Opportunities and Risks of Artificial Intelligence in the Inpatient Space

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WHEN ANIMALS LOST THEIR VITAMIN C SUPERPOWER

Most animals make their own Vitamin C. These are the ones that **lost the recipe**.

Vitamin C (ascorbic acid)
Essential for immunity, collagen, wound healing, and antioxidant protection.

ANIMAL GROUP (Examples)

MILLIONS OF YEARS AGO (mya)

80 — 70 — 60 — 50 — 40 — 30 — 20 — 10 — PRESENT

Primates (Humans, Apes, Monkeys)

~40–60 mya
Likely due to a diet rich in fruits and leaves.

Rodents (Guinea Pigs, Hamsters)

~25–30 mya
Diet shifted to seeds and grains (low in C).

Bats (Many Species)

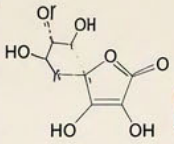
~20–25 mya
Fruitarian ancestors shifted to insects.

Carnivores (Dogs, Cats, Seals, Bears)

~10–20 mya
Meat-rich diets already provide enough C.

Birds (Parrots, Finches)

~3–10 mya
Varied diets reduced need for synthesis.



THE BIGGEST REASON?
DIET MADE IT UNNECESSARY.

When food started providing enough Vitamin C, natural selection said: "Why make it if you can eat it?" Over millions of years, the genes for Vitamin C production were lost.

GEOLOGIC TIME SCALE

CRETACEOUS	PALEOGENE	NEOGENE	QUATERNARY
145 – 66 mya	66 – 23 mya	23 – 2.6 mya	2.6 mya – Present

WHY DID THEY LOSE IT?

TOP REASON:

DIETARY SUFFICIENCY

When Vitamin C is easily obtained from food, the body stops needing to make it.

OTHER FACTORS:

- Smaller body size (less C needed)
- Lower oxidative stress (less need for C)
- Energy conservation (no need to spend energy making it)

Audience Response Question 1

- Word Cloud
- What skills do you think would be obsolete in next 10-20 years?


If you work as a radiologist, you're like
the coyote that's already over the edge
of the cliff but hasn't yet looked down.
- Geoffrey Hinton

Are we ready for this patient?

A PATIENT ARRIVING TODAY

She walks in with her AI app in hand. It has already:

- pulled her records from five other health systems
- incorporated her wearables data
- "listened" to her health concerns, symptoms, goals, and fears (for weeks)
- identified a potential misdiagnosis and a drug interaction
- flagged some possible causes of her health issues based on the comprehensive data and its analysis
- helped her prepare specific questions for her doctor

...and she would like to record the visit for analysis by her AI companion

Ms. Laura Adams, Senior Advisor at National Academy of Medicine

https://blog.google/innovation-and-ai/models-and-research/google-research/amie-video-consultations/

Disclosures

- All images without reference have been created by
  - Copilot from Microsoft, it used GPT 5.5/5.6 from Open AI or Claude Sonnet/Opus from Anthropic,
  - Gemini from Google
- I have used Open Evidence to search the literature.
- I have received no funding about material presented.
- No other conflicts of interest.

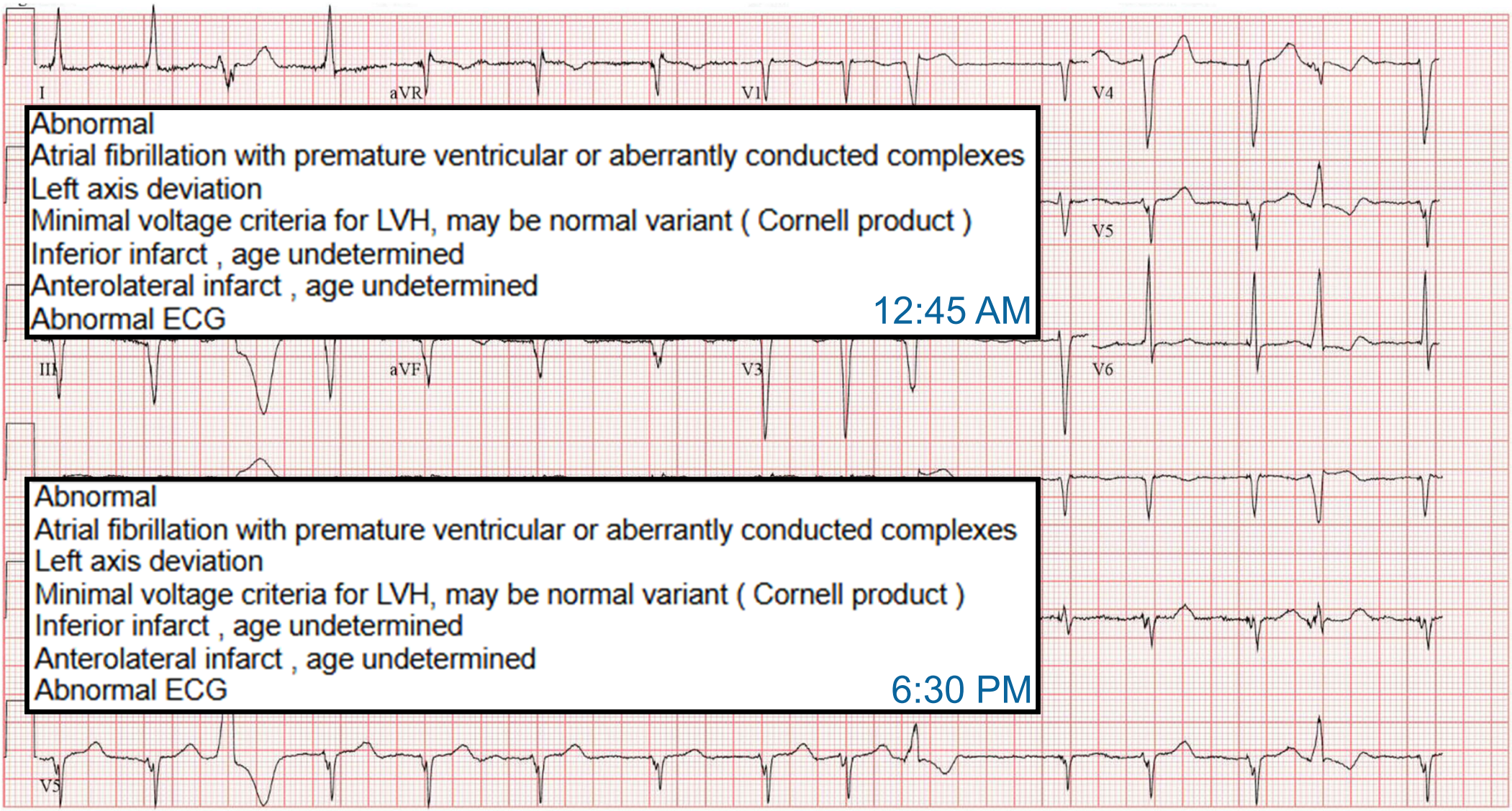
Why AI?

