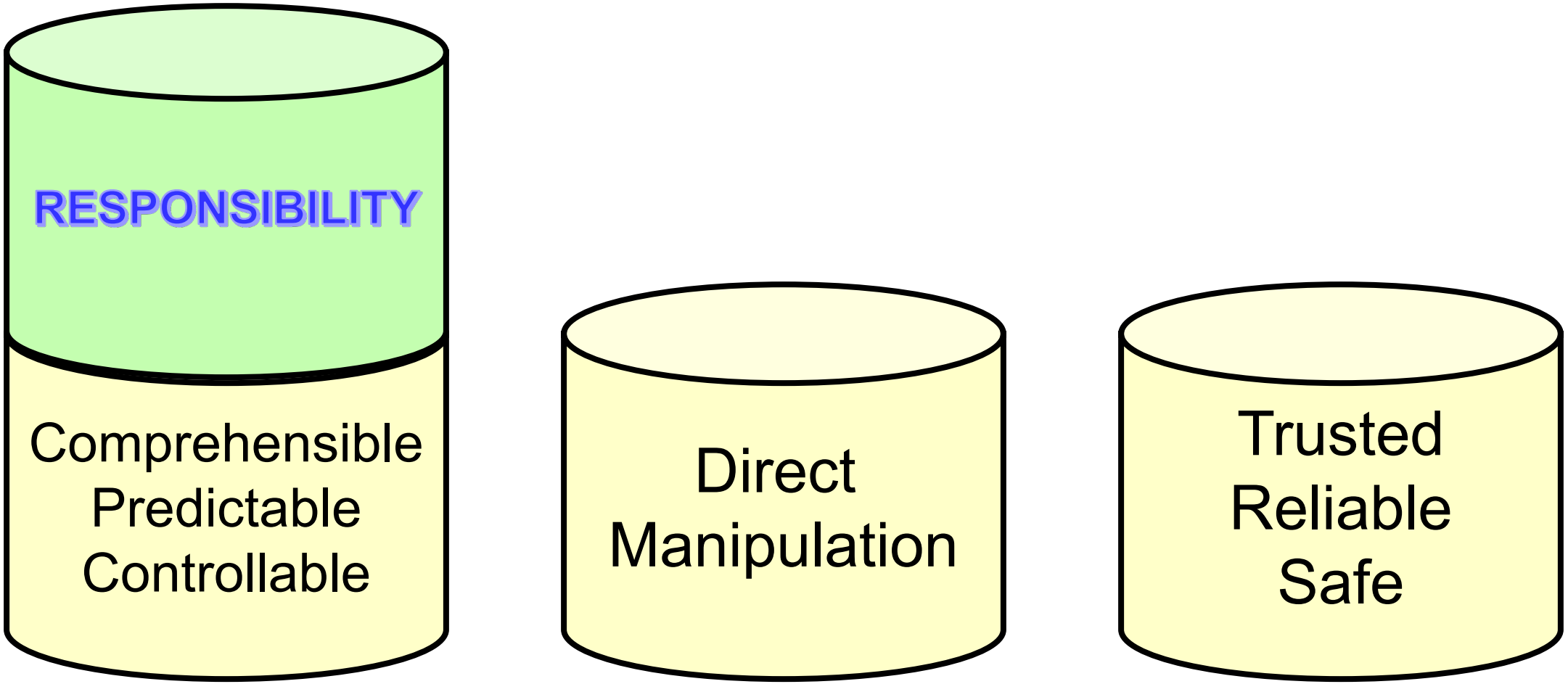

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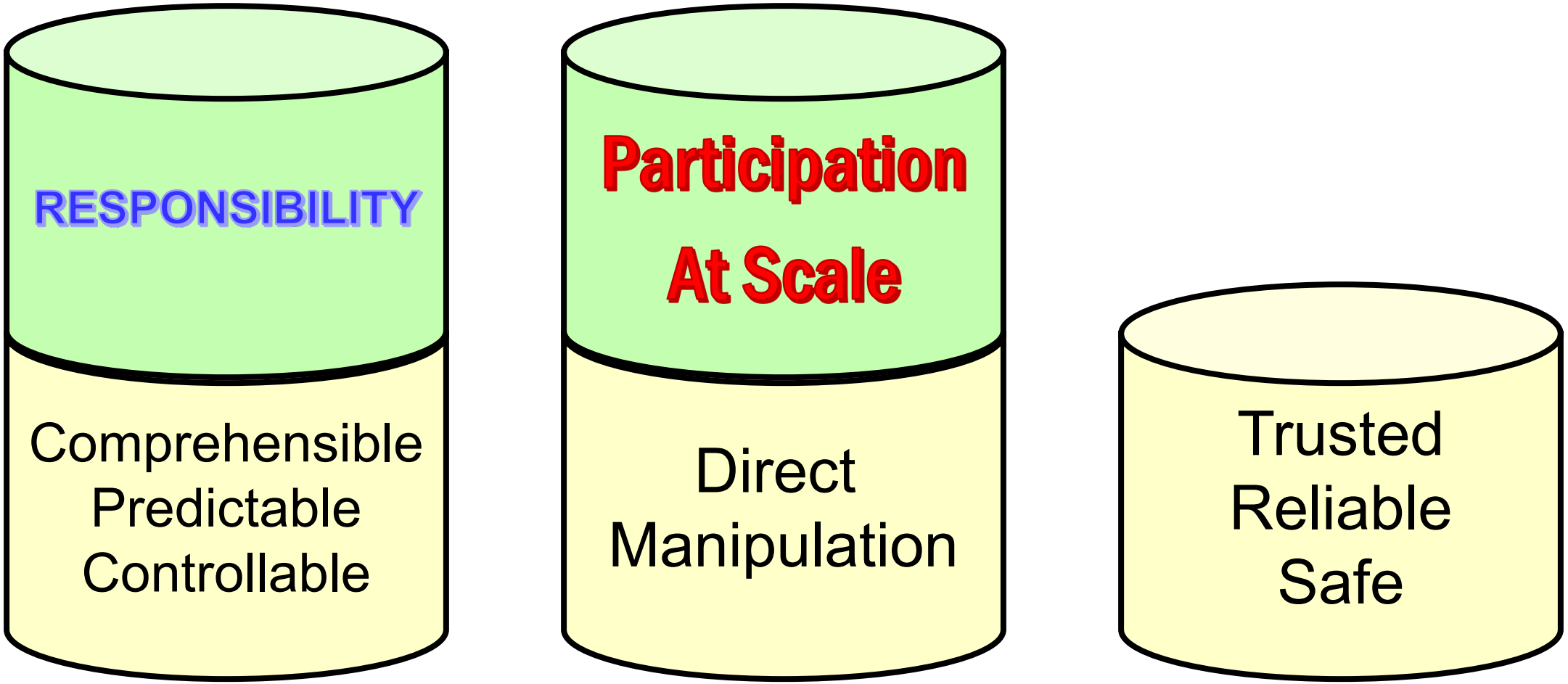

