Jose de Francisco
R&D World Summit Chair

Human Factors Engineering & Experience Design

Professional Affiliations:

- MIT CTO Program | Class of 2024
- IEEE Systems, Man and Cybernetics
- Human Factors & Ergonomics Society
- Aspen Institute Society of Fellows
- Fmr. Bell Labs Distinguished Technologist
- Fmr. IEEE CQR Distinguished Speaker

Human Scale AI

Boston | October 15-17, 2025

linkedin.com/
in/innovarista/

DISCLAIMER: This presentation shares selected insights from my MIT CTO Program coursework (2023-24) for discussion and exploration purposes. Viewpoints and insights articulated here are solely my own and do not represent third-party endorsements or necessarily reflect the views of others.

jose.de.francisco@professional.mit.edu


"You can't improve what you don't measure"
Peter Drucker 1909-2005
"This expression emphasizes the importance of quantifying performance or behavior in order to understand, control, and improve it—especially relevant in fields like human-centered design and AI systems."
Hilton
BOSTON LOGAN AIRPORT


R&D Innovation Excellence
& Product Development


the
innovation
gap
Hilton


Business Design!
IDEO defines it as a way of operating that com the
tools of business thinkers, analysts, and strate with the
methods and mindsets of design.

Reimagining Design to Value (DtV) as Human Centered Artificial Intelligence (HC AI) Comes to Age

Businesses of all kinds are confronted with the excruciating need to stay relevant and outcompete by internalizing an emerging breed of game-changing principles that overwhelm conventional best practices.

A dramatic paradigm shift is taking effect as a rapidly evolving experience engineering stack emerges. Under this construct, deep user understanding and design Intelligence serve as the critical source of differentiation at unprecedented speed and scale.

Interconnecting and seamlessly integrating Customer Experience (CX) and User Experience (UX) Lifecycle Analytics is no longer an option, but integral to any enterprise's staying power because digital experiences can now be delivered as custom services that are intelligent and intuitive, all on demand, anywhere and anytime.

Today's reality emphasizes the necessity of excelling in scalable value creation, which overrides known standards and propels innovative trendsetters across industries.

STATE OF THE ART ◁ ▷ FUTURE ART

MAYA MOST ADVANCED YET ACCEPTABLE

MARKETS / TECHNOLOGY	RED OCEAN	BLUE OCEAN
GREEN FIELD		PERSONALIZED BLENDED EXPERIENCES AS A SERVICE XaaS INTELLIGENT & INTUITIVE DIGITAL SERVICE SUITE
BROWN FIELD		

ART OF THE POSSIBLE LONG TERM ENDEAVOR	FORWARD LOOKING VISION
MOONSHOT	BLUE SKY

"The best way to predict the future is to invent it" | Alan Kay

"It seems impossible until it's done" | Nelson Mandela

“You can’t improve what you don’t measure”

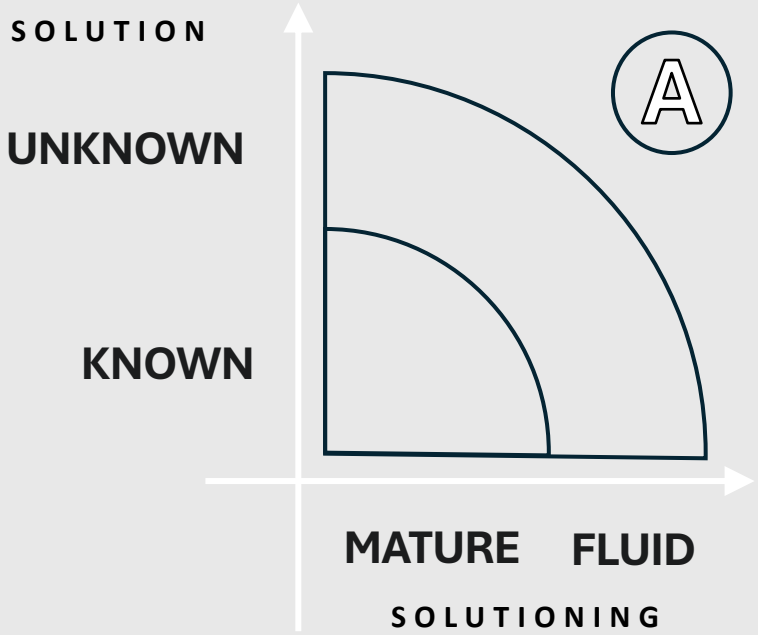
Peter Drucker 1909-2005

“This expression emphasizes the importance of quantifying performance or behavior in order to **understand**, **control**, and **improve** it—especially relevant in fields like **human-centered design** and **AI systems**.”

Microsoft Copilot

jose.de.francisco@professional.mit.edu

IVF | INTELLIGENCE VALUATION FRAMEWORK



B

VALUE DIMENSIONS	INCREMENTAL	NET NEW
DEPTH Specialized	PROGRESSIVE	TRANSFORMATIONAL
x WIDTH Interdisciplinary	EXPANSIVE	HOLISTIC

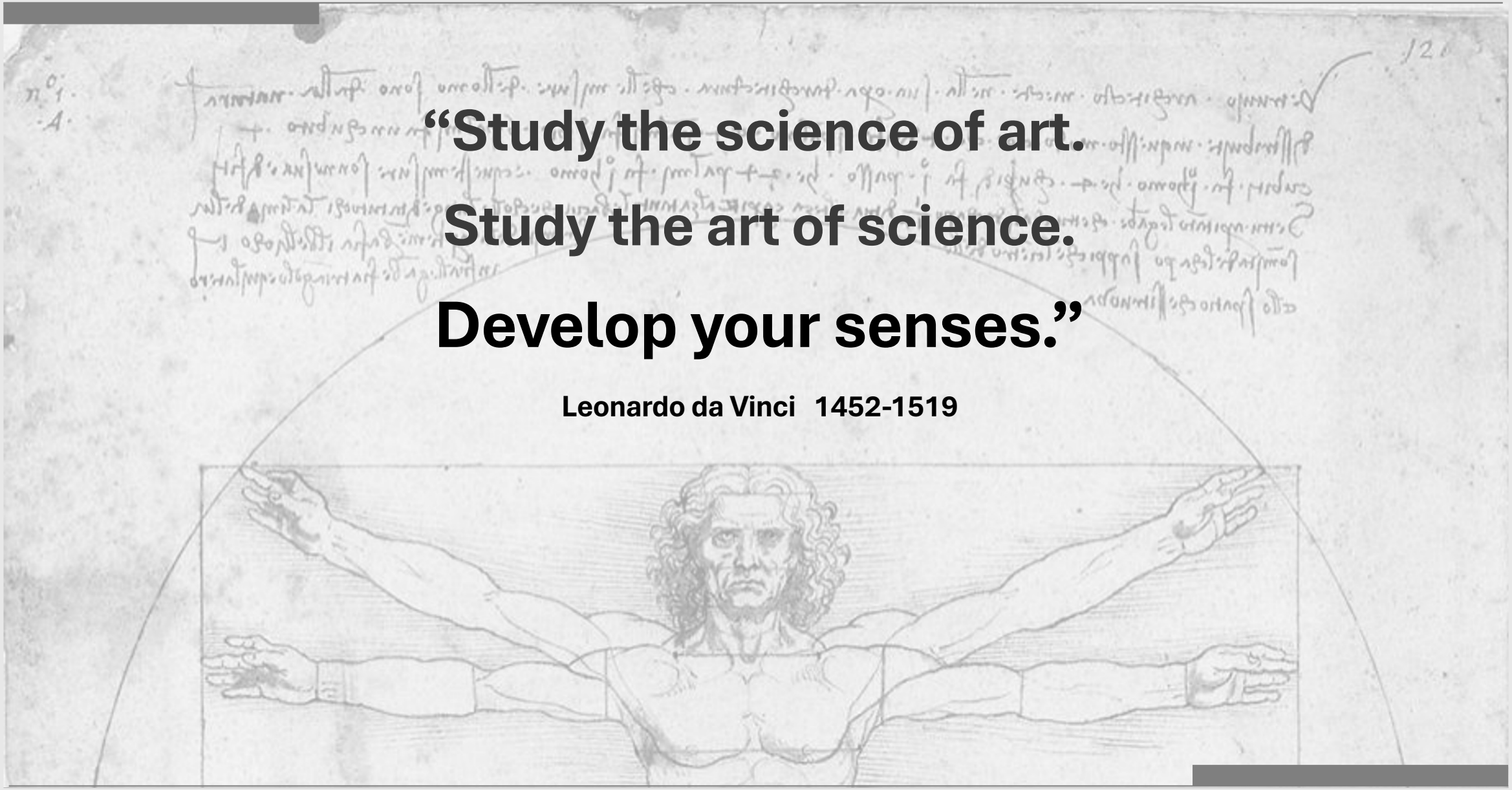
C **METHODS**

SUM OF THE PARTS	VALUE OF THE WHOLE	SUBSTITUTION EFFECT	NETWORK EFFECTS
OPPORTUNITY COST		SWITCHING COST	EXTERNALITIES

Human Scale Intro

*https://commons.wikimedia.org/wiki/File:Vitruvian.jpg

jose.de.francisco@professional.mit.edu



“Study the science of art.

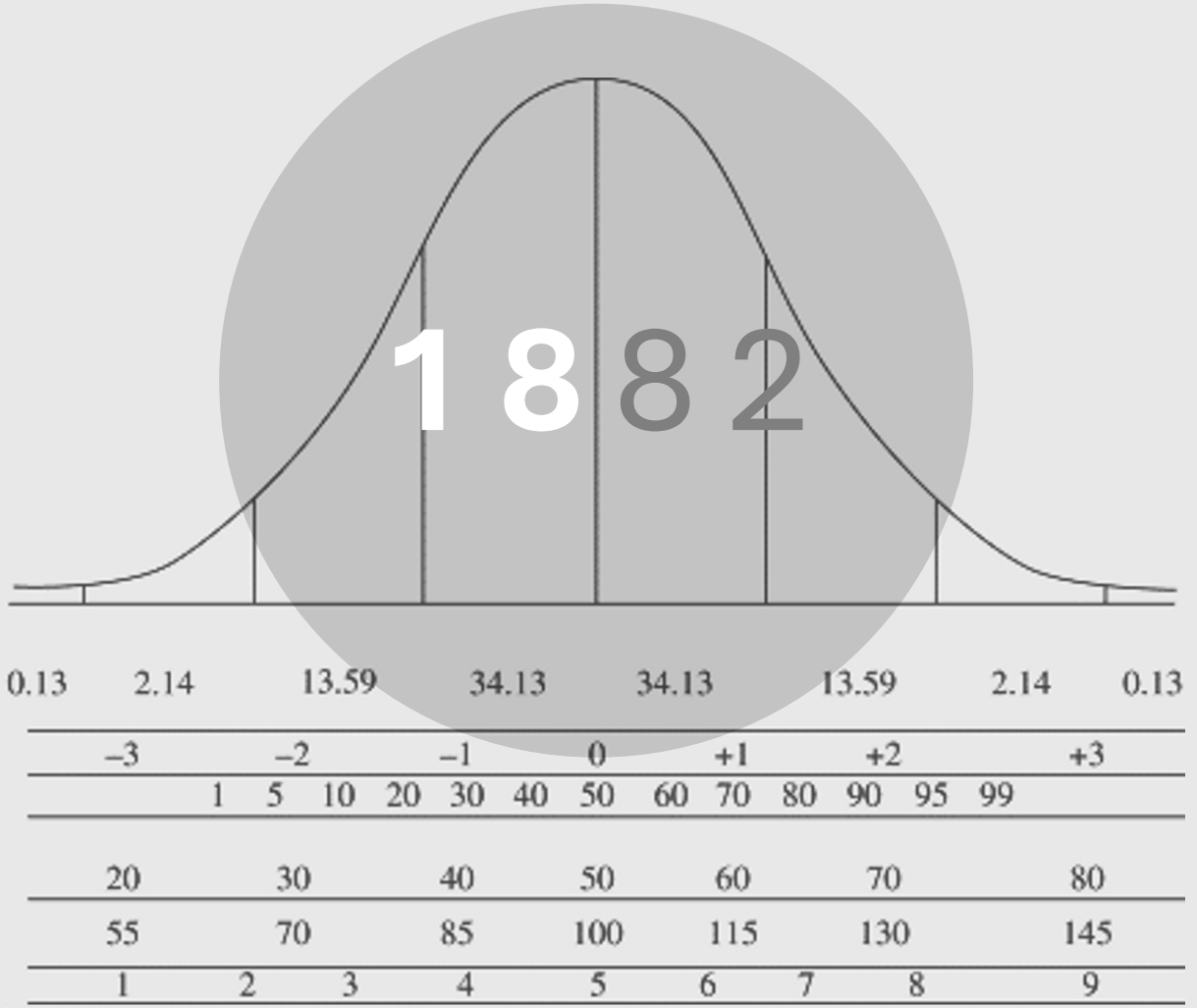
Study the art of science.

Develop your senses.”

Leonardo da Vinci 1452-1519

Intelligence:

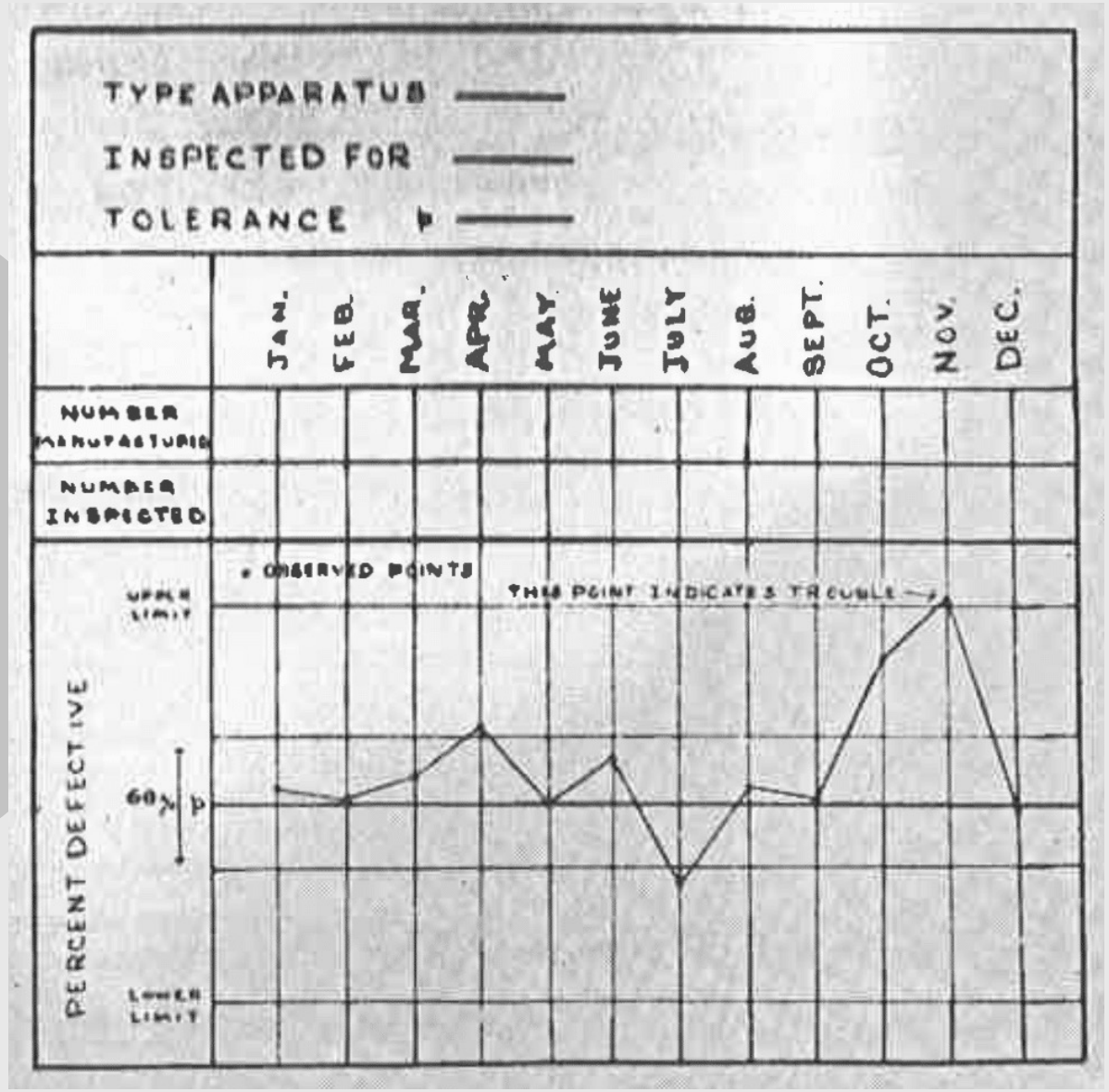
"Ability to
derive **information,**
learn from **experience,**
adapt to the **environment,**
understand and correctly
utilize **thought** and **reason.**"