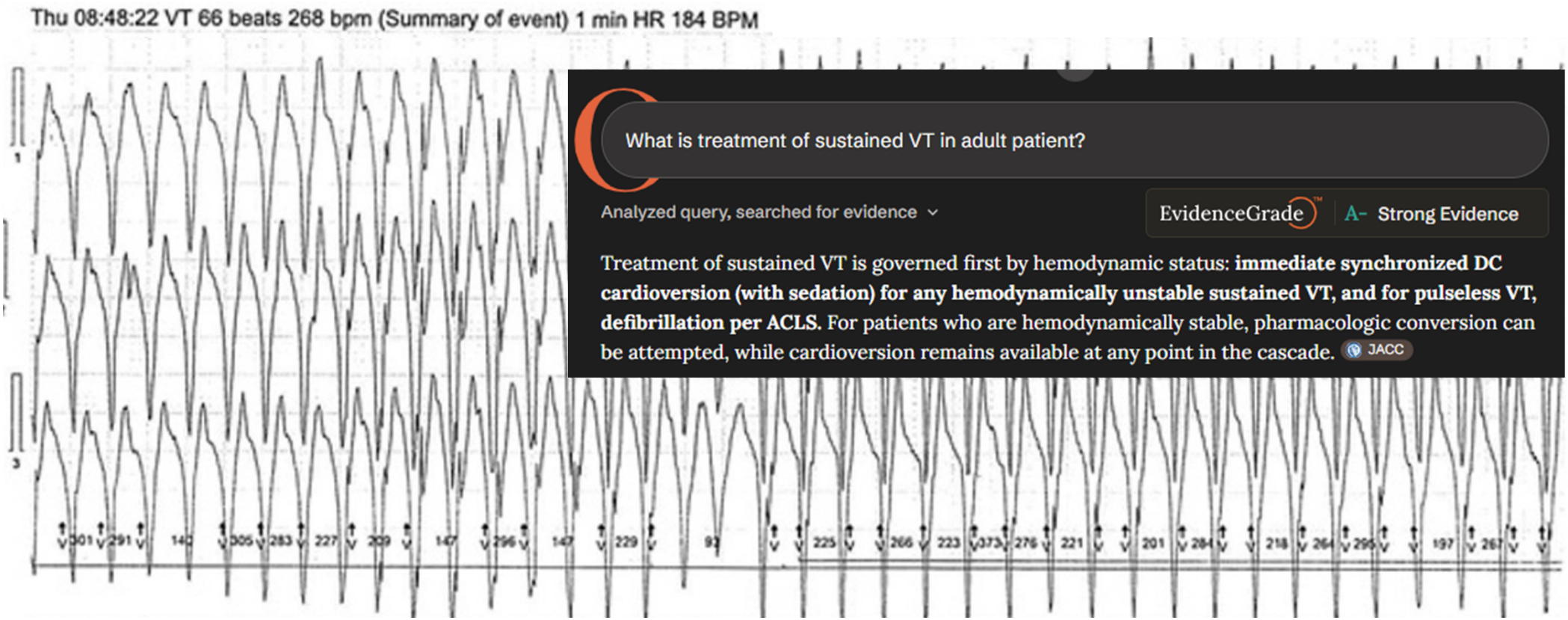
Learning Objectives

Distinguish rule-based AI, machine learning, deep learning, and generative AI, and map each to concrete inpatient use cases in hospital medicine.

Critique the strengths, weaknesses, opportunities, and threats of AI in hospital medicine using clinical, operational, and equity examples from the literature and current health-system implementations.

Apply a practical decision framework to determine when an inpatient AI tool should be adopted, piloted with guardrails, or deferred based on value, safety, bias, workflow fit, ROI, sustainability, and governance


I
aVR
V1
V4
V5
III
aVF
V3
V6
V5
Abnormal
Atrial fibrillation with premature ventricular or aberrantly conducted complexes
Left axis deviation
Minimal voltage criteria for LVH, may be normal variant (Cornell product)
Inferior infarct , age undetermined
Anterolateral infarct , age undetermined
Abnormal ECG
12:45 AM
Abnormal
Atrial fibrillation with premature ventricular or aberrantly conducted complexes
Left axis deviation
Minimal voltage criteria for LVH, may be normal variant (Cornell product)
Inferior infarct , age undetermined
Anterolateral infarct , age undetermined
Abnormal ECG
6:30 PM



Yashwant Agrawal, Vishal Gupta. To treat the patient and not the telemetry: Electric toothbrush causing hospital admission. International Journal of Cardiology 221 (2016) 112–113

International Journal of Cardiology 221 (2016) 112–113

International Journal of Cardiology

journal homepage: www.elsevier.com/locate/ijcard

To treat the patient and not the telemetry: Electric toothbrush causing hospital admission