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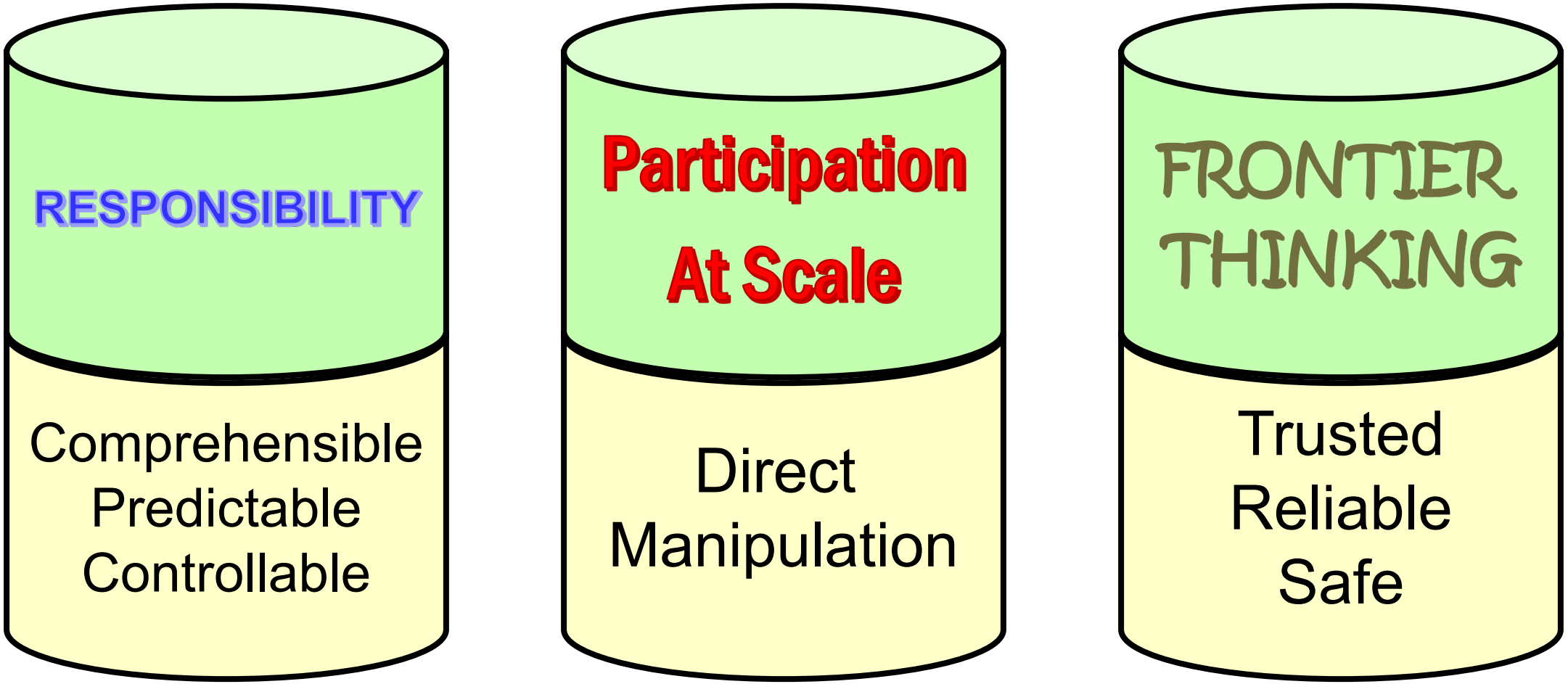