https://dictionary.apa.org/intelligence

jose.de.francisco@professional.mit.edu

1924



1924 | SPC, Statistical Process Control

1948 | Information Theory

https://historyofinformation.com/detail.php?id=588

https://deming.org/the-first-control-chart/

jose.de.francisco@professional.mit.edu

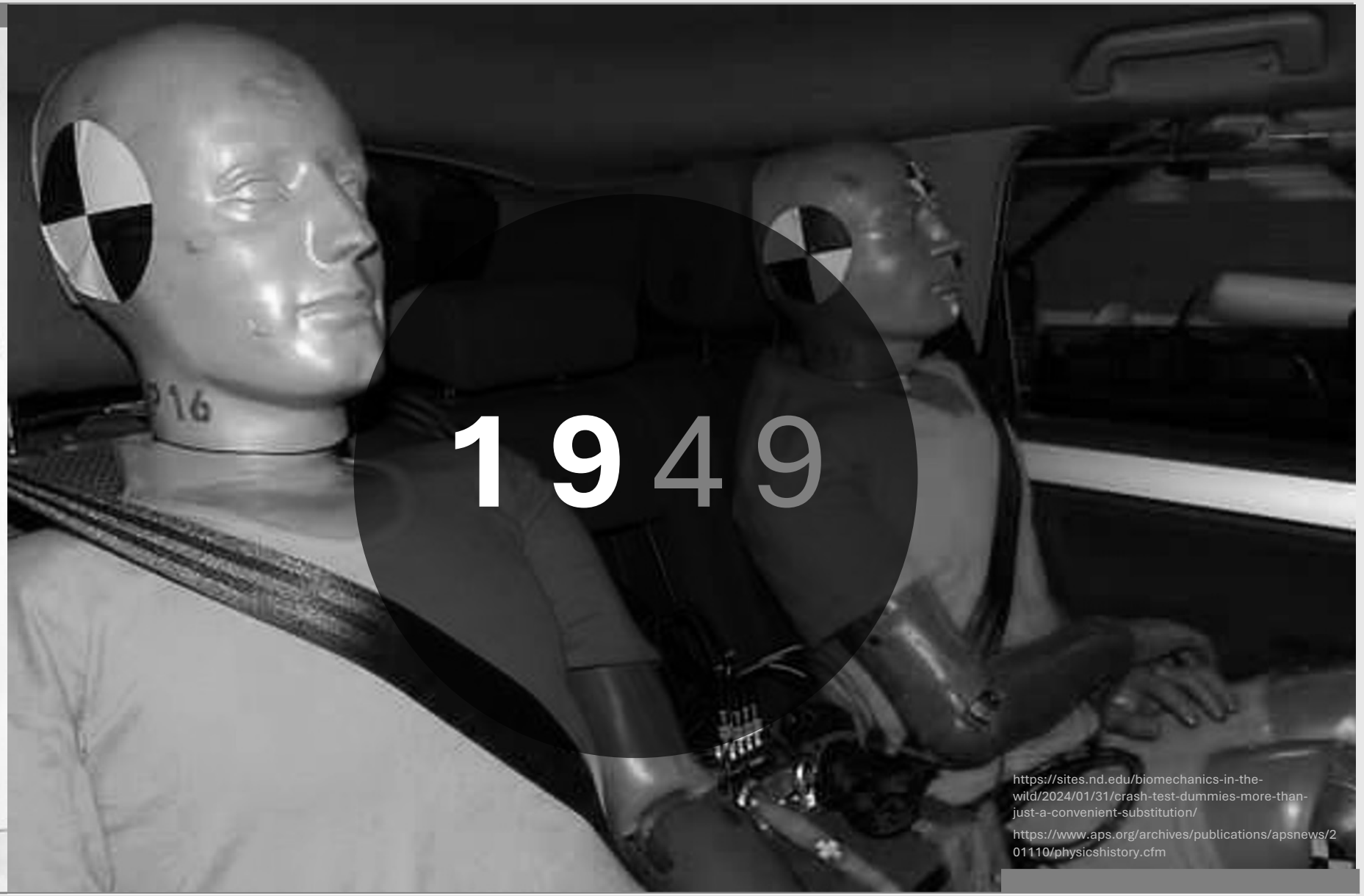
1947

Human Factors Engineering

Bell Labs' Fmr. User Preference Department

https://www.nytimes.com/2013/02/09/business/john-e-karlin-who-led-the-way-to-all-digit-dialing-dies-at-94.html

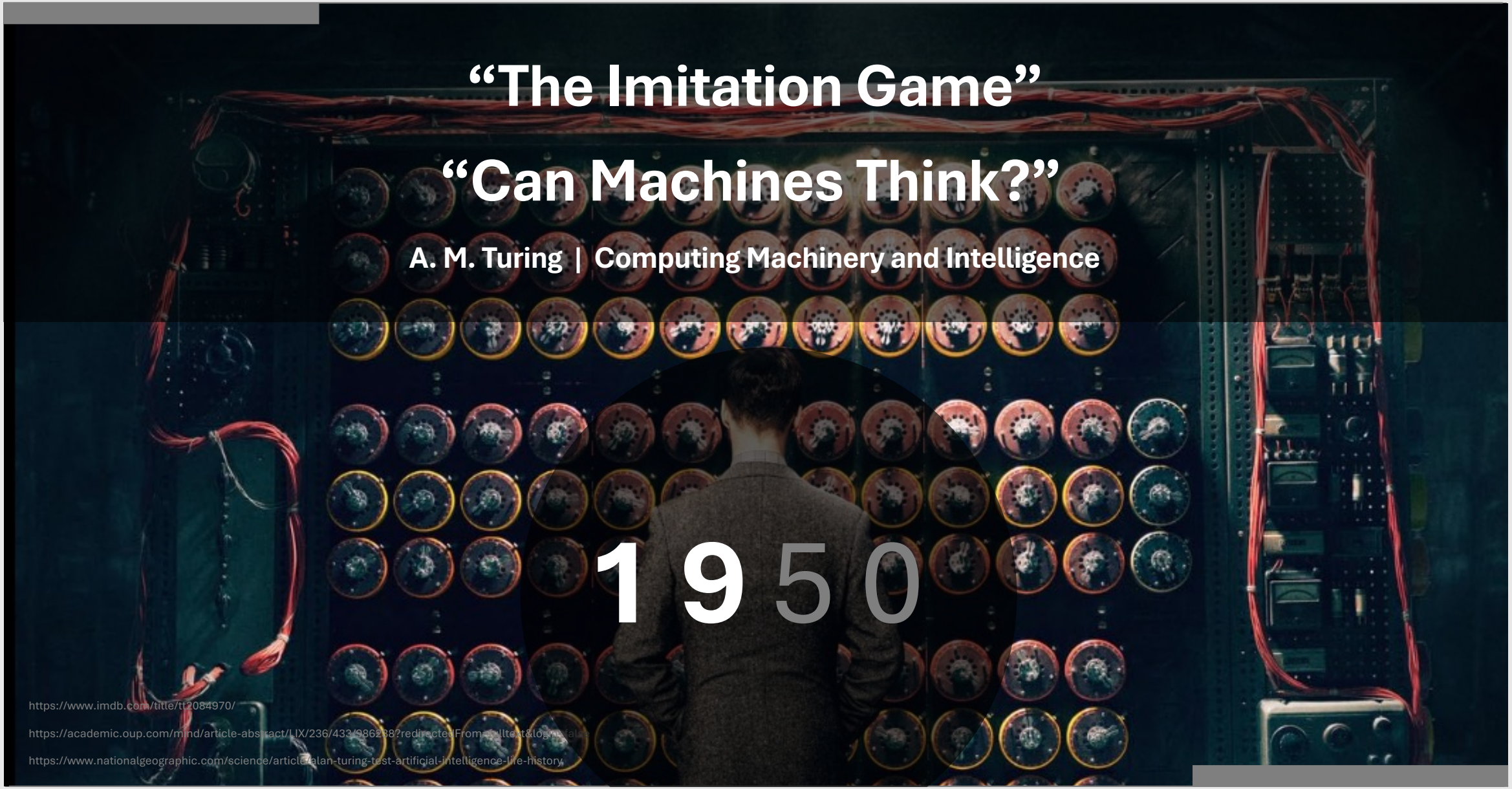
jose.de.francisco@professional.mit.edu



https://sites.nd.edu/biomechanics-in-the-wild/2024/01/31/crash-test-dummies-more-than-just-a-convenient-substitution/

https://www.aps.org/archives/publications/apsnews/201110/physicshistory.cfm

jose.de.francisco@professional.mit.edu



jose.de.francisco@professional.mit.edu

monday afternoon

december 9

3:45 p.m. / arena

Chairman:
DR. D. C. ENGELBART
Stanford Research Institute
Menlo Park, California

a research center for augmenting human intellect

This session is entirely devoted to a presentation by Dr. Engelbart on a computer-based, interactive, multiconsole display system which is being developed at Stanford Research Institute under the sponsorship of ARPA, NASA and RADC. The system is being used as an experimental laboratory for investigating principles by which interactive computer aids can augment intellectual capability. The techniques which are being described will, themselves, be used to augment the presentation.
The session will use on-line closed circuit television hook-up to the SRI computing system in Menlo Park.
Following the presentation remote terminals to the system, in operation, may be viewed during the remainder of the conference in a special room set aside for that purpose.

1968

THE MOTHER OF ALL DEMOS

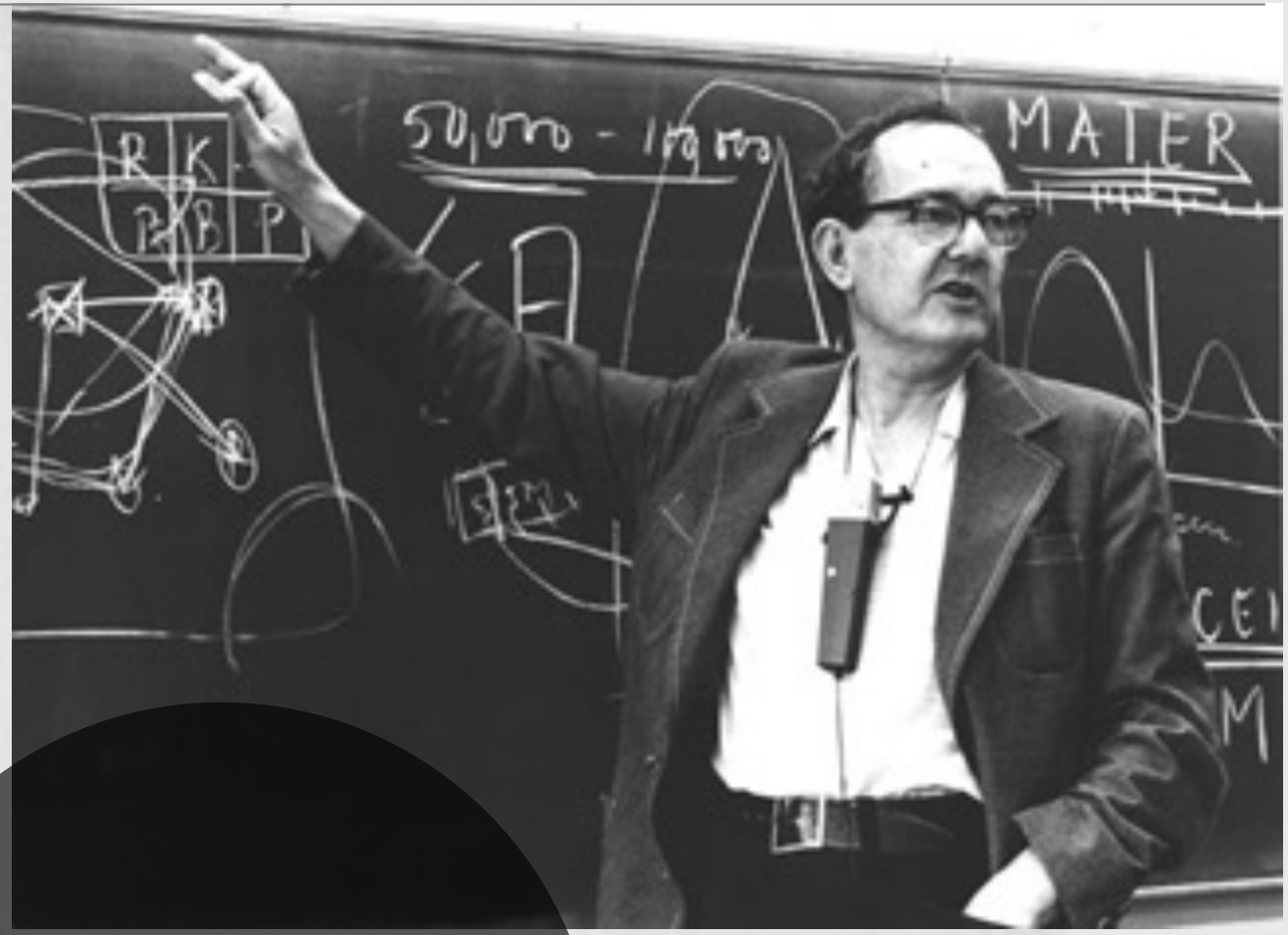
Mouse **Windowed Interfaces** **Video conferencing**

Hypertext **Collaborative real-time editing**

https://arstechnica.com/information-technology/2018/12/50-years-on-were-living-the-reality-first-shown-at-the-mother-of-all-demos/
https://www.computerweekly.com/photostory/2240107279/Photos-Celebrating-the-mother-of-all-demos/2/The-mother-of-all-demos

jose.de.francisco@professional.mit.edu

The Sciences of the Artificial

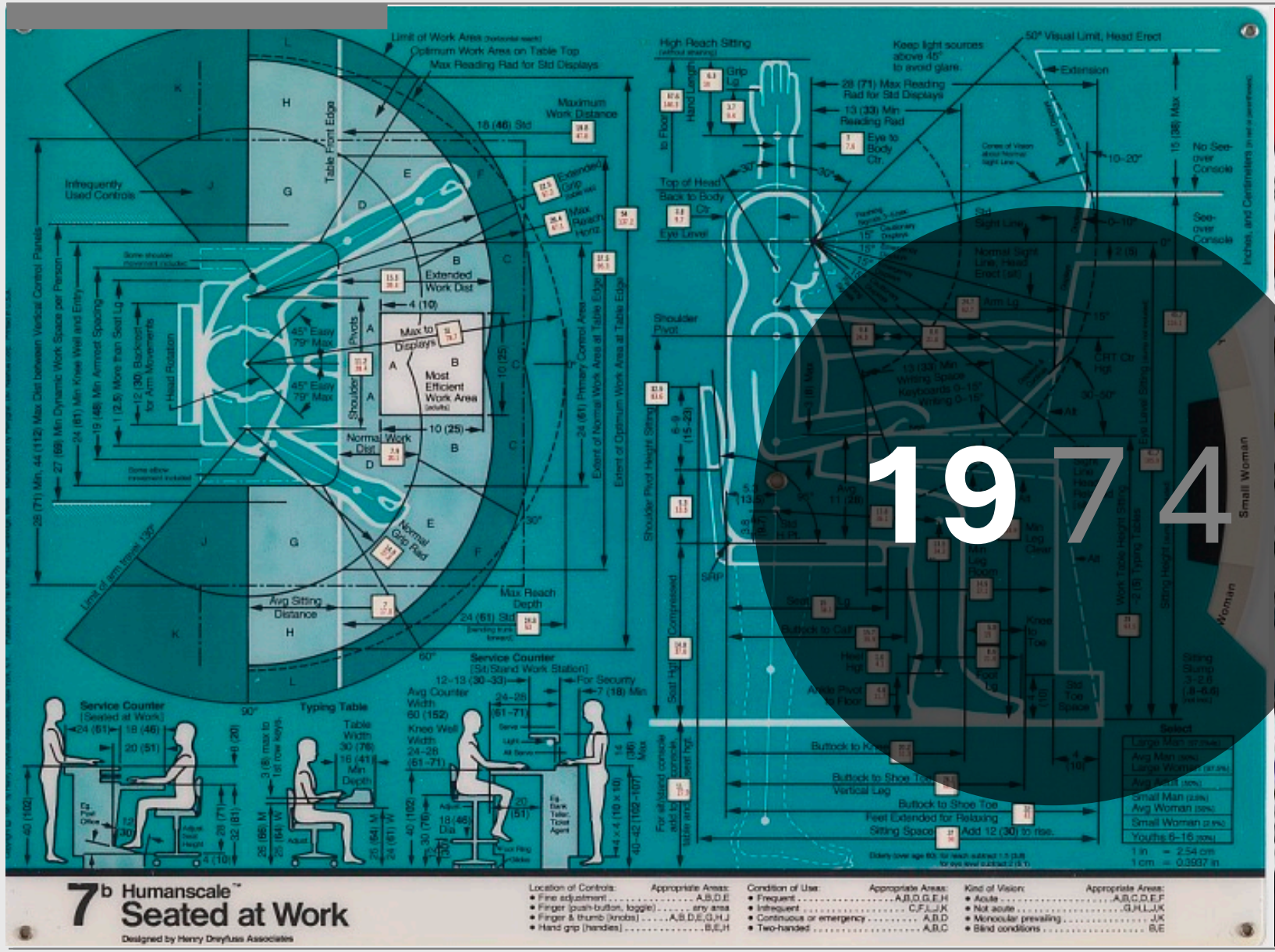


1969

https://monoskop.org/images/9/9c/Simon_Herbert_A_The_Sciences_of_the_Artificial_3rd_ed.pdf