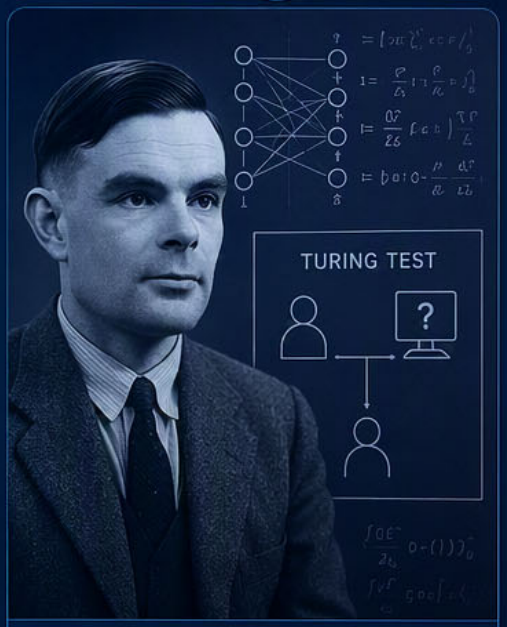
Yashwant Agrawal [a,*], Vishal Gupta [b]

[a] Department of Internal Medicine/Pediatrics, Western Michigan University Homer Stryker School of Medicine, Kalamazoo, MI, USA
[b] Department of Cardiology, Borgess Medical Center, Kalamazoo, MI, USA

Yashwant Agrawal, Vishal Gupta. To treat the patient and not the telemetry: Electric toothbrush causing hospital admission. International Journal of Cardiology 221 (2016) 112–113

The Evolution of AI: From Theory to Generative Intelligence

1950s



Researchers began exploring whether machines could think intelligently.

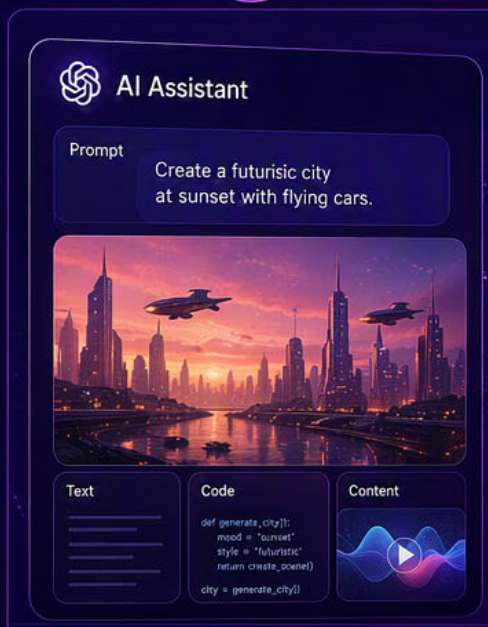
1990s

AI demonstrated expertise in specialized tasks, including championship-level chess.

2010s

Machine learning and deep neural networks transformed pattern recognition.

2020s



Generative AI became mainstream and widely accessible.

AT FIRST: "AMAZING AI!"

1. NEW & IMPRESSIVE

A machine does a cognitive task that was once thought to require human intelligence.

2. CALLED "AI"

It is labeled as AI and seen as a major milestone.

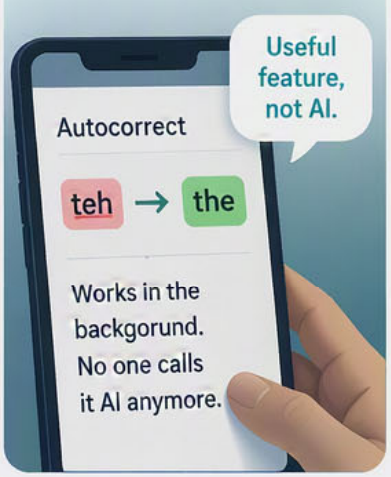
3. BECOMES NORMAL

Over time, it works reliably, improves, and becomes widely used.

LATER: "JUST SOFTWARE."

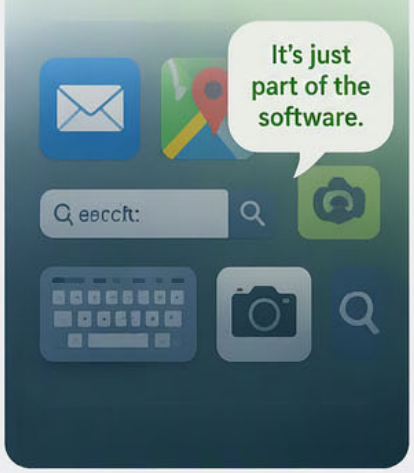
4. RECLASSIFIED

People stop calling it AI and start calling it software.



5. JUST SOFTWARE

It's taken for granted—expected, invisible, and no longer impressive.



LARRY TESLER

1939–2020

Pioneer in human–computer interaction and usability. Coined "**copy and paste.**"

> *"AI is whatever hasn't been done yet. Once it's done, it's just software."*
>
> *– Larry Tesler*

Types of AI

Technology

- Machine learning (ML)
  - Deep learning
- Natural Language Processing (NLP)
- Computer Vision (CV)