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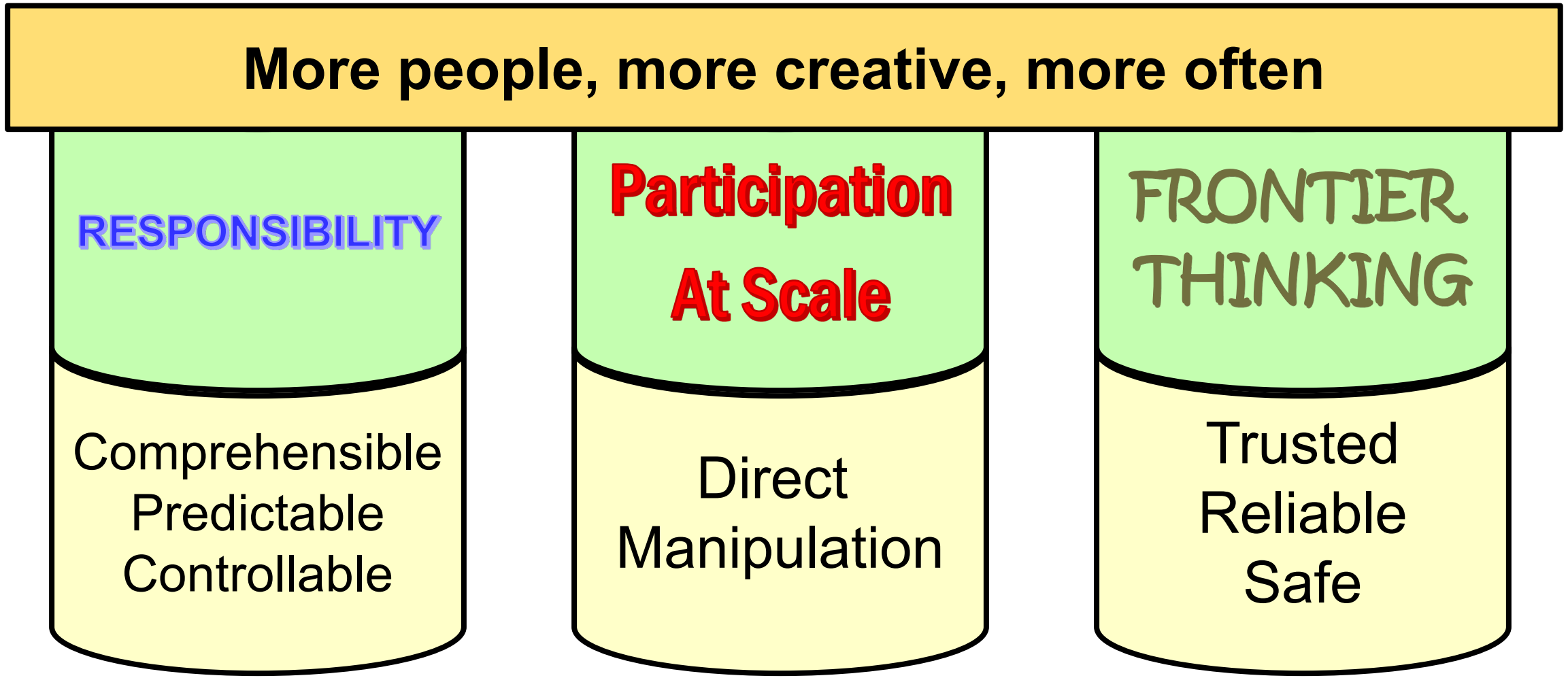