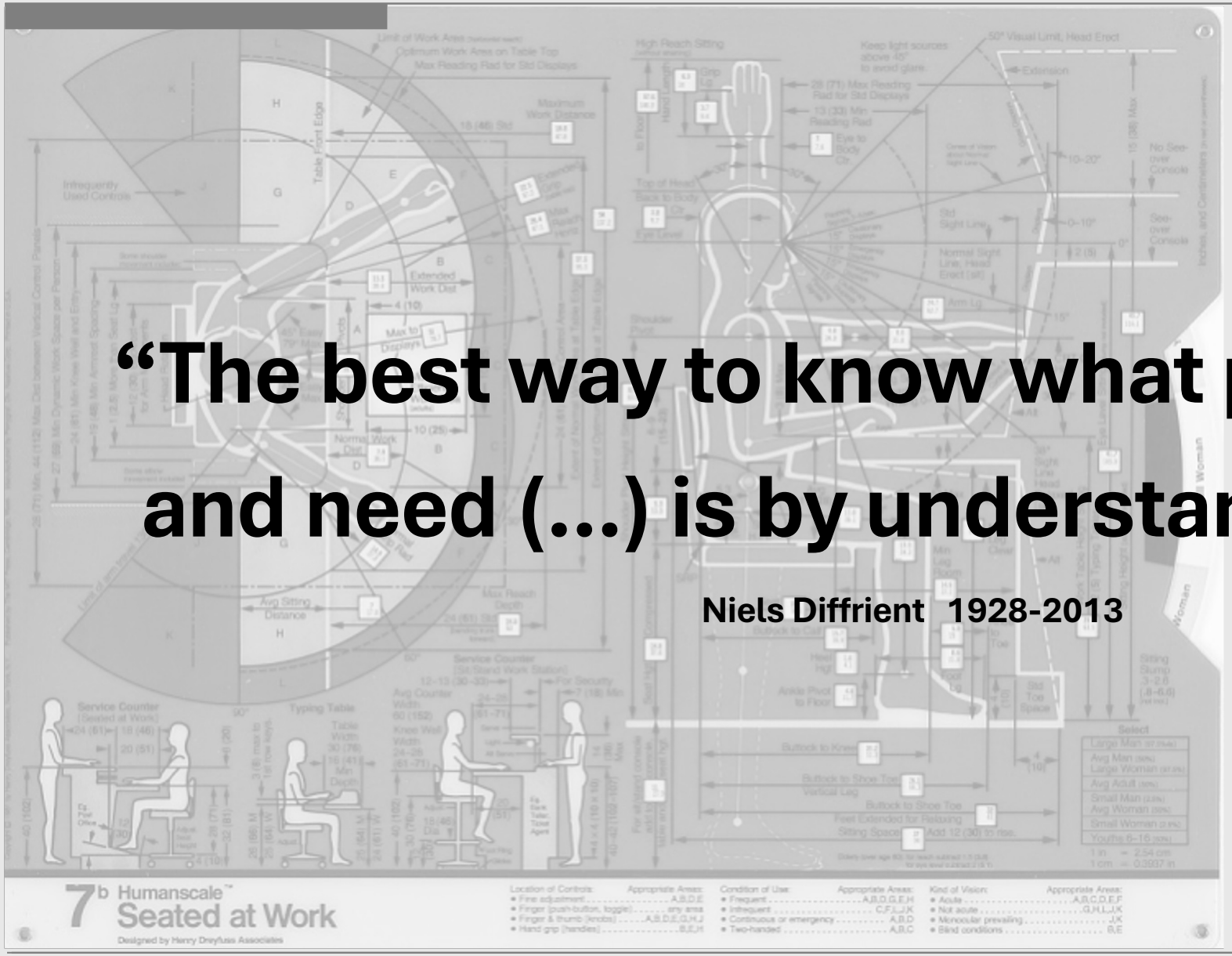
https://undsoc.org/wp-content/uploads/2011/01/simond2.gif

jose.de.francisco@professional.mit.edu



1974

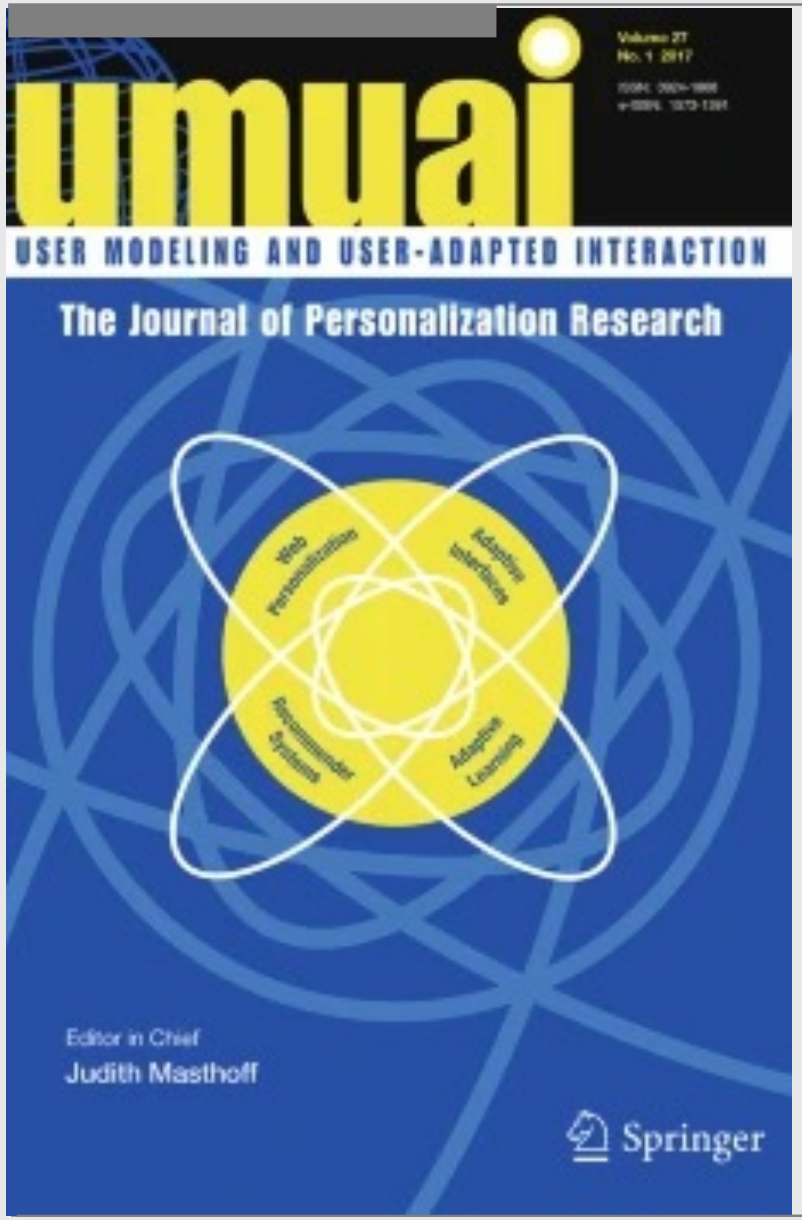
https://www.sciencedirect/chndm_15.2013.6



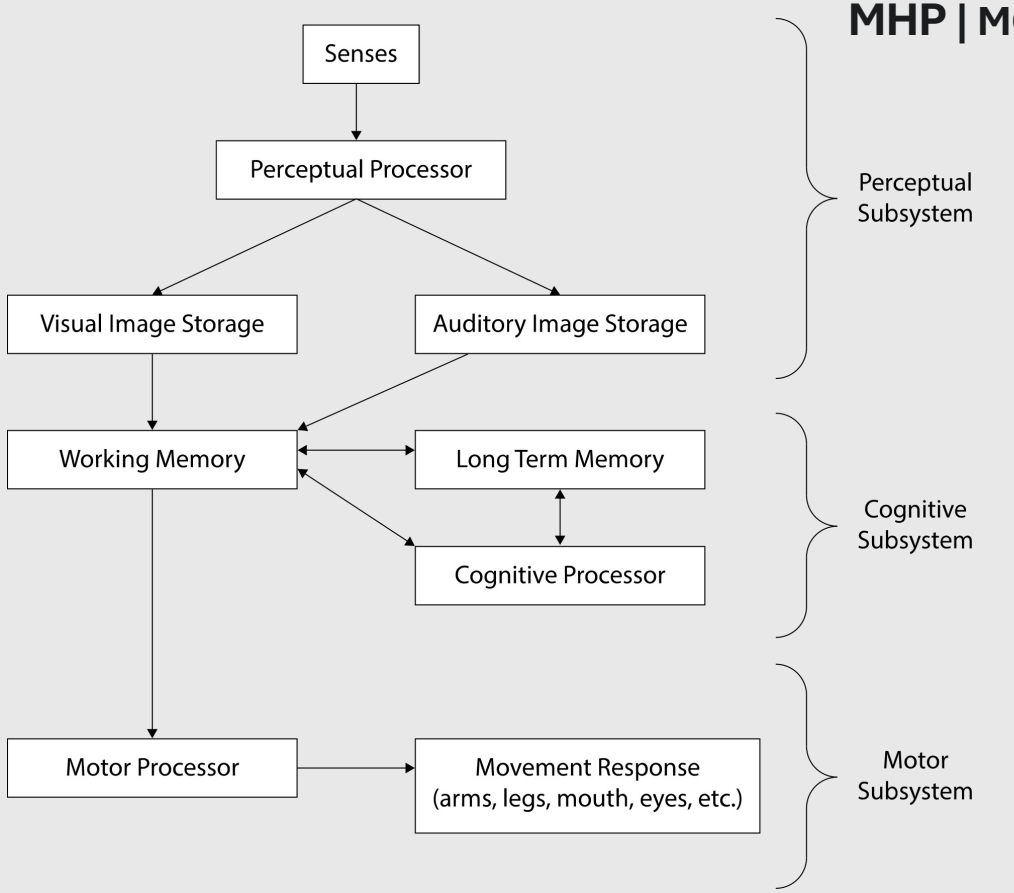
“The best way to know what people want and need (…) is by understanding them”

Niels Diffrient 1928-2013

https://www.si.edu/object/chndm_15.2013.6



User Modeling and User-Adapted Interaction provides an interdisciplinary forum for the dissemination of novel and significant original research results about interactive computer systems that can adapt themselves to their users, and on the design, use, and evaluation of user models for adaptation.



MHP | MODEL HUMAN PROCESSOR

1980s

Parameter	Mean	Range
Eye movement time	230 ms	70–700 ms
Decay half-life of visual image storage	200 ms	90–1000 ms
Visual Capacity	17 letters	7–17 letters
Decay half-life of auditory storage	1500 ms	900–3500 ms
Auditory Capacity	5 letters	4.4–6.2 letters
Perceptual processor cycle time	100 ms	50–200 ms
Cognitive processor cycle time	70 ms	25–170 ms
Motor processor cycle time	70 ms	30–100 ms
Effective working memory capacity	7 chunks	5–9 chunks
Pure working memory capacity	3 chunks	2.5–4.2 chunks
Decay half-life of working memory	7 sec	5–226 sec
Decay half-life of 1 chunk working memory	73 sec	73–226 sec
Decay half-life of 3 chunks working memory	7 sec	5–34 sec

https://www.um.org/conferences/past-conferences
https://link.springer.com/journal/11257

jose.de.francisco@professional.mit.edu

SUS

SYSTEM USABILITY SCALE

TLX

TASK LOAD INDEX

	The System Usability Scale Standard Version	Strongly Disagree					Strongly Agree
			1	2	3	4	5
1	I think that I would like to use this system frequently.		O	O	O	O	O
2	I found the system unnecessarily complex.		O	O	O	O	O
3	I thought the system was easy to use.		O	O	O	O	O
4	I think that I would need the support of a technical person to be able to use this system.		O	O	O	O	O
5	I found the various functions in this system were well integrated.		O	O	O	O	O
6	I thought there was too much inconsistency in this system.		O	O	O	O	O
7	I would imagine that most people would learn to use this system very quickly.		O	O	O	O	O
8	I found the system very awkward to use.		O	O	O	O	O
9	I felt very confident using the system.		O	O	O	O	O
10	I needed to learn a lot of things before I could get going with this system.		O	O	O	O	O

NASA Task Load Index

Hart and Staveland's NASA Task Load Index (TLX) method assesses work load on five 7-point scales. Increments of high, medium and low estimates for each point result in 21 gradations on the scales.

Name	Task	Date

Mental Demand — How mentally demanding was the task?

Very Low — Very High

Physical Demand — How physically demanding was the task?

Very Low — Very High

Temporal Demand — How hurried or rushed was the pace of the task?

Very Low — Very High

Performance — How successful were you in accomplishing what you were asked to do?

Perfect — Failure

Effort — How hard did you have to work to accomplish your level of performance?

Very Low — Very High

Frustration — How insecure, discouraged, irritated, stressed, and annoyed wereyou?