Capability

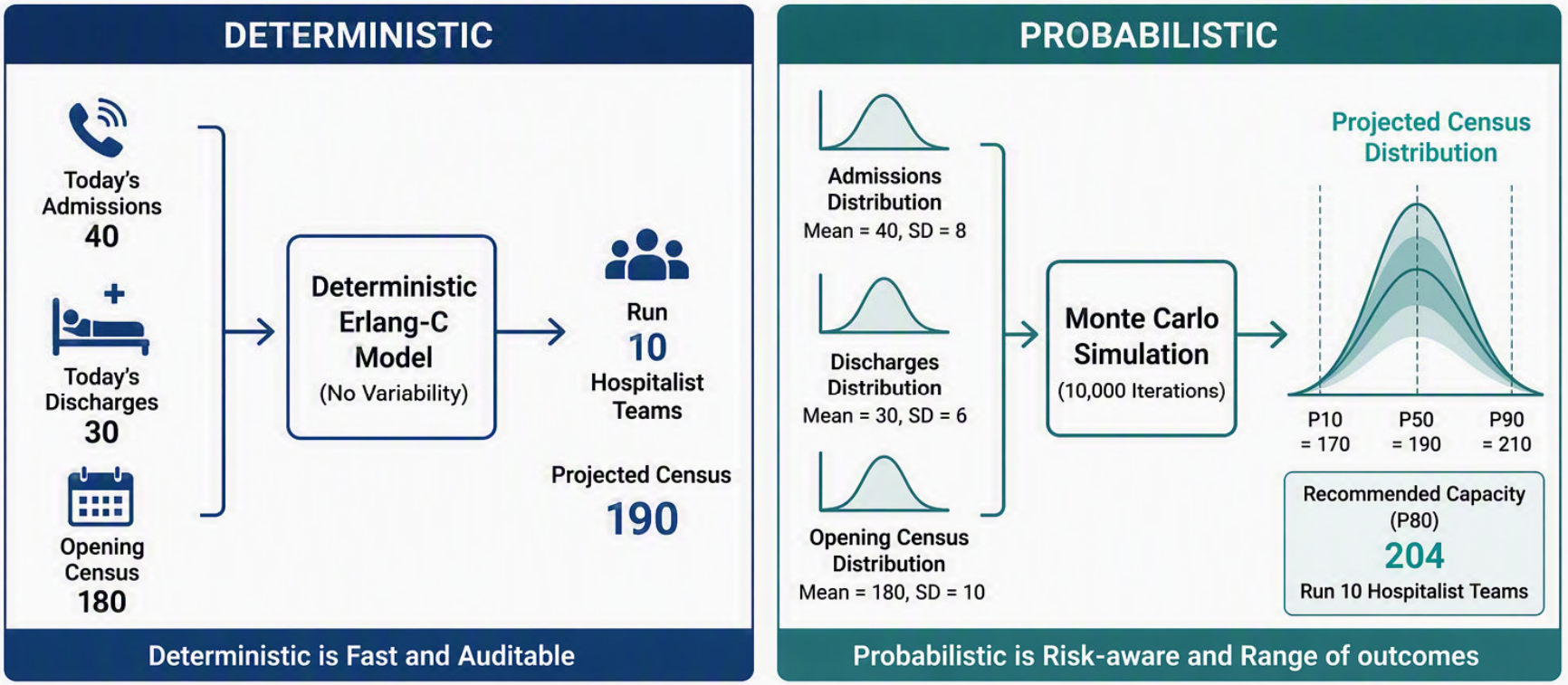
- Narrow AI (Weak AI)
  - Alexa/Siri and facial recognition
- General AI (Strong AI)
  - Theoretical concept
- Superintelligent AI
  - Hypothetical

Functionality

- Reactive machines
  - Netflix search
- Limited memory AI
  - Tesla(FSD), Waymo
- Theory of mind AI
  - Future concept
- Self-aware AI
  - Theoretical

DETERMINISTIC VS PROBABILISTIC MODELS

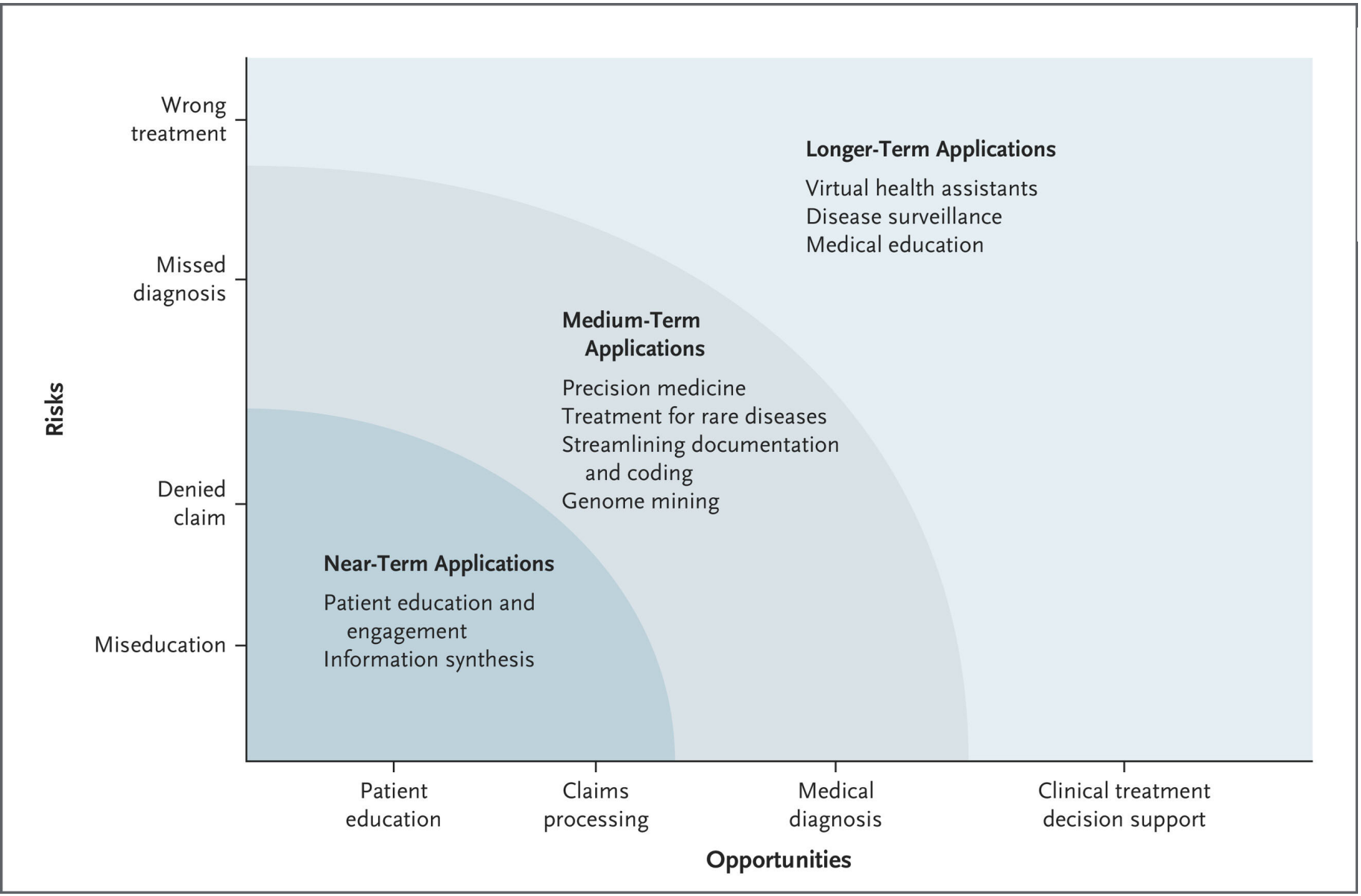
Hospitalist Census for Running 10 Teams



Goal:
Staff 10 hospitalist teams to meet patient demand while managing risk.