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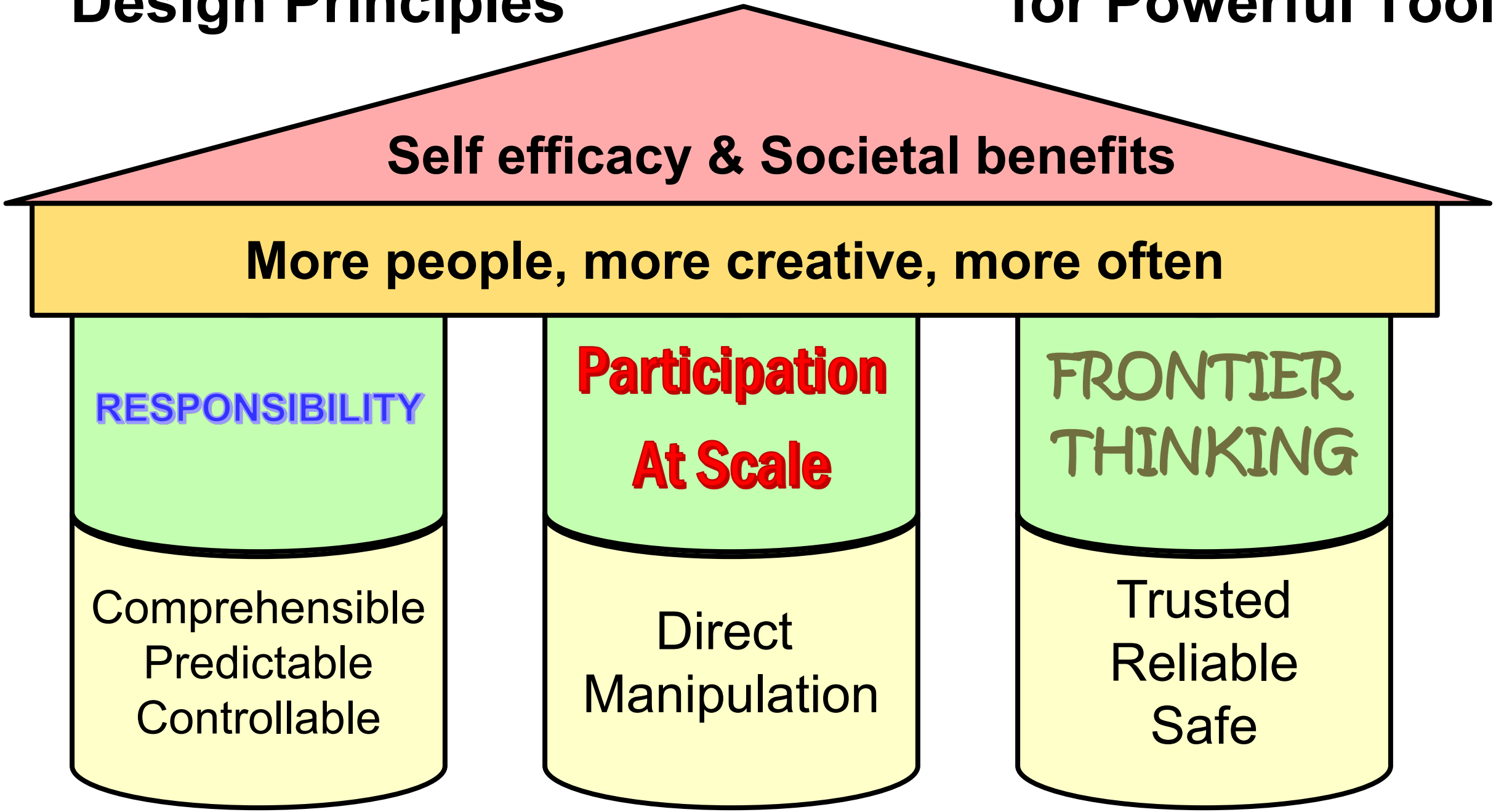