Very Low — Very High

1986

https://en.wikipedia.org/wiki/NASA-TLX

https://uxpajournal.org/item-benchmarks-system-usability-scale-sus/

jose.de.francisco@professional.mit.edu

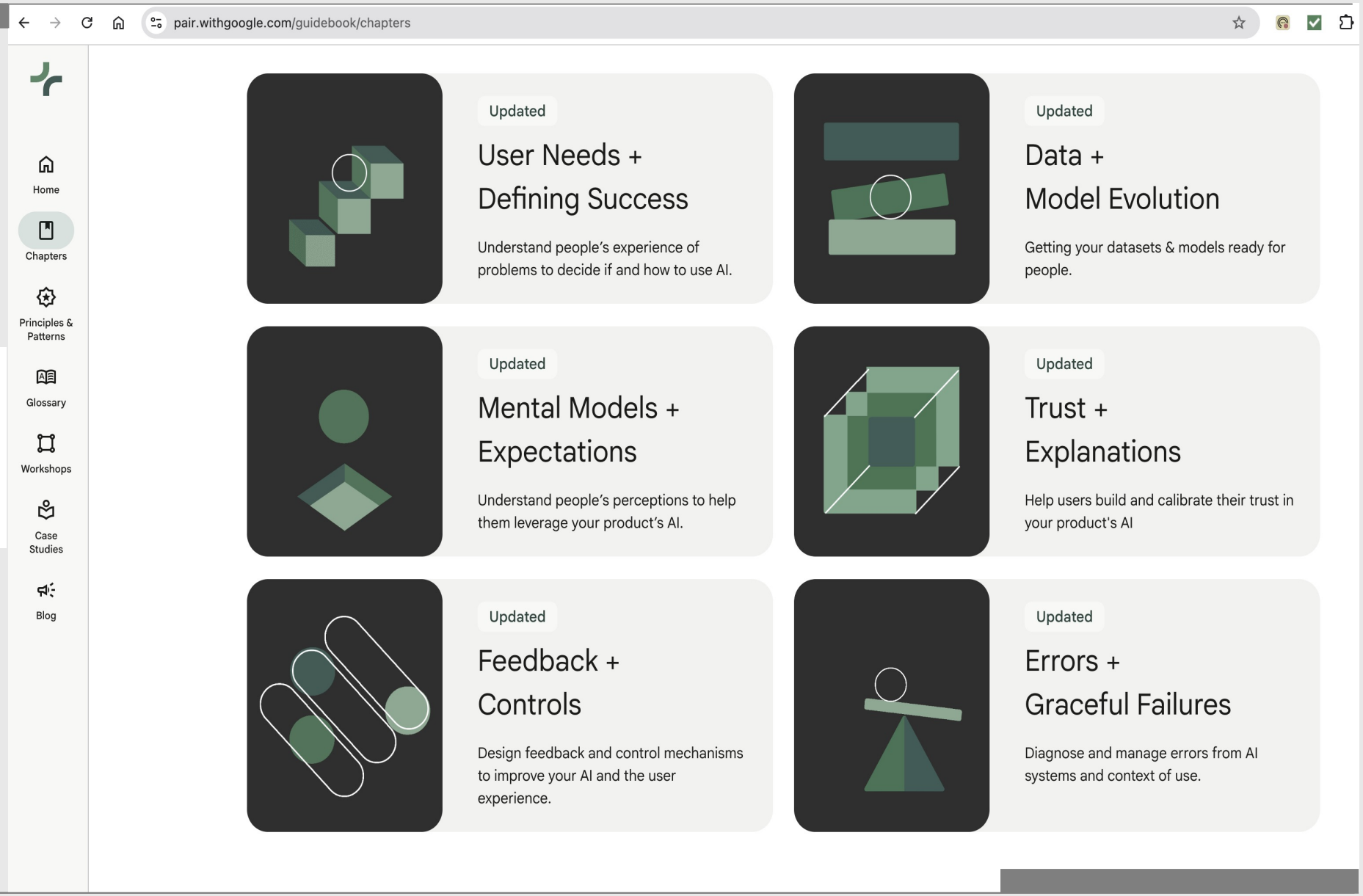
2010s

jose.de.francisco@professional.mit.edu

2017

People + AI Research

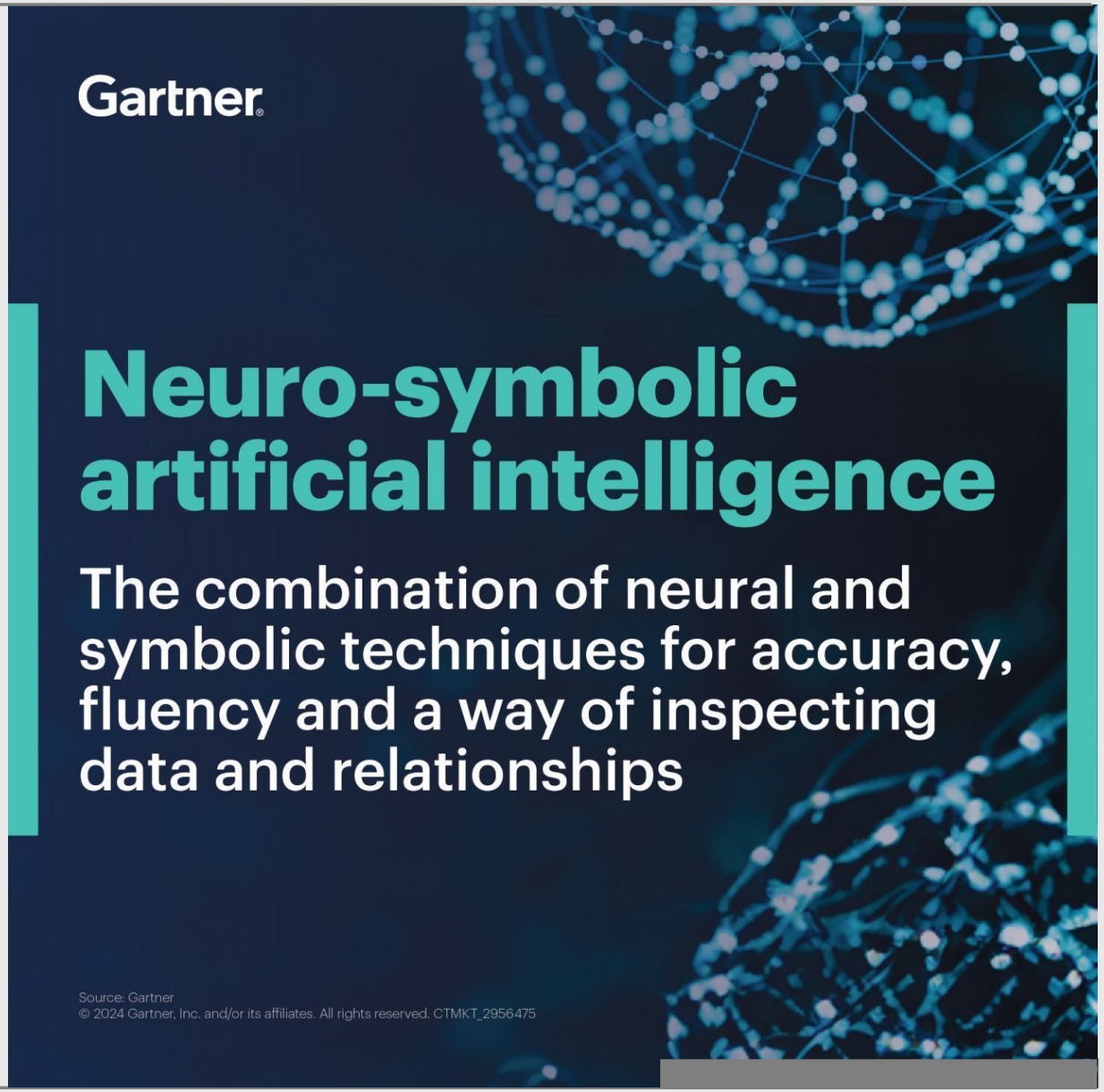
Google



https://pair.withgoogle.com/

2020s

Human Models **Reloaded**

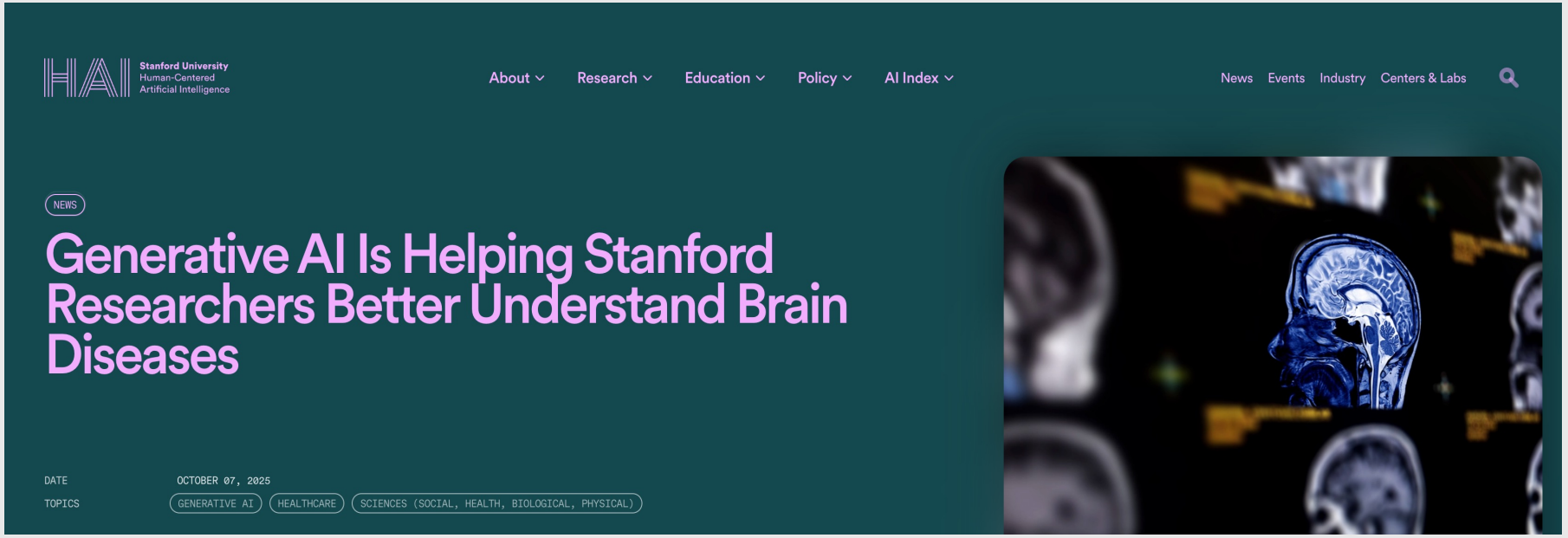


https://neurosymbolic-ai-journal.com/ https://www.youtube.com/watch?v=KATyAqPgDXw

jose.de.francisco@professional.mit.edu

2025

Metadata-conditioned generative models to synthesize anatomically-plausible 3D brain MRIs



"Synthetic brain MRI technology is supercharging computational neuroscience with massive data"

https://pubmed.ncbi.nlm.nih.gov/39208560/

https://hai.stanford.edu/news/generative-ai-is-helping-stanford-researchers-better-understand-brain-diseases

https://med.stanford.edu/news/all-news/2025/04/digital-twin.html

jose.de.francisco@professional.mit.edu

BENEFICIAL BY DESIGN

USER CENTERED

HUMAN SCALE AI

PEOPLE ORIENTED

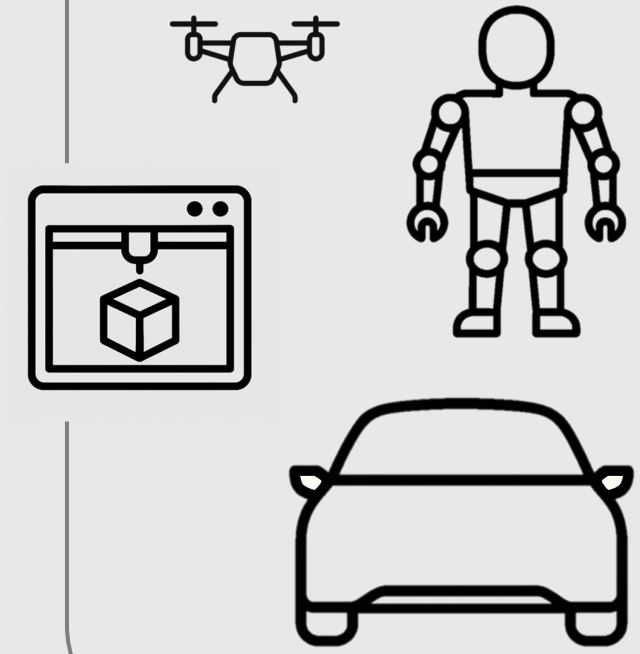
EXPANDING HUMANKIND's POSSIBILITIES

1. **HMS | Human Machine Systems**
2. **ACC | Agency Continuum Calibration**
3. **DSM | Dynamic System Modeling**
4. **AMA | Adaptable Machine Agency**
5. **Collective Intelligence | Macro cognition**
6. **Blended Intelligence | Metacognition**
7. **TOPS | Test Oriented Progressive Prototyping**
8. **HTI/OL | Human In/On The Loop | Autonomation**
9. **XQ | Experience Quality**
10. **X-QA | Experience Quality Assurance**
11. **CNE | Compounded Network Effects**
12. **Experience Models & Analytics**
13. **Service Design**
14. **Human Models**
15. **I2DS2 | Intelligent & Intuitive Digital Services Suite**
16. **Appendix**