Deterministic: Uses average values to give a single census number. Best for quick planning and operational transparency.

Probabilistic: Uses distributions and simulation to show a range of possible census outcomes and recommended staffing.



Maddox et al. Generative AI in Medicine - Evaluating Progress and Challenges. N Engl J Med. 2025;392(24): 2479-2483.

A Incorporation of artificial intelligence (AI) into clinical practice

CLINICAL INDICATIONS	EXAMPLES OF AI
Interaction with patient	Ambient voice dictation, scheduling, electronic health record inbox tools
Risk stratification (precision medicine)	Patient risk assessment tools
Diagnosis	Analysis of clinical data or imaging (eg, echocardiography)
Interpretation of laboratory results	Analysis and description of test results
Eliciting patient preferences or behavioral changes	Conversational chatbot
Procedures	Surgical assistance
Prescribing medication	Drug interaction assessment
Patient or population monitoring	Glucose monitoring, population-at-risk monitoring
Research and learning	Research participant identification and engagement
Continuing education and training	Virtual reality case simulation

B Development of clinical AI analogous to pharmacotherapies

	DRUG DEVELOPMENT	AI DEVELOPMENT
Phase 1	Pharmacokinetics and pharmacodynamics studies	**Model development:** Testing on large retrospective dataset
Phase 2	Collection of safety data and efficacy signals	**Silent mode evaluation:** Prospective performance evaluation in the clinical environment without notification to clinical teams
Phase 3	Clinical trial with outcomes assessment	**Clinical deployment:** AI prospectively implemented with measurement of downstream care and outcomes (consider randomized clinical trial [RCT] design for high-risk clinical indication)
Phase 4	Real-world use (postmarket registry of use in practice)	**Monitoring and assurance network:** Deployment in multiple environments with local monitoring of performance and outcomes

C Guideline recommendations for AI use (used by the ACCF/AHA and ESC/EACTS guidelines task forces)

SIZE OF TREATMENT EFFECT

Class I	Class IIa	Class IIb	Class III
Benefit >>> risk	Benefit >> risk	Benefit ≥ risk	No benefit or harm
Should be performed	*Reasonable to perform*	*May be considered*	*Should not be performed*

LEVEL OF EVIDENCE

Level A	Level B	Level C
Multiple populations	Limited populations	Very limited data
Data derived from multiple RCTs or meta-analyses	*Data derived from a single RCT or nonrandomized studies*	*Expert consensus of opinion, case studies, or standard of care*

Patel et al. Translating AI for the Clinician. JAMA. 2024;332;(20):1701-1702.

Evidence?

Open Evidence

Microsoft Copilot

Indication	Examples
Risk stratification (Precision Medicine)	
Patient or population monitoring	
Interaction with patient, including Ambient AI	
Diagnosis	
Interpretation of laboratory results	
Prescribing medication	
Research and learning	
Procedures	
Continuing education and training	

Evidence?

Open Evidence

Microsoft Copilot

Indication	Examples
Risk stratification (Precision Medicine)	Predictive models (Sepsis, Deterioration, Fall, AKI)
Patient or population monitoring	
Interaction with patient, including Ambient AI	
Diagnosis	
Interpretation of laboratory results	
Prescribing medication	
Research and learning	
Procedures	
Continuing education and training	

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Procedures	
Continuing education and training	

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Indication	Examples
Risk stratification (Precision Medicine)	Predictive models (Sepsis, Deterioration, Fall, AKI)
Patient or population monitoring	Same Predictive models
Interaction with patient, including Ambient AI	Limited Ambient, huge potential, rest limited
Diagnosis	
Interpretation of laboratory results	
Prescribing medication	
Research and learning	
Procedures	
Continuing education and training	

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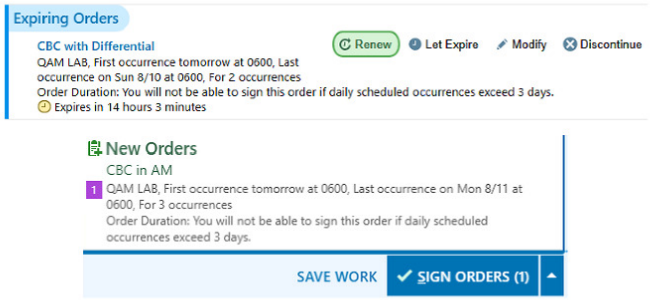
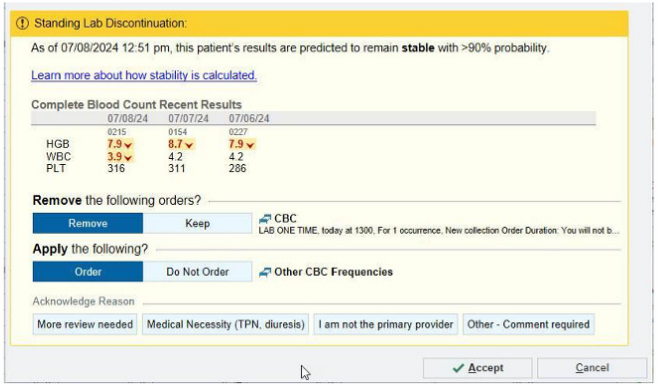
Diagnosis	Clinical vignette
Interpretation of laboratory results	CBC Study
Prescribing medication	
Research and learning	
Procedures	
Continuing education and training	

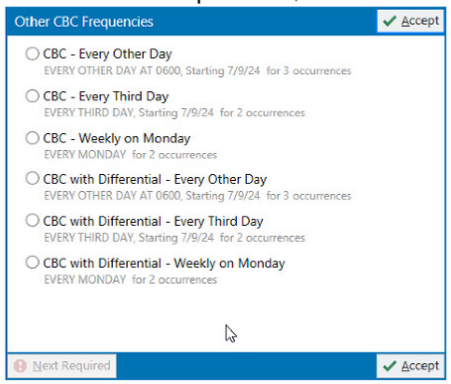
1. Provider renews or orders standing lab with daily or higher frequency between 7 a.m. and 6 p.m.