RESPONSIBILITY

RESPONSIBILITY

Accountability, Liability, Fairness, Transparency, Explainability & Interpretability

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- **A**udit trails to review failures & near misses
- **B**enchmark tests for verification & validation
- **C**ontinuous improvement & process monitoring
- **D**ata quality & bias testing

RESPONSIBILITY

Accountability, Liability, Fairness, Transparency, Explainability & Interpretability

Seek culture of safety by independent oversight

- Government regulation
- Insurance companies require standards
- Accounting firms audit systems
- Voluntary industry plans: Partnership on AI
- Professional societies promote education & ethics

Participation At Scale

Participation At Scale

Community, Cooperation, Collaboration, Contribution, Consensus & Consultation

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Community, Cooperation, Collaboration, Contribution, Consensus & Consultation

Skype, Slack, Zoom, Webex,... Dropbox, Google Docs, Wikipedia, Intellipedia, PatientsLikeMe,...

Participation At Scale

Community, Cooperation, Collaboration, Contribution, Consensus & Consultation

Skype, Slack, Zoom, Webex,... Dropbox, Google Docs, Wikipedia, Intellipedia, PatientsLikeMe,... Innocentive, Kickstarter, GoFundMe, Open Science,... Citizen science, Community safety, Medical advice, ...

FRONTIER THINKING

Human creativity pushes past the frontier

Steam Ship → Diesel Train → Gasoline Engine → Electric Cars → TRS Cars → ???

Computers → Local Area Networks → Internet → WWW → Social Media → ???

Mainframe Programs → Desktop Applications → Websites → Mobile Apps → ???

FRONTIER THINKING

Assembly Language → FORTRAN → C → C++
→ Java → Python → ???

Microscope → X-Ray → MRI → CAT Scan
→ Sonogram → PET Scan → ???