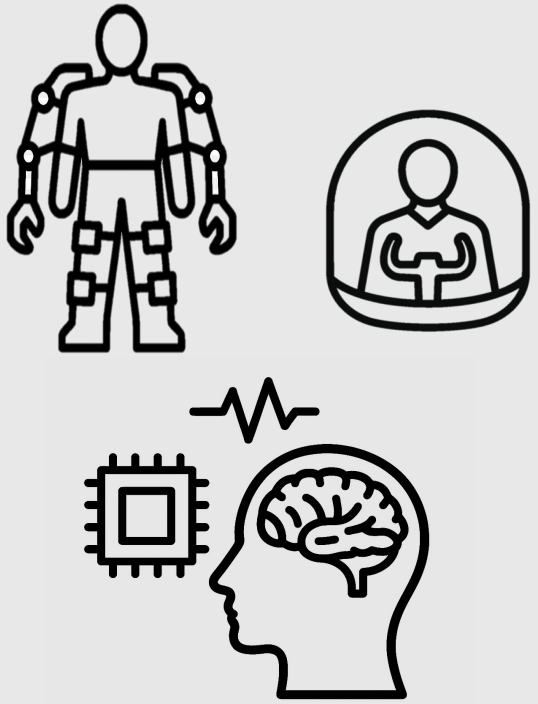
HMS | HUMAN MACHINE SYSTEMS

EVERYDAY AI EXPERIENCES

AUTONOMOUS & EMBODIED AI

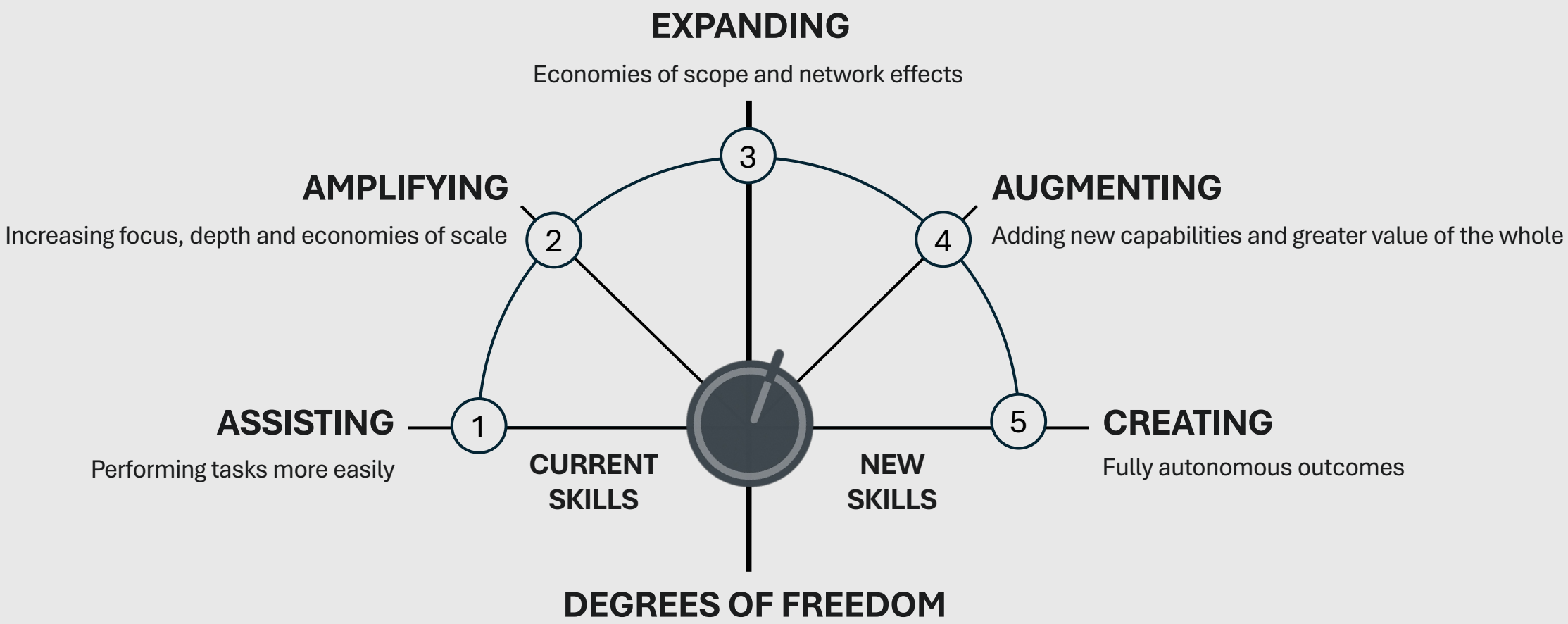


HUMAN SYSTEMS INTEGRATION HSI

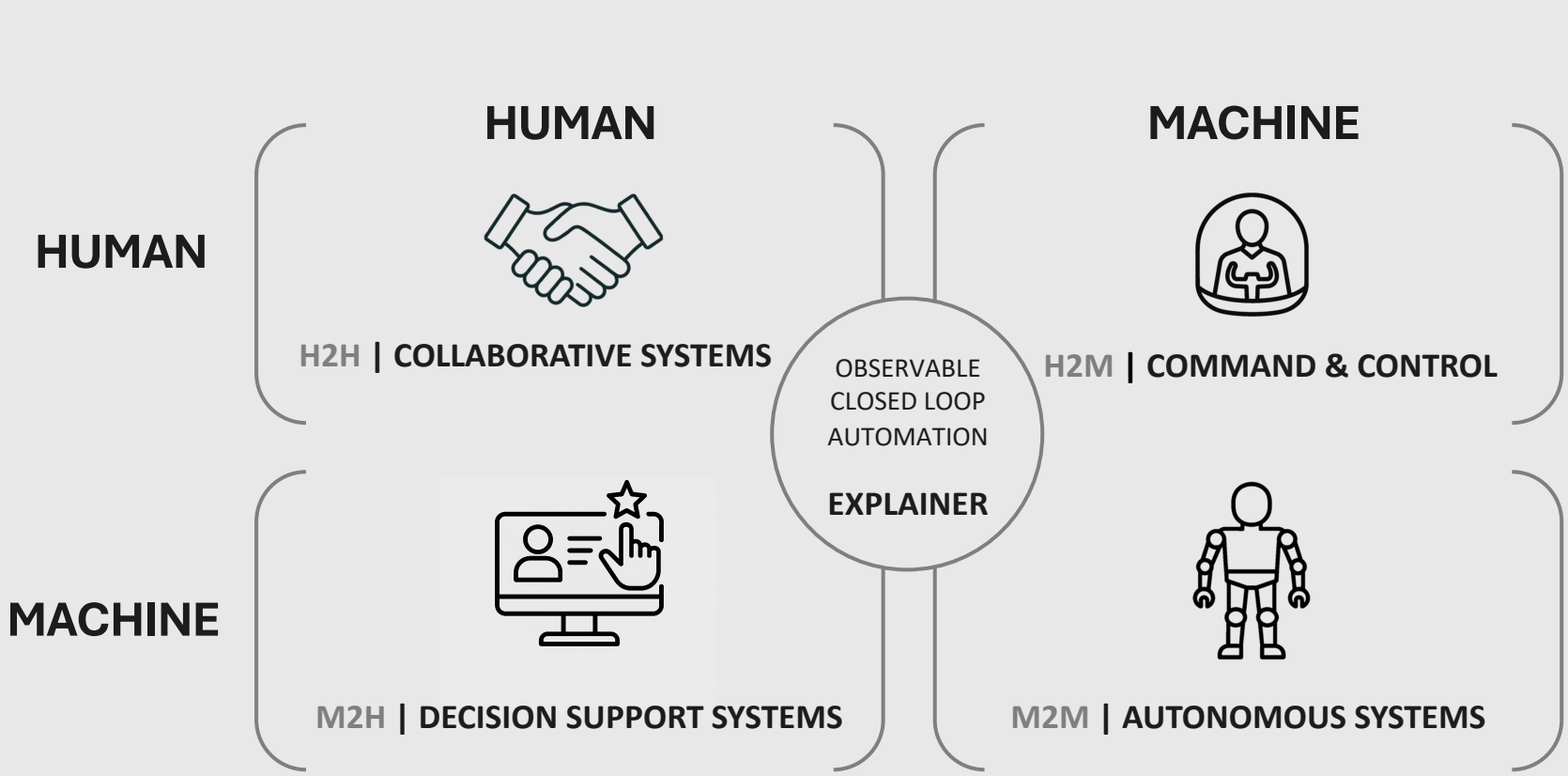


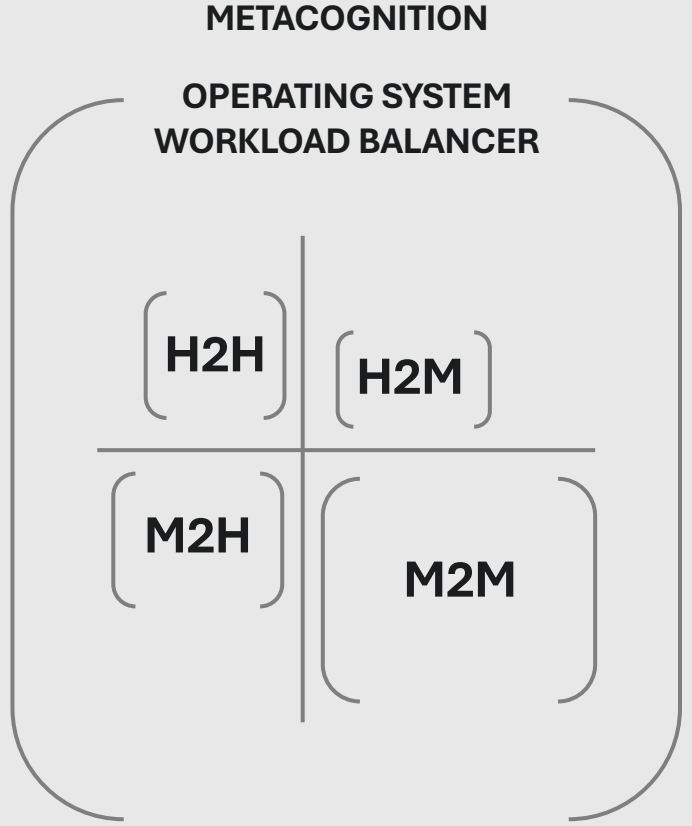
ACC | AGENCY CONTINUUM CALIBRATION

REVISITING JIKODA | INTELLIGENT AUTOMATION



HMS DESIGN | DYNAMIC SYSTEM MODELING





ADAPTABLE MACHINE AGENCY

HUMAN

AGENTS

HUMAN

AGENTS

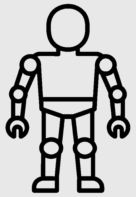
H2H | COLLABORATIVE SYSTEMS

H2A | COMMAND & CONTROL

OBSERVABLE
CLOSED LOOP
AUTOMATION

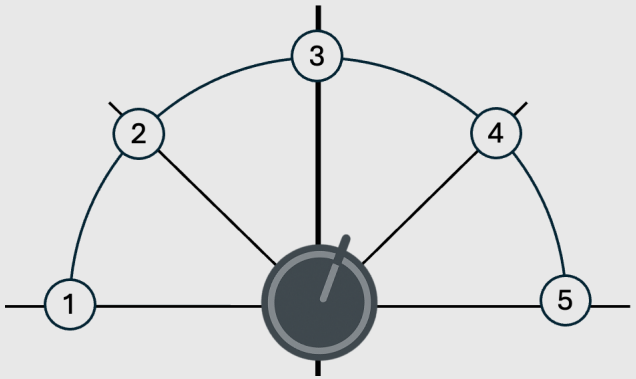
EXPLAINER

A2H | DECISION SUPPORT SYSTEMS

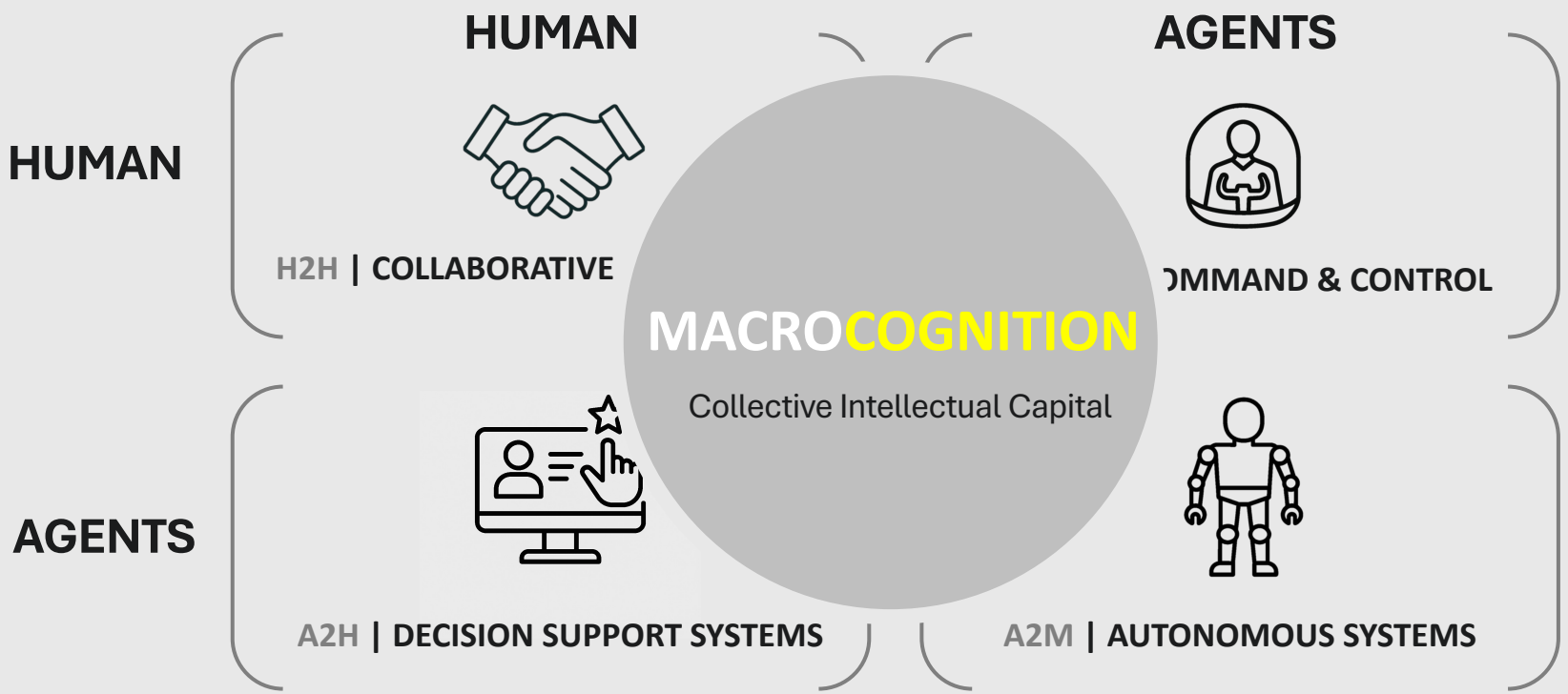


A2A | AUTONOMOUS SYSTEMS

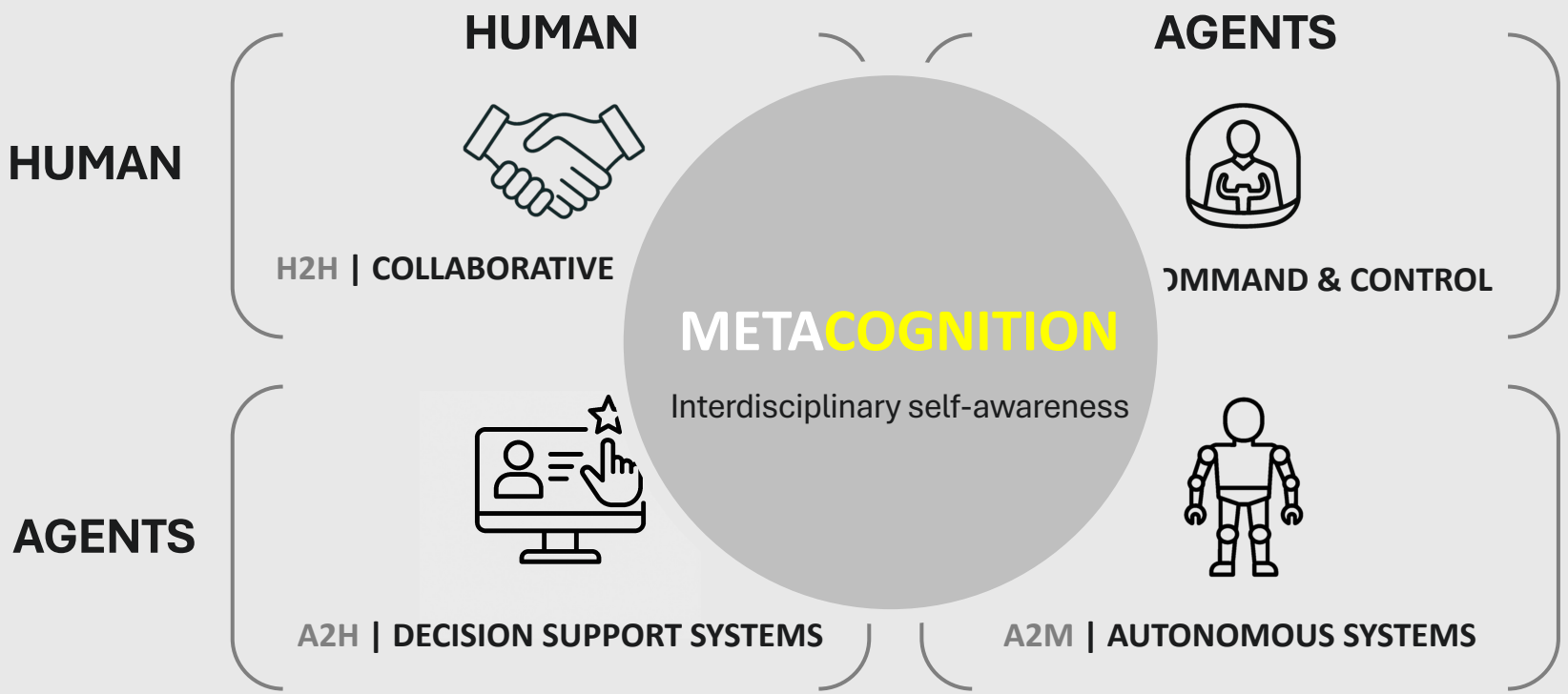
CONTINUUM CALIBRATION



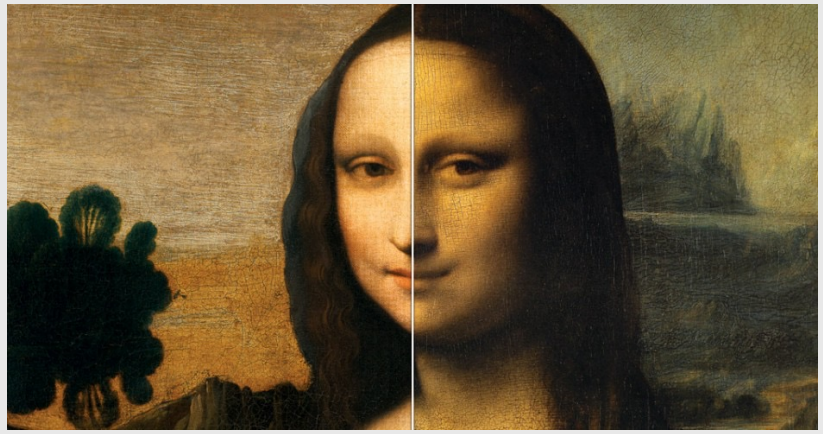
COLLECTIVE INTELLIGENCE



BLENDED INTELLIGENCE



https://monalisa.org/2012/09/10/the-raphael-sketch/



https://en.wikipedia.org/w/index.php?title=Mona_Lisa_(Prado)&oldid=1314024846

https://monalisa.org/2013/03/20/summary-of-critical-comparison/

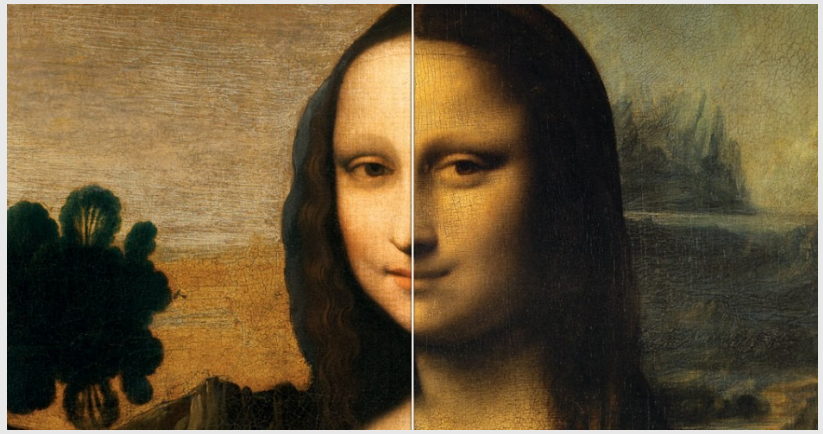
jose.de.francisco@professional.mit.edu

NON-LINEAR DIMENSIONALITY MANAGEMENT

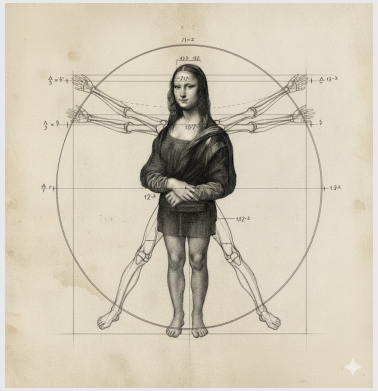
TEST ORIENTED PROGRESSIVE PROTOTYPING

FEATURE RICHNESS

RESOLUTION	LOWER	GREATER
GREATER	SOME POINT SOLUTION HIGH FIDELITY BETAS	A/B BLUEPRINT MODELS **“DOING THINGS RIGHT”**
LOWER	MANY LEFT SHIFT LOW FIDELITY MODELS **”DOING THE RIGHT THING”**	SOME END-TO-END MID FIDELITY BETAS



?