2. SmartAlert displays if most recent probability of lab stability >90%



3. Other lab frequencies, if selected



Liang et al. SmartAlert - Implementing Machine Learning-Driven Clinical Decision Support for Inpatient Laboratory Utilization Reduction. NEJM AI. 2026;3(7):10.

Evidence?

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Microsoft Copilot

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Prescribing medication	CDS Warnings (AKI-Meds, VTE, Med-Rec)
Research and learning	
Procedures	
Continuing education and training	

Evidence?

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Microsoft Copilot

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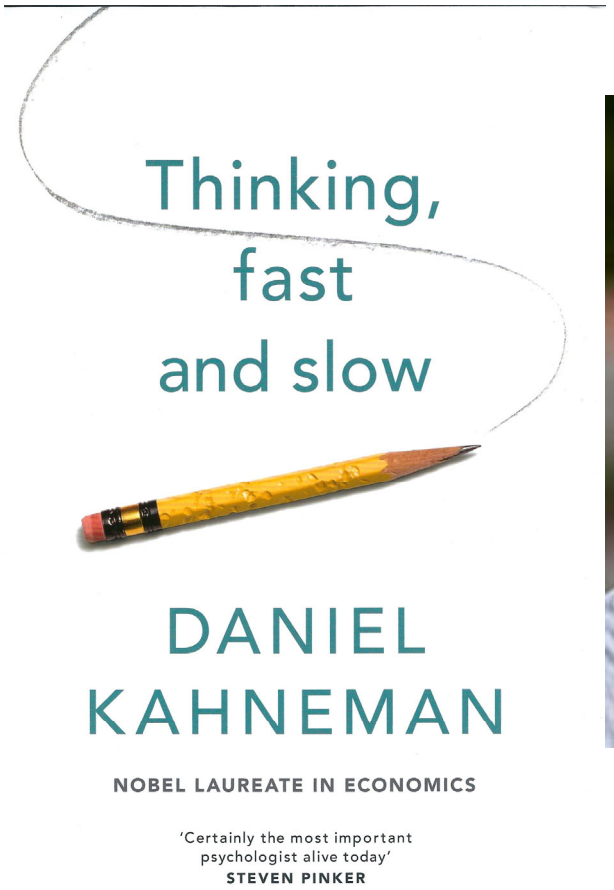
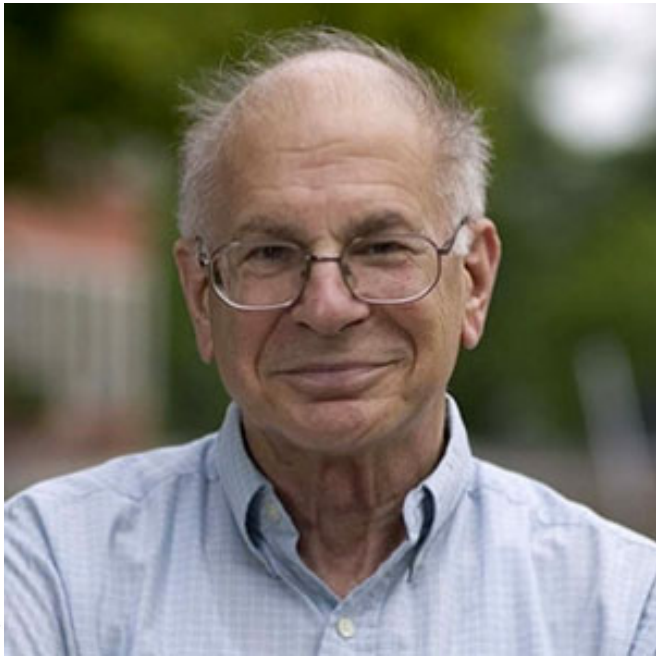
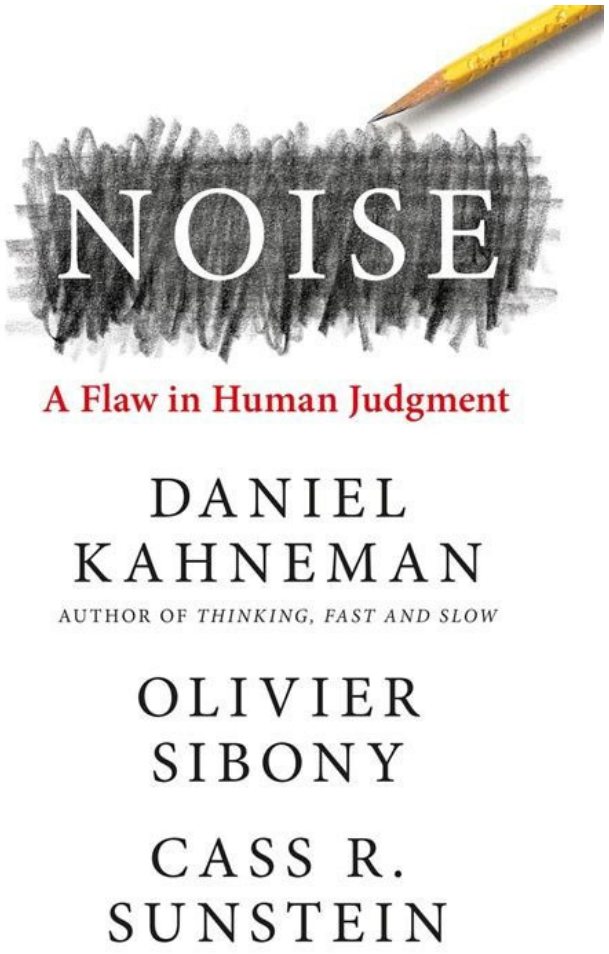

Thinking,
fast
and slow
DANIEL
KAHNEMAN
NOBEL LAUREATE IN ECONOMICS
'Certainly the most important
psychologist alive today'
STEVEN PINKER