Daguerrotype → Tintype → Kodak Camera
→ Polaroid Camera → SLR → Digital Camera

Rationalism vs Empiricism

Rationalism: logical perfectability of human endeavors

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Next Generation User Experiences

- Humanoid robots fade as superior designs appear
- Excessive automation gives way to human control

Next Generation User Experiences

⬇ Humanoid robots fade as superior designs appear

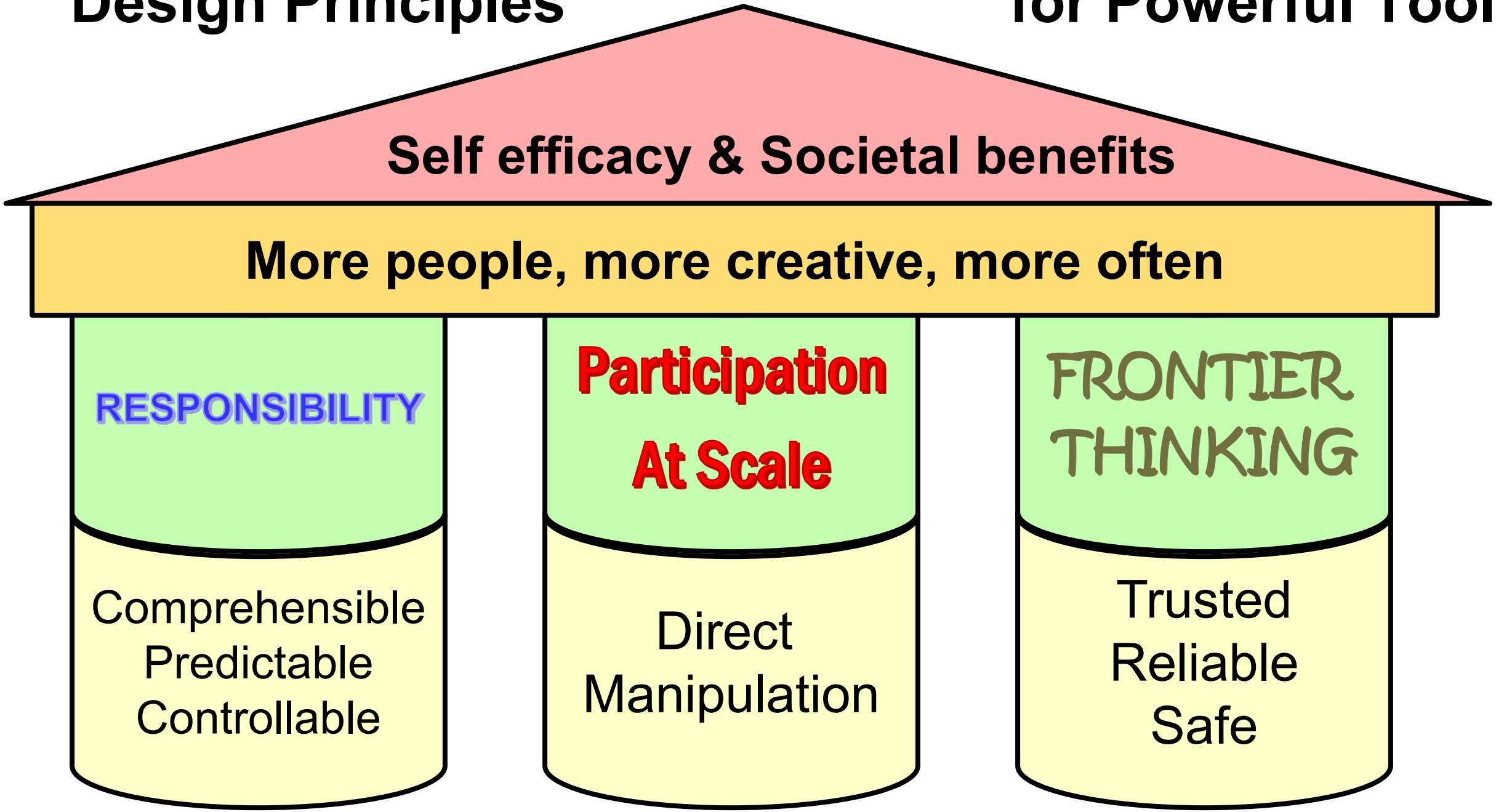
⬇ Excessive automation gives way to human control