Gemini 2.5 Flash

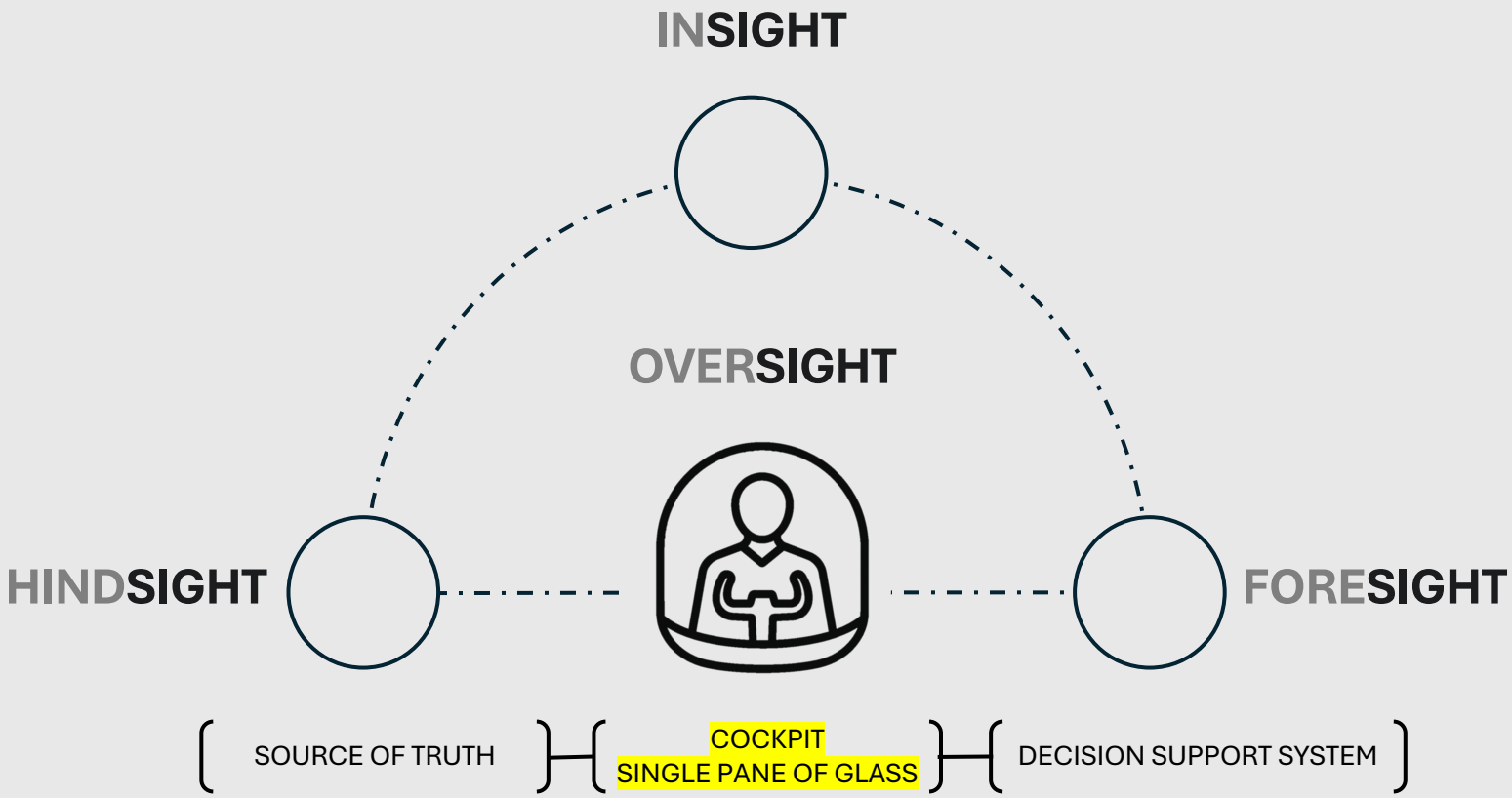
jose.de.francisco@professional.mit.edu

HUMAN

IN : ON

CLOSED LOOP

AUTONOMATION



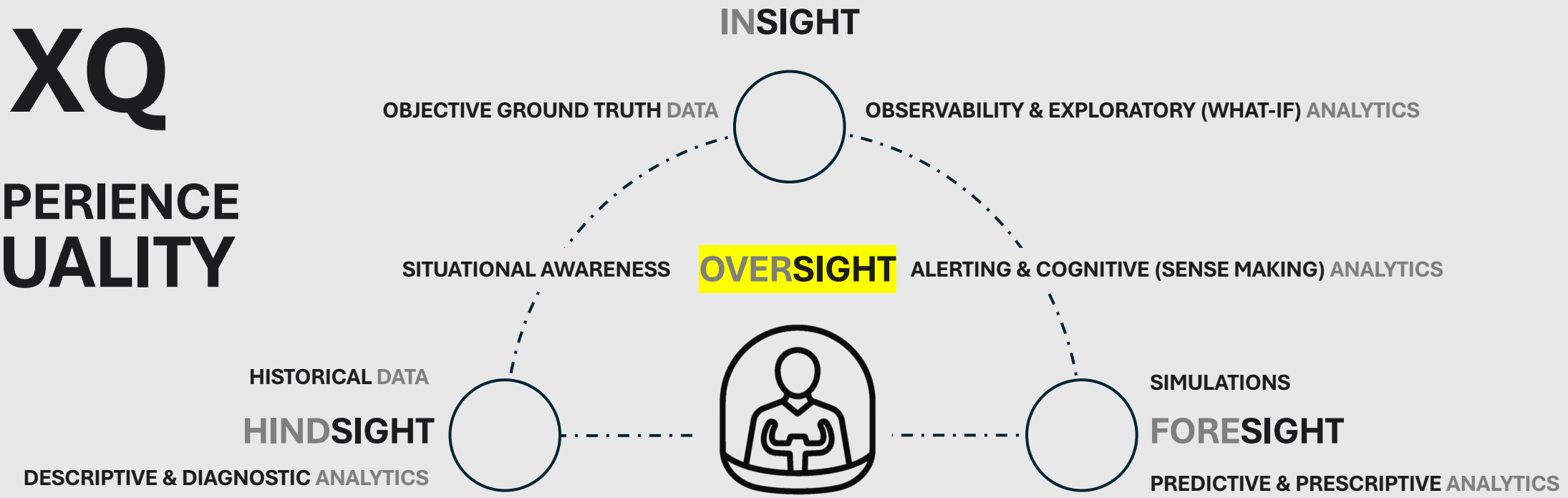
"Humans must remain the ultimate decision-makers in all AI-supported systems."*

*https://ntrs.nasa.gov/api/citations/20210012886/downloads/NASA-TM-20210012886.pdf

jose.de.francisco@professional.mit.edu

XQ

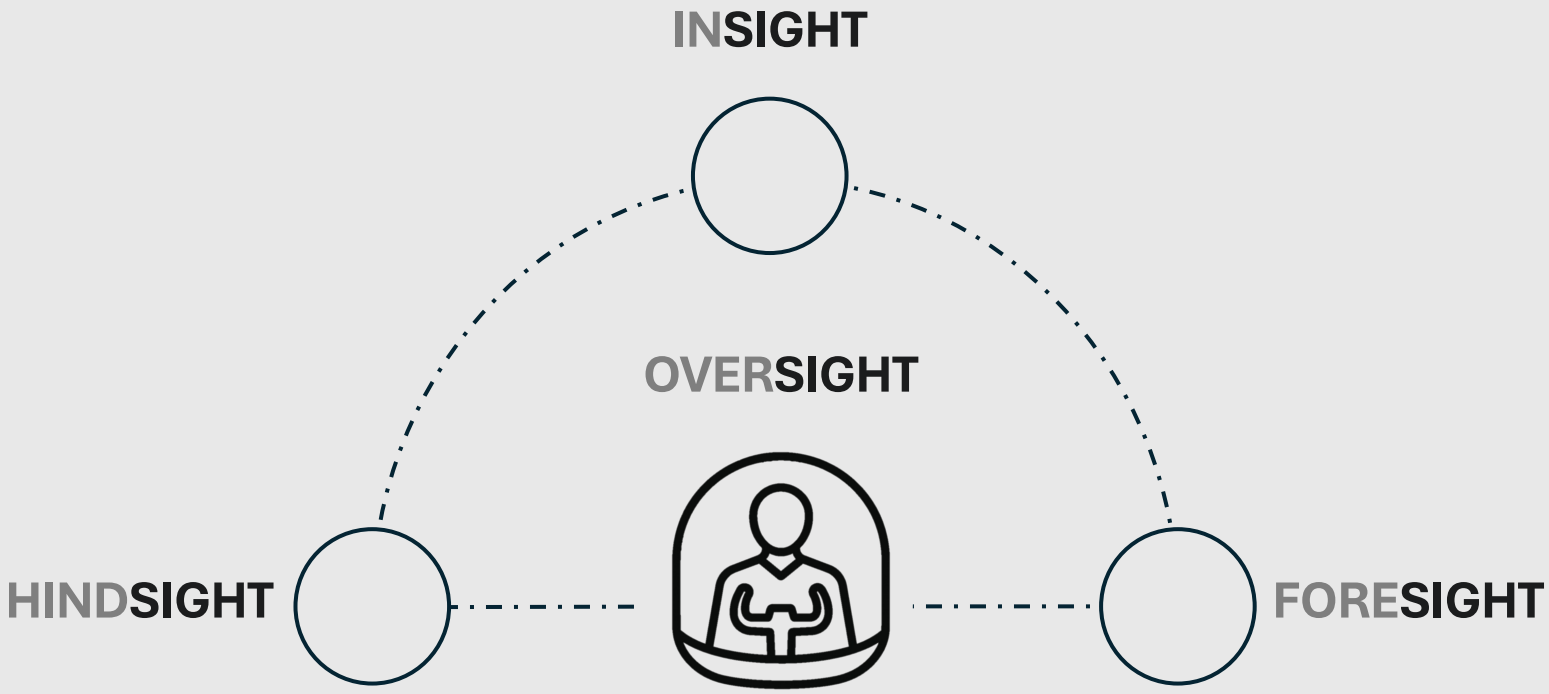
EXPERIENCE QUALITY



Assistive Accessible	Immediate	Interactive	Intelligent	Visibility	Multi-modal	Responsive
Personalized	Ubiquitous	Immersive	Intuitive	Conversational	Omnichannel	Responsible
Customizable	Self-serviceable	Contextual	Trustworthy	Explainability	Interoperable	Error-proof +Fail-safe

X-QA

EXPERIENCE QUALITY ASSURANCE



GRC | GOVERNANCE, RISK, COMPLIANCE

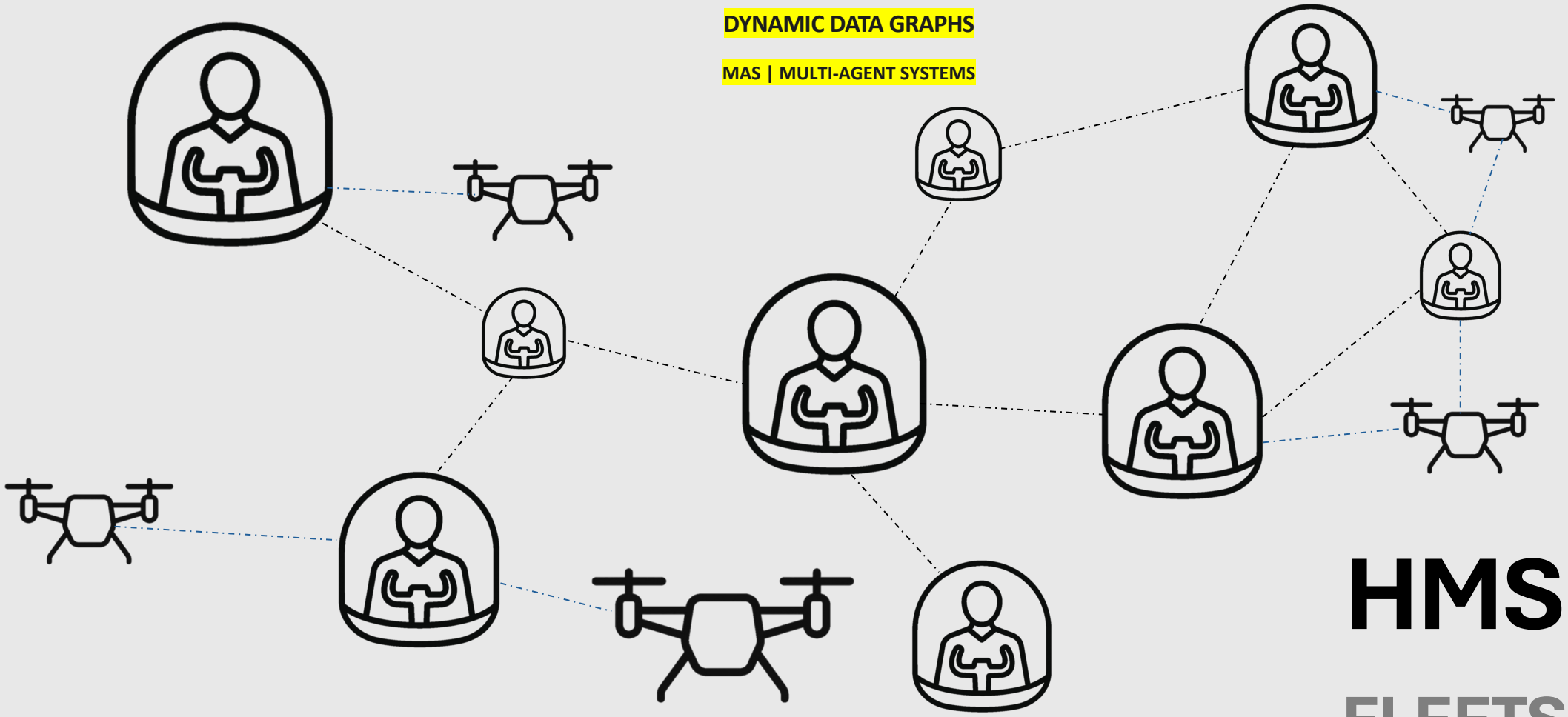
ADVERSARIAL NETWORK — POLICY & RULES ENGINE — COGNITIVE ARCHITECTURE

Relevance | Recency | Resolution | Robustness | Repeatability

COMPOUNDED **NETWORK** EFFECTS

DYNAMIC DATA GRAPHS

MAS | MULTI-AGENT SYSTEMS



HMS

FLEETS

jose.de.francisco@professional.mit.edu

CX|UX TELEMETRY → DEEP UNDERSTANDING → INTELLIGENT AUTOMATION

A — Instrumentation

- **PROFILE**
  - Demographics
  - Segmentation
  - Signals
  - ...
  - Lifecycle
- **USER MODEL**
  - Context
  - Journey
  - Behavioral
  - ...
  - Sentiment
- **HUMAN MODEL**
  - Culture
  - Cognitive
  - Affective
  - ...
  - Memory

B — From Data to Actionable Analytics

- **Testing**
- **Observability**
- **Performance Assessment**
- **Sensitivity Analysis**
- **Anomaly Detection**
- **Event Correlation**
- **Root Cause Analysis**
- ...
- **Lead User Innovation**
- **Design to Value**

C — Human Machine System in Motion

MACHINE -BACK STAGE-	HUMAN -FRONT STAGE-
Compliance	**Assistive Tech**
Optimization	**Basic Personalization**
Feature Flagging	**Advanced Personalization**
Robotic Process Automation	**Self-Service Customization**
Preventive Maintenance	**Channel Adaptation**
...	...
Agent Modeling	**Connectedness**
Model Training	**Collaboration**

CLOSED FEEDBACK LOOP

SERVICE DESIGN

USE CASE SAMPLER

FRONT STAGE

UX VISIBILITY LINE

BACK STAGE

Trends & Patterns

Anomaly Detection

User Simulation | Test Agent

User Agent | Digital Twin

Group Dynamics Simulation

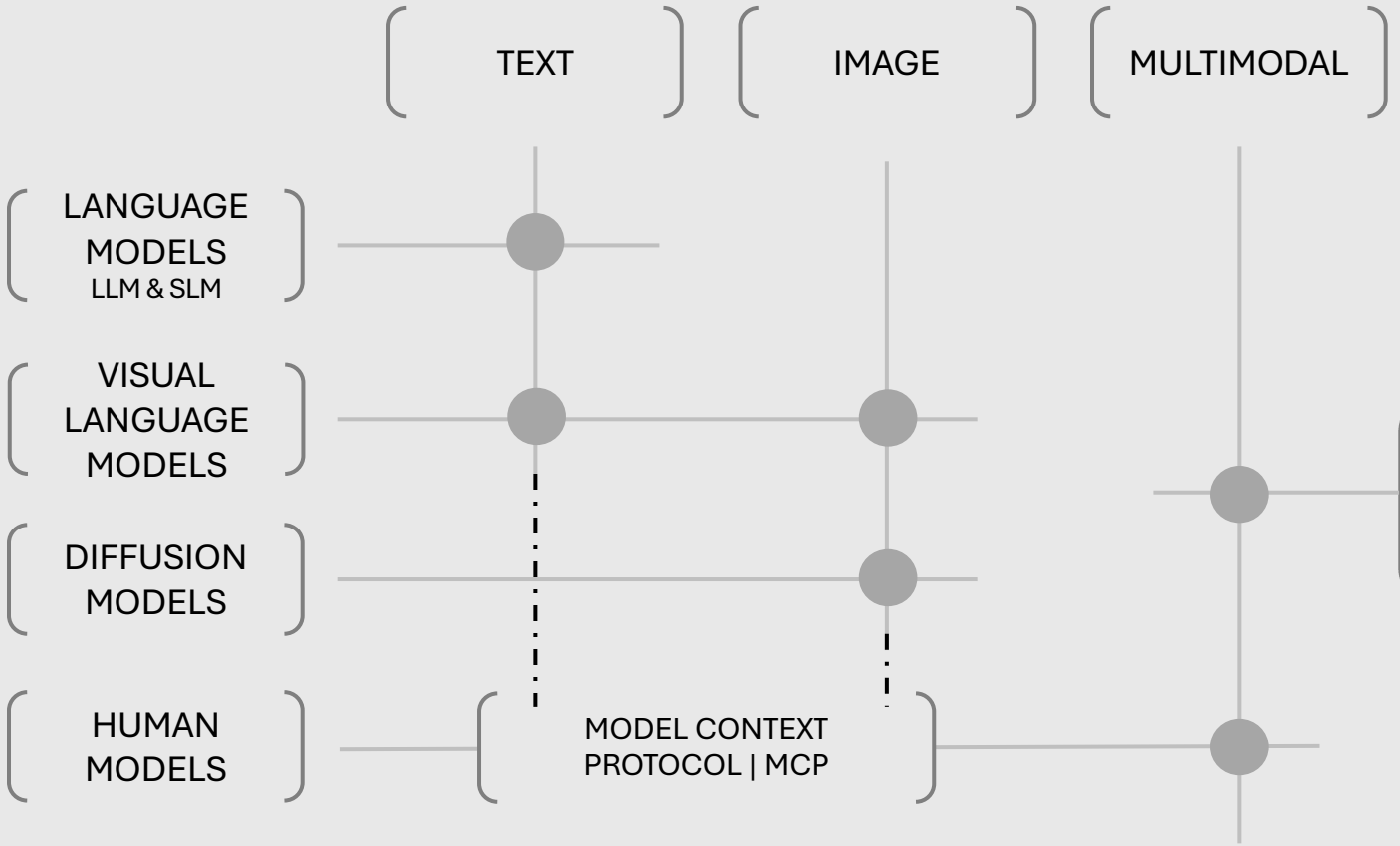
Agentic Fleet Simulation

...