⬆ Clarifying **Responsibility** accelerates quality

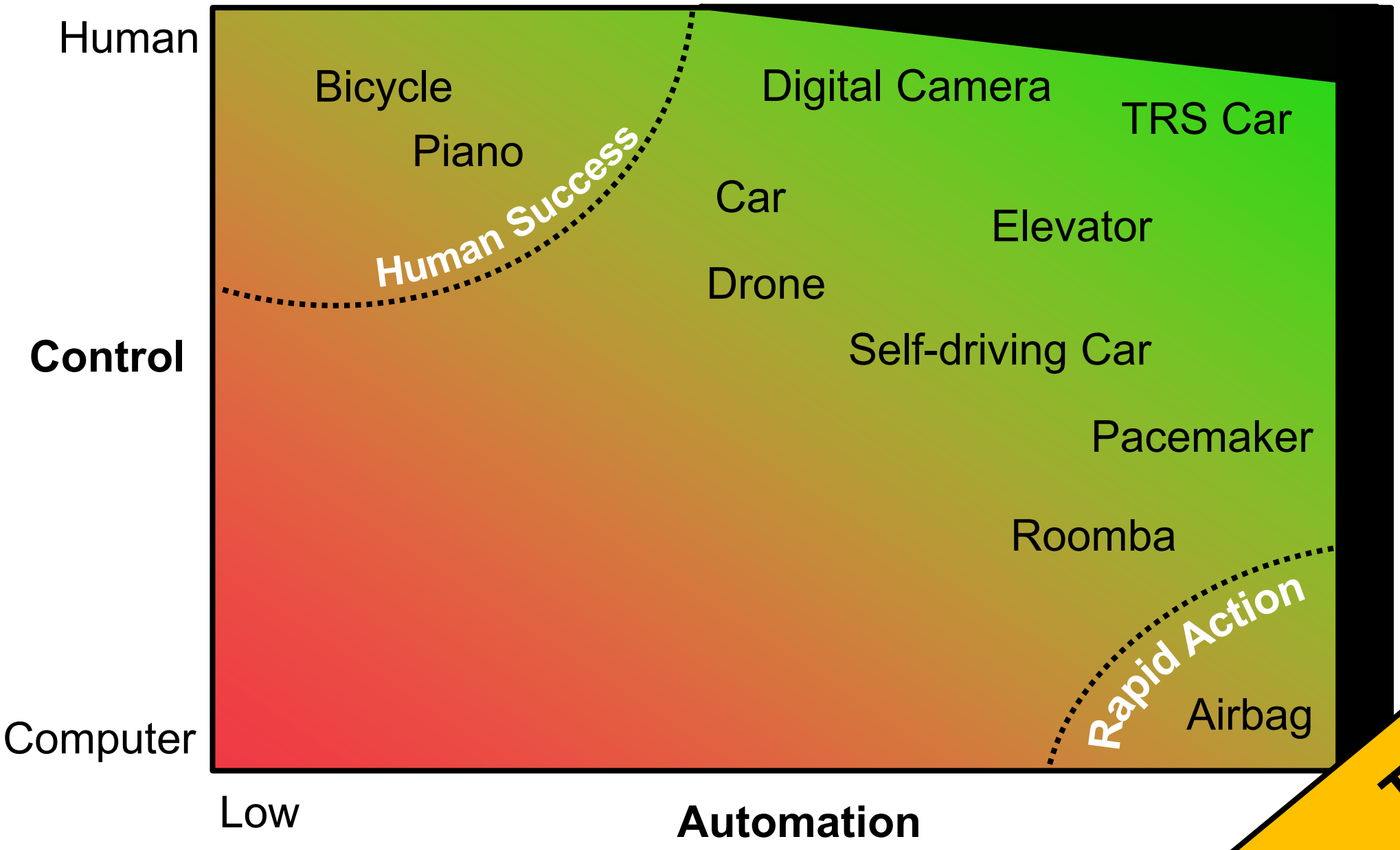
⬆ **Participation at Scale** delivers beneficial outcomes