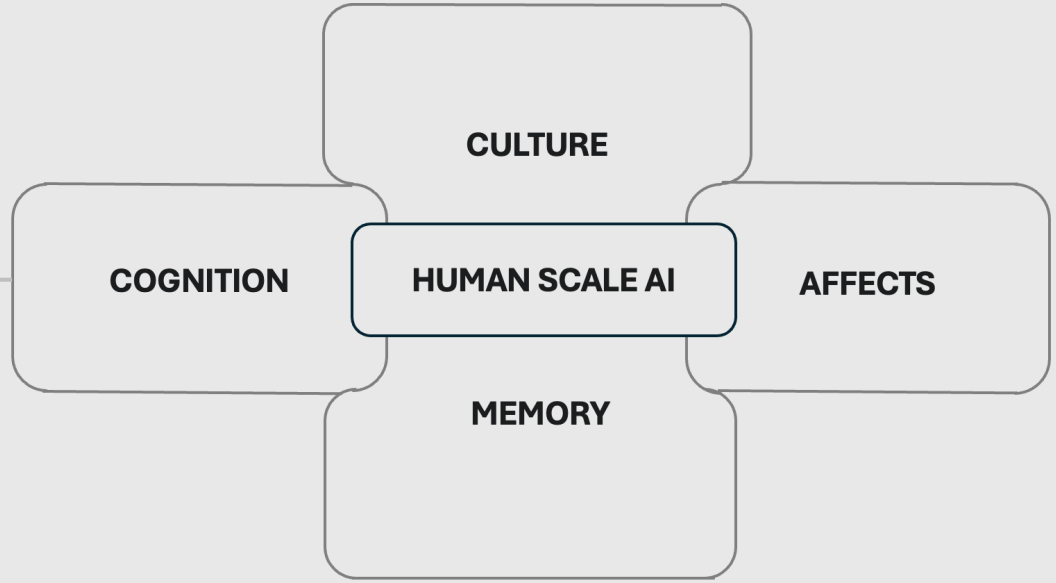
Designer Agent

- Smart Reporting
- Situational Awareness
- Recommendations Engine
- Predictive Personalization (consumption, usage level, context, content, flow)
- Proactive Streamlining (VSM, RPA)
- Assistive & Support Tech
- Progressive Abstraction Levels and Disclosure
- Tailored CX-UX Journeys
- Dynamic Workflow Adaptation
- Decision Support Systems
- Root Cause Analysis
- Explainability
- Multimodal Interactive Infographics
- Guided Training & Gamification
- Preventive Maintenance
- ...
- **Unarticulated Need Discovery**

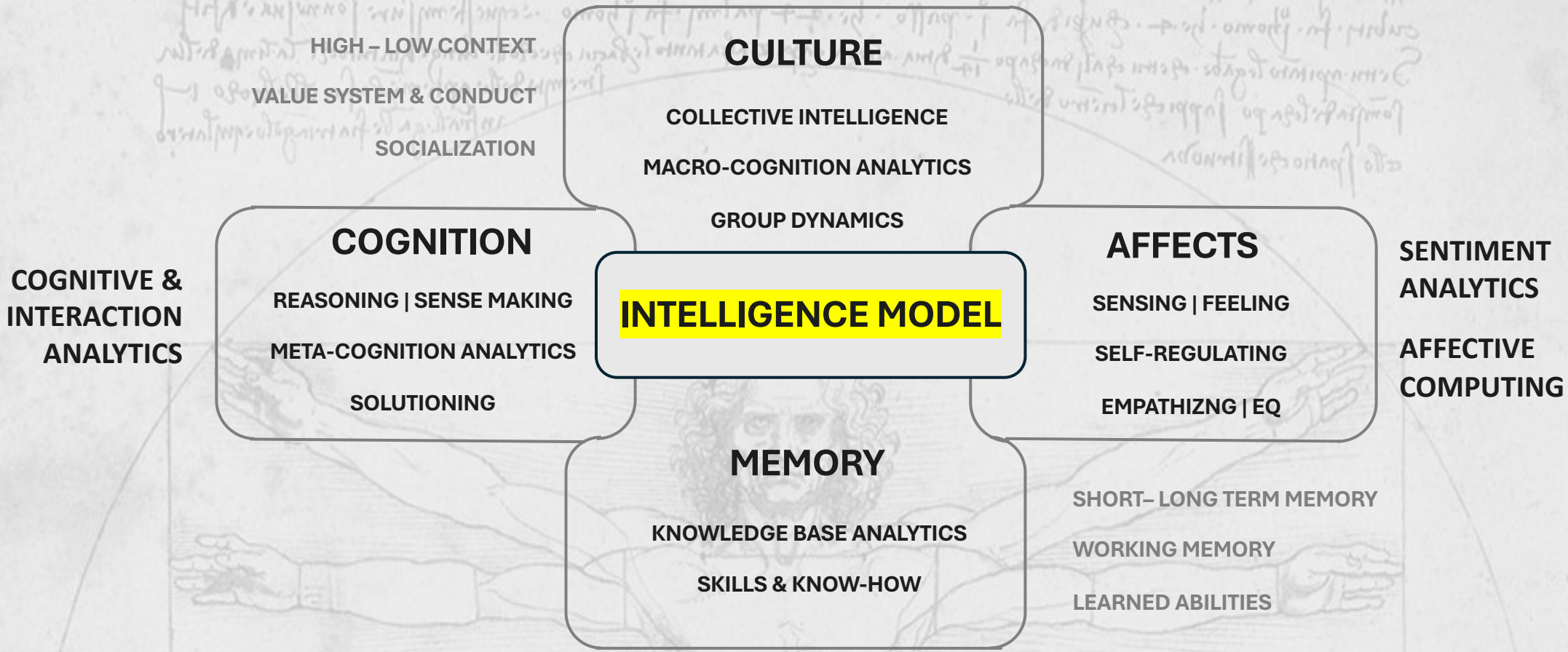
a key requirement that a user has but has not yet expressed or may not even be consciously aware of



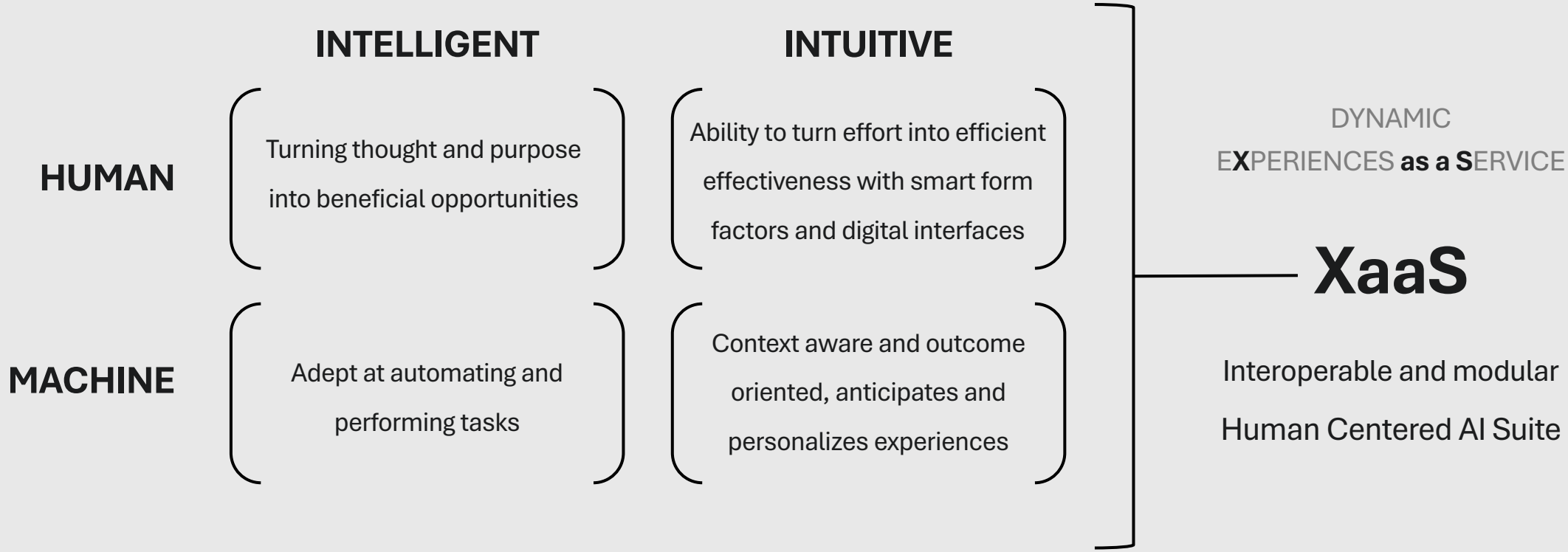
Human Models help bridge the gap between **technical systems** and **human needs**, making AI more usable, ethical, and effective.



HUMAN MODEL & DIGITAL TWIN PROXY



INTELLIGENT & INTUITIVE DIGITAL SERVICES SUITE



1. **HMS | Human Machine Systems**
2. **ACC | Agency Continuum Calibration**
3. **DSM | Dynamic System Modeling**
4. **AMA | Adaptable Machine Agency**
5. **Collective Intelligence | Macro cognition**
6. **Blended Intelligence | Metacognition**
7. **TOPS | Test Oriented Progressive Prototyping**
8. **HTI/OL | Human In/On The Loop | Autonomation**
9. **XQ | Experience Quality**
10. **X-QA | Experience Quality Assurance**
11. **CNE | Compounded Network Effects**
12. **Experience Models & Analytics**
13. **Service Design**
14. **Human Models**
15. **I2DS2 | Intelligent & Intuitive Digital Services Suite**
16. **Appendix**

jose.de.francisco@professional.mit.edu

jose.de.francisco@professional.mit.edu

I2DS2 CONCEPT

Insight Driven | Outcome Oriented

Personalized x Self-Service Customization

Dynamic Journey & Value Stream Mapping

Outcome and Process Modes

Interactive Infographic Quality

Agency, Resolution and Quality Grade Calibration

Layered See-through Info-Surfaces

Collaborative Multi-modal and Interlaced Conversations with Humans and Agents

ANYTIME | ANYWHERE | FORM FACTOR AGNOSTIC

I2DS2 Project | MIT CTO Program 2023-24

jose.de.francisco@professional.mit.edu

SO WHAT?

jose.de.francisco@professional.mit.edu

1

Hyper-Personalization at Scale

Customers demand real-time, context-aware, personalized experiences across all channels.
I2DS2 enables adaptive design with telemetry-driven personalization.

2

Human-Centered AI and Compliance

Regulatory frameworks require AI transparency and human oversight.
I2DS2 embeds governance to ensure ethical, compliant experiences.

3

Agentic AI and Multi-Agent Systems

AI evolves into autonomous, collaborative agents managing complex workflows.
I2DS2 orchestrates these systems for blended experiences.

4

Cognitive and Affective Modeling

Simulating user behavior with cognitive models and digital twins allows adaptive, predictive service design via I2DS2 with XaaS as the delivery model.

5

Experience Economy and Invisible Tech

Seamless, intuitive experiences surpass product features.
XaaS and I2DS2 enable frictionless, interoperable, experience-driven services.

Copilot Generated | GPT-5

Human Scale AI represents a shift from technology-centric innovation to people-first design, where intelligent and intuitive services are built on deep user understanding, adaptive human models, and closed feedback loops—enabling organizations to deliver personalized, ethical, and scalable value-based experiences that drive trust, dynamic engagement, and long-term competitive advantages.

Implications	Why It Matters	Call to Action	Benefits
Human-Centered AI Design	Aligns AI systems with human needs, values, and cognitive models, reducing friction and increasing adoption.	Invest in user modeling and human-in-the-loop governance for all AI initiatives.	Higher user trust, improved engagement, and competitive differentiation through superior UX.
Intelligent & Intuitive Digital Services Suite (XaaS)	Experience-driven design is becoming the core of the AI Experience Economy; personalization and adaptability are critical success factors.	Develop modular AI design systems that enable dynamic personalization, closed feedback loops, and agentic AI orchestration.	Increased customer loyalty, scalable personalization, and faster time-to-market for new services.
Human Models for Simulation & Decision Support	Cognitive architectures and digital twins enable predictive insights and adaptive high-performance systems.	Integrate human models into UX-CX lifecycle analytics, training systems, and decision support platforms.	Reduced risk, better situational awareness, and cost savings through proactive design and automation.

Copilot Generated | GPT-5

1. **Hyper-Personalization at Scale**
   Customers demand real-time, context-aware, personalized experiences across all channels.
   I2DS2 enables adaptive design with telemetry-driven personalization.

2. **Human-Centered AI and Compliance**
   Regulatory frameworks require AI transparency and human oversight.
   I2DS2 embeds governance to ensure ethical, compliant experiences.

3. **Agentic AI and Multi-Agent Systems**
   AI evolves into autonomous, collaborative agents managing complex workflows.
   I2DS2 orchestrates these systems for blended experiences.

4. **Cognitive and Affective Modeling**
   Simulating user behavior with cognitive models and digital twins allows adaptive, predictive service design via I2DS2 with XaaS as the delivery model.

5. **Experience Economy and Invisible Tech**
   Seamless, intuitive experiences surpass product features.
   XaaS and I2DS2 enable frictionless, interoperable, experience-driven services.

Copilot Generated | GPT-5

Human Scale AI represents a shift from technology-centric innovation to people-first design, where intelligent and intuitive services are built on deep user understanding, adaptive human models, and closed feedback loops—enabling organizations to deliver personalized, ethical, and scalable value-based experiences that drive trust, dynamic engagement, and long-term competitive advantages.

Implications	Why It Matters	Call to Action	Benefits
Human-Centered AI Design	Aligns AI systems with human needs, values, and cognitive models, reducing friction and increasing adoption.	Invest in user modeling and human-in-the-loop governance for all AI initiatives.	Higher user trust, improved engagement, and competitive differentiation through superior UX.
Intelligent & Intuitive Digital Services Suite (XaaS)	Experience-driven design is becoming the core of the AI Experience Economy; personalization and adaptability are critical success factors.	Develop modular AI design systems that enable dynamic personalization, closed feedback loops, and agentic AI orchestration.	Increased customer loyalty, scalable personalization, and faster time-to-market for new services.
Human Models for Simulation & Decision Support	Cognitive architectures and digital twins enable predictive insights and adaptive high-performance systems.	Integrate human models into UX-CX lifecycle analytics, training systems, and decision support platforms.	Reduced risk, better situational awareness, and cost savings through proactive design and automation.

Copilot Generated | GPT-5

When technology becomes invisible,

the user experience is everything…

“any sufficiently advanced technology is indistinguishable from magic.”

Arthur C. Clarke’s Third Law

jose.de.francisco@professional.mit.edu

APPENDIX I

jose.de.francisco@professional.mit.edu

Value is in the eyes of the beholder and **always is a human consideration**

GOOD DESIGN	BETTER DESIGN	BEST DESIGN
		Creates a memorable impact, sets the standard and becomes iconic
	Resonates and outcompetes	
Closes gaps and meets expectations		

AI's Experience Economy leverages **computational design** powered by **deep user understanding**

Human Centered AI | Dynamic System Modeling (DSM) X Value Stream & Journey Mapping

Meta Network

CULTURE

- Diffusion of Information | Collective Intelligence
- High – Low Context Cultures
- Collective Value System | Worldview | Policies
- Norms | Conducts
- Social and Behavioral Analysis

HITL | Human In the Loop Computing

PERCEPTUAL EXPERIENCE

- Human-Machine System's Intellectual Capital
- Sensing | Observing | Situational Awareness
- Sense Making | Reasoning | Explainability
- Exploration | Experimentation | Simulation
- Decisioning | Risk-Reward Estimation
- Operationalizing | Executing | Manifesting
- Dynamic Control System | Safeguards | Fail-proof
- Network Effects | First and Second Order Effects
- Closed Feedback Loop | Learning
- Continuous Improvement | Lifecycle Motion

- Rules | Know-How
- High – Low Road Processing
- Inference
- Reasoning
- Recommender System

Cognitive Computing

COGNITION

Affective Computing

AFFECT

- Sentiment Analysis
- Clinical Empathy
- Emotional Intelligence (EQ)
  - Maturity Levels
  - Self-Regulation

Knowledge Base

MEMORY

- Short – Long Term
- Working Memory | Decisioning
- Knowledge Graph
- Memory Augmentation

- Entities
- Relationships | Networks
- Semantics
- Flows

Human Centered AI | Dynamic System Modeling (DSM) X Value Stream & Journey Mapping

ANALYTICS

- Descriptive
- Diagnostic
- Predictive
- Prescriptive
- Exploratory
- Cognitive

QUALITY ASSURANCE

- Relevance
- Recency
- Resolution
- Robustness
- Reliability

- Hindsight
- Insight
- Foresight
- Oversight

ACTIONABLE INSIGHTS

Meta Network

CULTURE

- Diffusion of Information | Collective Intelligence
- High – Low Context Cultures
- Collective Value System | Worldview | Policies
- Norms | Conducts
- Social and Behavioral Analysis

HITL | Human In the Loop Computing

PERCEPTUAL EXPERIENCE

- Human-Machine System's Intellectual Capital
- Sensing | Observing | Situational Awareness
- Sense Making | Reasoning | Explainability
- Exploration | Experimentation | Simulation
- Decisioning | Risk-Reward Estimation
- Operationalizing | Executing | Manifesting
- Dynamic Control System | Safeguards | Failproof
- Network Effects | First and Second Order Effects
- Closed Feedback Loop | Learning
- Continuous Improvement | Lifecycle Motion

- Rules | Know-How
- High – Low Road Processing
- Inference
- Reasoning
- Recommender System

Cognitive Computing

COGNITION

Affective Computing

AFFECT

- Sentiment Analysis
- Clinical Empathy
- Emotional Intelligence (EQ)
  - Maturity Levels
  - Self-Regulation

REASONING TAXONOMY

- Pattern | Outlier | Rarity | Anomaly Detection
- Statistical | Probabilistic
- Causal | Cause and Effect
- Deductive | Logical Premises
- Inductive | Correlation
- Abductive | Hypothesis
- Analogical | Comparables (Analogues)

- Detrimental Bias
- Logical Fallacies
- Confusion Matrix
- Black Swan Effect

- Model Complexity
- Class Imbalance
- Overfitting | Underfitting
- Bias Variance Tradeoff
- Feature Selection
- Hyperparameter Tuning

Knowledge Base

MEMORY

- Short – Long Term
- Working Memory | Decisioning
- Knowledge Graph
- Memory Augmentation

- Entities
- Relationships | Networks
- Semantics
- Flows

jose.de.francisco@professional.mit.edu

Human Factors Engineering | Intelligent & Intuitive Digital Services Suite

Leading with Cutting Edge Human Centered AI by Designing for the Senses and Sense Making in Today's Experience Economy

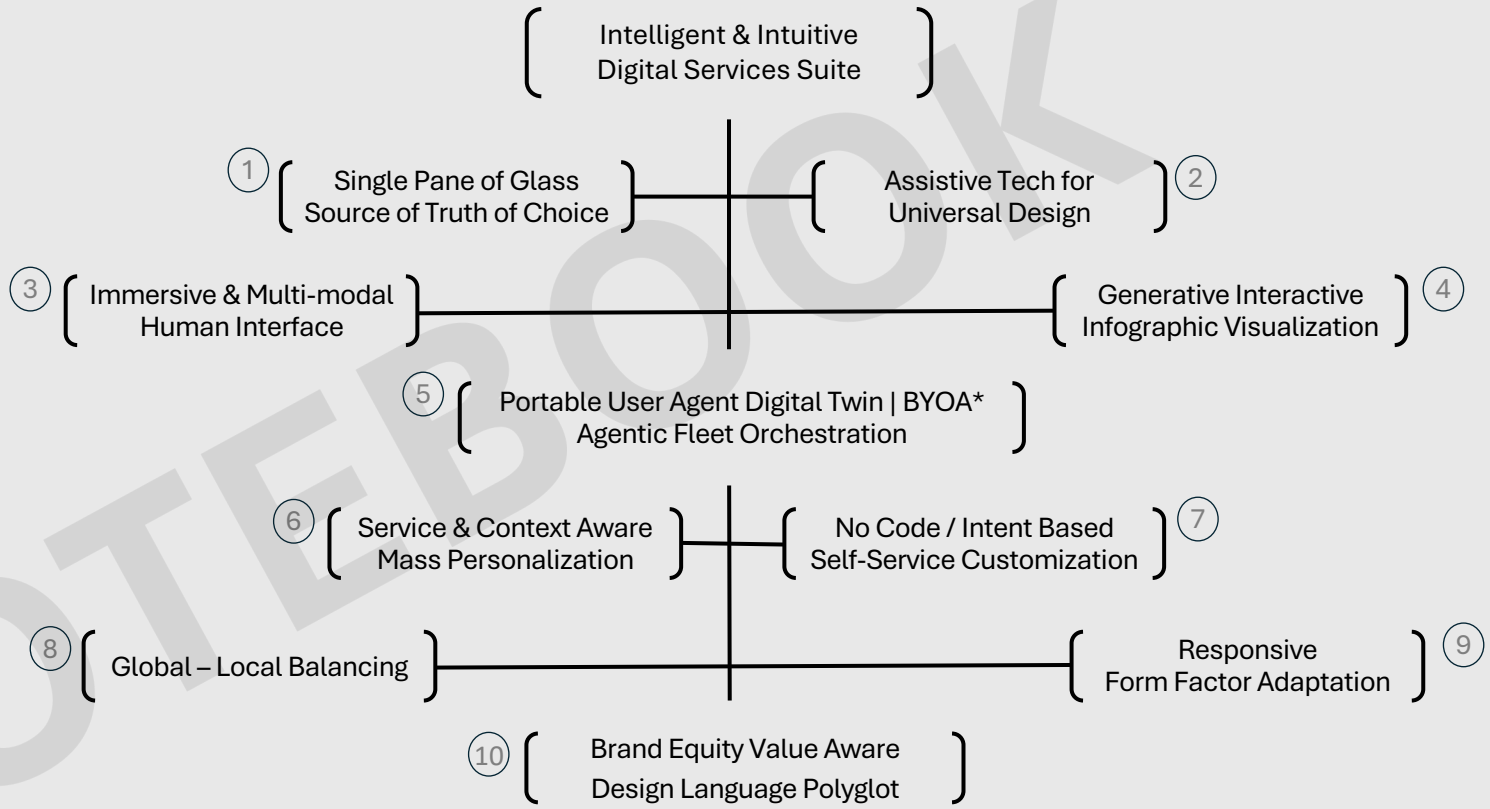
AI design system as a suite of **Intelligent and Intuitive Digital Services** set to dynamically compose, generate and scale with self-organizing user interfaces and streamlined journeys along the UX-CX continuum and lifecycle.

Design Intelligence enables anyone, anywhere and anytime experience fully integrated end-to-end multi-sensory (aka multi-modal) abilities that harness and inform user behaviors, content adaptation, context, observability, situational awareness, sensemaking, action-oriented insights, options valuation, decisioning and learning.

Design Intelligence also anticipates needs and promotes lean and agile value-based-activities that (a) simplify complex tasks, as well as (b) makes nuanced and detailed oriented ones addressable by fine-tuning abstraction vs. granularity levels, all predicated on user models that articulate degrees of optimal sophistication.

Automated **Value Stream Mapping** weeds out nonsensical elements, unproductive cognitive workloads, noise and dissonance. **Robotic Process Automation** elevates users' visual thinking, hand-eye and gesture coordination. Natural language assists with interrogation and intent based items.

Promoting germane cognitive loads purposely serves human abilities with meaning by (c) amplifying existing skills. Gradually introducing new ones augments (d) professional development coupled with interdisciplinary collaborative talent. Overall system responsiveness shapes assistive tech beyond accessibility standards to deliver universal design that is personalized.



Closed loop system-wide automation optimizes continuous improvement, facilitating interoperable experiences that purposely feel intelligent and intuitive given their natural and frictionless nature.

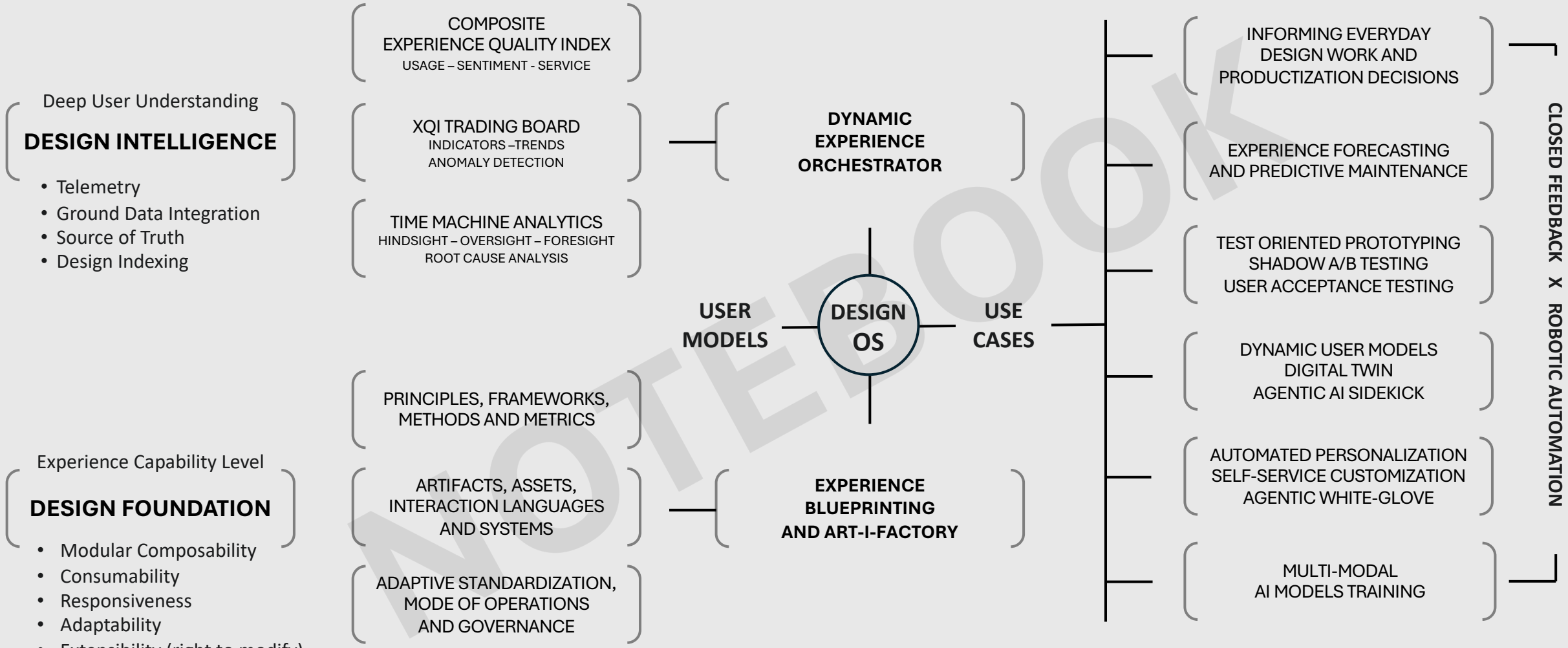
Informatic quality assurance tests and adapts for responsiveness and trustworthiness under continually relevant, current, resilient, and responsible principles.

*Bring Your Own Agent

I2DS2 Project | MIT CTO Program 2023-24

jose.de.francisco@professional.mit.edu

Intelligent & Intuitive Digital Services Suite



APPENDIX II

jose.de.francisco@professional.mit.edu

User Modeling and User-Adapted Interaction

The Journal of Personalization Research

In addition to papers from Computer Science, relevant papers from the fields of Psychology, Linguistics, Information Systems, Information Science, Education, Rehabilitation and Medicine are also considered if they have implications for the design of computer systems.

The journal mainly publishes empirical research papers.

Adaptability refers to the end-user's ability to adapt the UI.

Adaptivity or self-adaptation refers to the system's ability to perform UI adaptation.

Personalization is a particular form of adaptivity, usually for the UI contents, that is based on data originating solely from the end-user.

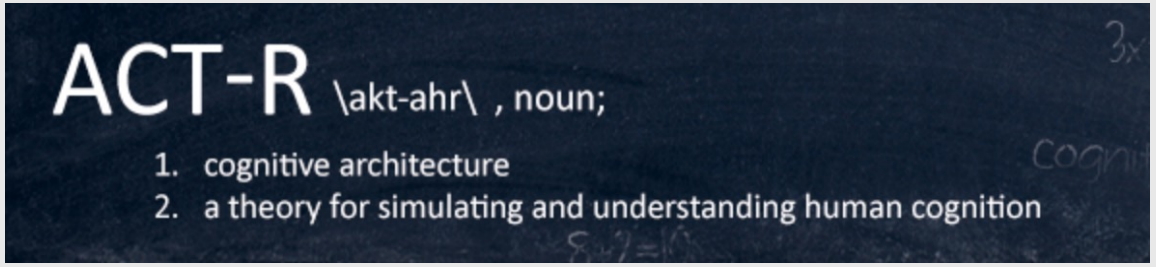
Recommender Systems leverage data from sources that can be external to the end-user, such as other user groups.

- Acquisition and formal representation of user models, including modeling of affect, personality, knowledge, expertise, interests, preferences, attitudes, goals, plans, culture, relationships and mental models
- Conceptual models and user stereotypes for personalization
- Student modeling and adaptive learning
- Models of groups of users
- User model driven personalized information discovery and retrieval
- Recommender systems
- Adaptive user interfaces and agents
- Adaptation for accessibility and inclusion
- Generic user modeling systems and tools
- Interoperability of user models
- Personalization in areas such as
  - Affective computing
  - Ubiquitous and mobile computing
  - Language based interactions
  - Multi-modal interactions
  - Virtual and augmented reality
  - Social media and the web
  - Human-robot interaction
  - Behavior change interventions
- Personalized applications in specific domains, such as: health, mobility, vehicular operation, news, workplace, consumer electronics, e-commerce and retail, cultural heritage, tourism, smart cities, games, cyber-security
- Privacy, accountability, and security of information for personalization
- Responsible adaptation: fairness, accountability, explainability, transparency and control
- Methods for the design and evaluation of user models and adaptive systems

https://link.springer.com/journal/11257

https://link.springer.com/article/10.1007/s10270-021-00909-7

jose.de.francisco@professional.mit.edu



- **Human-Computer Interaction Simulation**: Simulates user behavior in complex systems like cockpit interfaces, medical devices, and enterprise software to predict cognitive load and usability issues.
- **Training and Decision Support**: In defense and healthcare, ACT-R models help simulate decision-making under stress or uncertainty, aiding in interface design and training systems.
- **Agentic AI Systems**: Integrated into intelligent agents that learn and adapt through interaction, supporting applications like virtual assistants and adaptive UIs.

- **Goal-Oriented UX Agents**: Soar powers agents that break down user tasks into subgoals, useful in complex enterprise workflows and automation systems.
- **Simulation-Based Training:** Used in scenario-based training environments where agents simulate realistic human responses, such as emergency response or military operations.
- **Natural Language Interfaces:** Soar's reasoning capabilities support conversational agents and decision-support tools in customer service and technical support.

http://act-r.psy.cmu.edu/ https://soar.eecs.umich.edu/

jose.de.francisco@professional.mit.edu

Designing for people by applying care and understanding

. . . Humankind Scale AI

Homo sapiens' nature, experience, and existence