⬆ **Frontier Thinking** enables breakthrough innovation

Design Principles for Powerful Tools



Landscape of Automation



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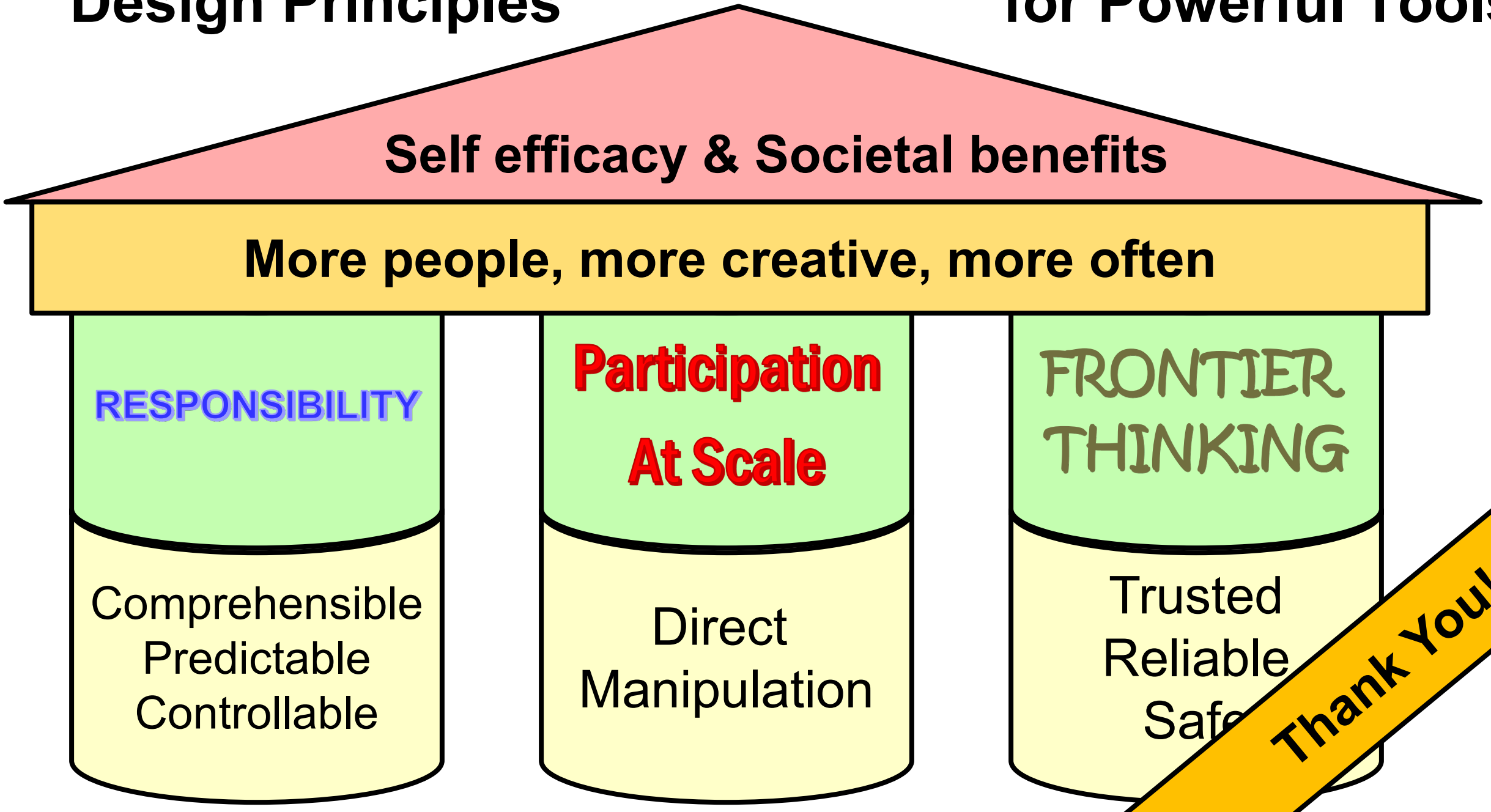
Design Principles for Powerful Tools