1934-2024

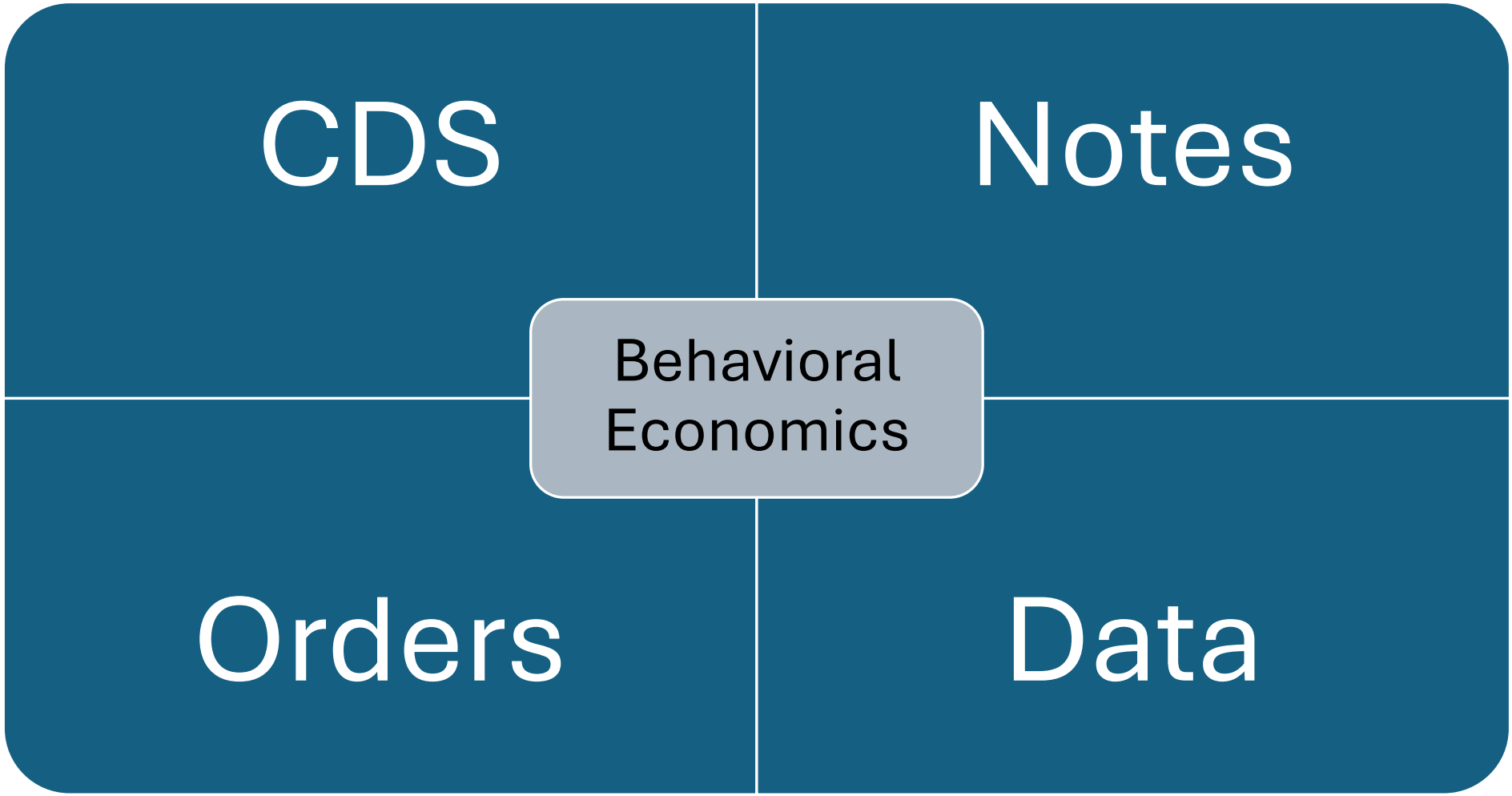

NOISE
A Flaw in Human Judgment
DANIEL
KAHNEMAN
AUTHOR OF THINKING, FAST AND SLOW
OLIVIER
SIBONY
CASS R.
SUNSTEIN

Homo economicus | Homo sapiens

Rational
Selfish
Monotonous

Not rational
Not selfish
Exciting

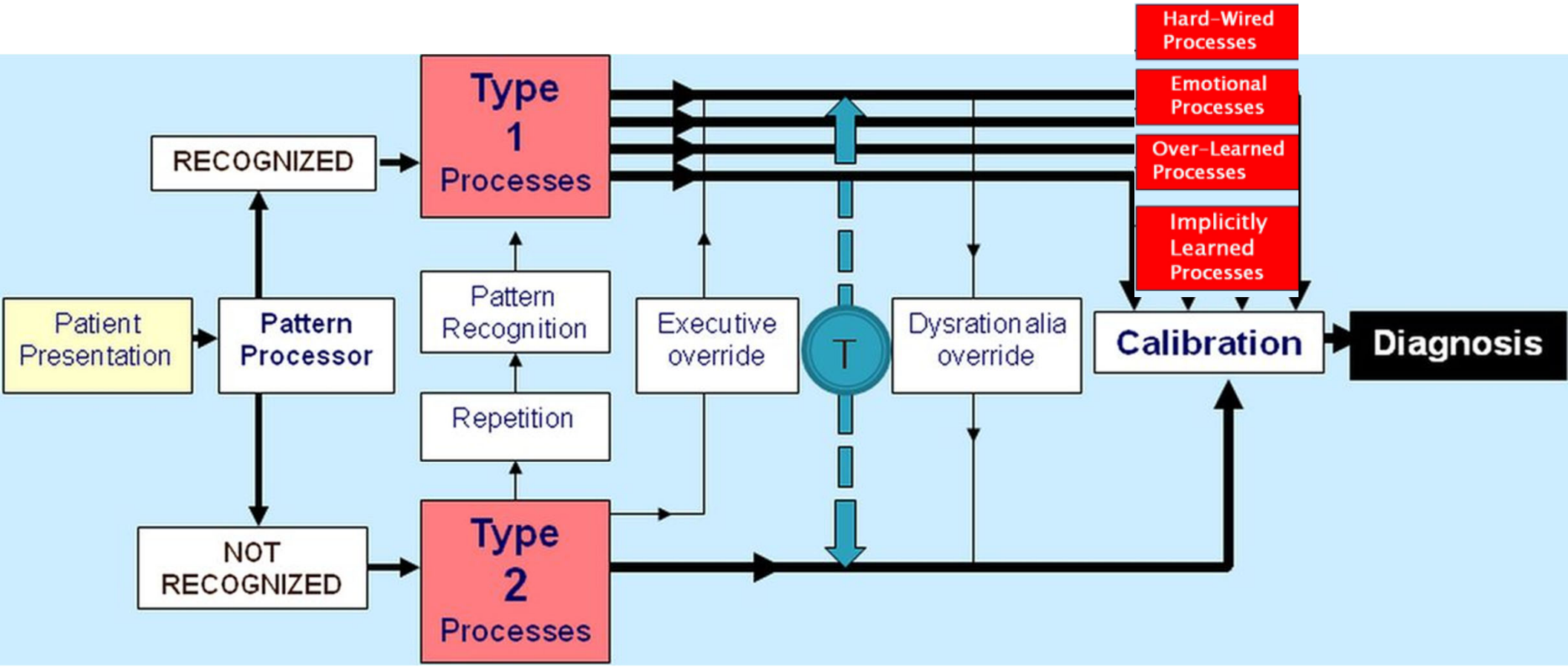

ACTION
INACTION
GOAL
Adobe Stock | #371871147



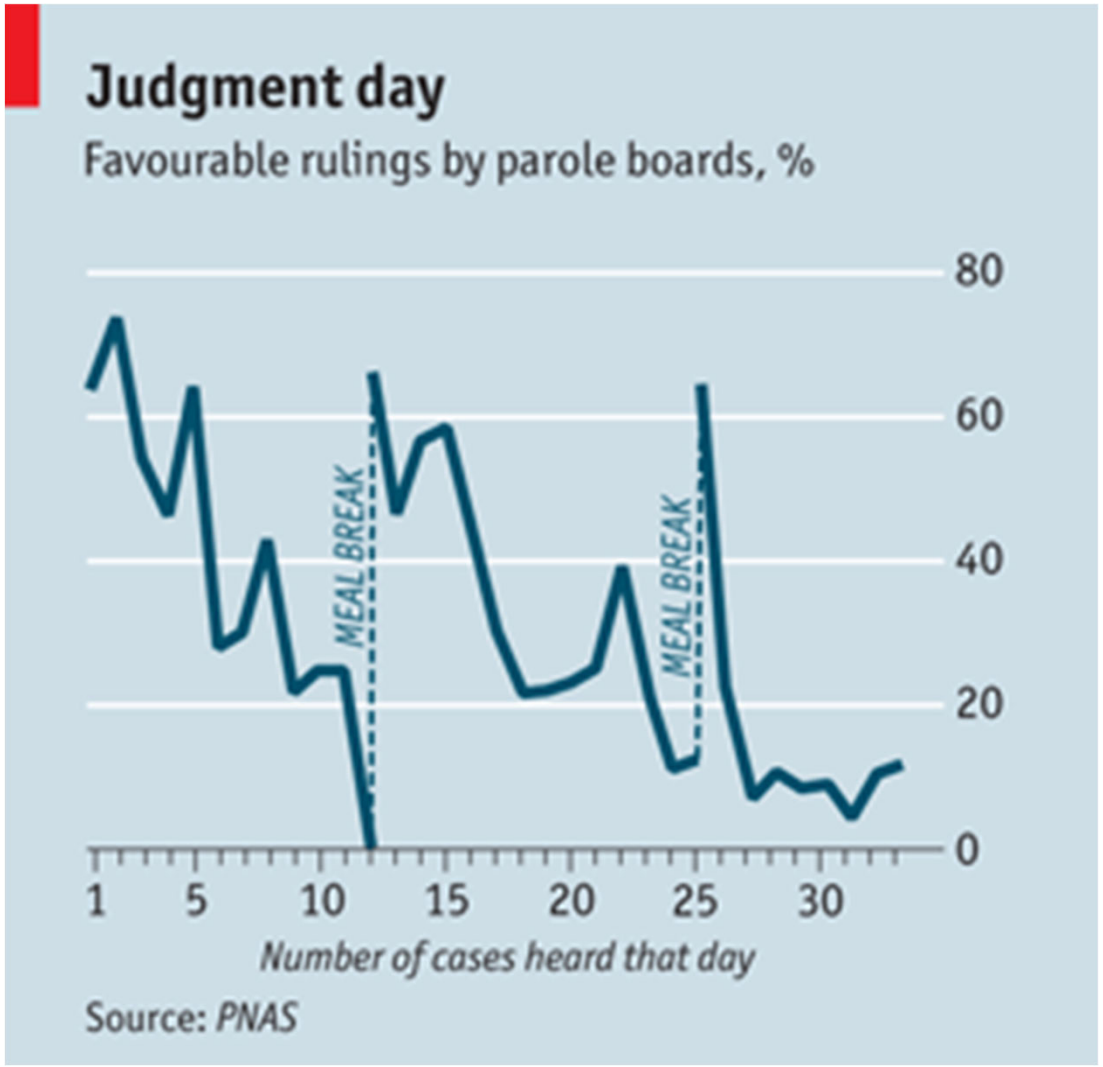
Informatics Tools

Cognitive Style	System 1, Unconscious	System 2, Conscious
Characteristics	Fast Unconscious Emotional	Slow Conscious Logical
Advantages	Natural reaction Automatic reaction From the heart	Considered reaction Thoughtful reaction From the head
Disadvantages	Difficult to explain to others Biased by emotion so could be wrong	Boring Can rationalize a wrong decision

https://www.b2bframeworks.com/system-1-system-2-thinking



Croskerry et al. Cognitive debiasing 1: origins of bias and theory of debiasing BMJ Qual Saf. 2013 Oct; 22(Suppl 2): ii58–ii64



Hunger

Fatigue

Danziger et al. Extraneous factors in judicial decisions. PNAS. April 11, 2011 108 (17) 6889-6892

What You See Is All There Is (WYSIATI)

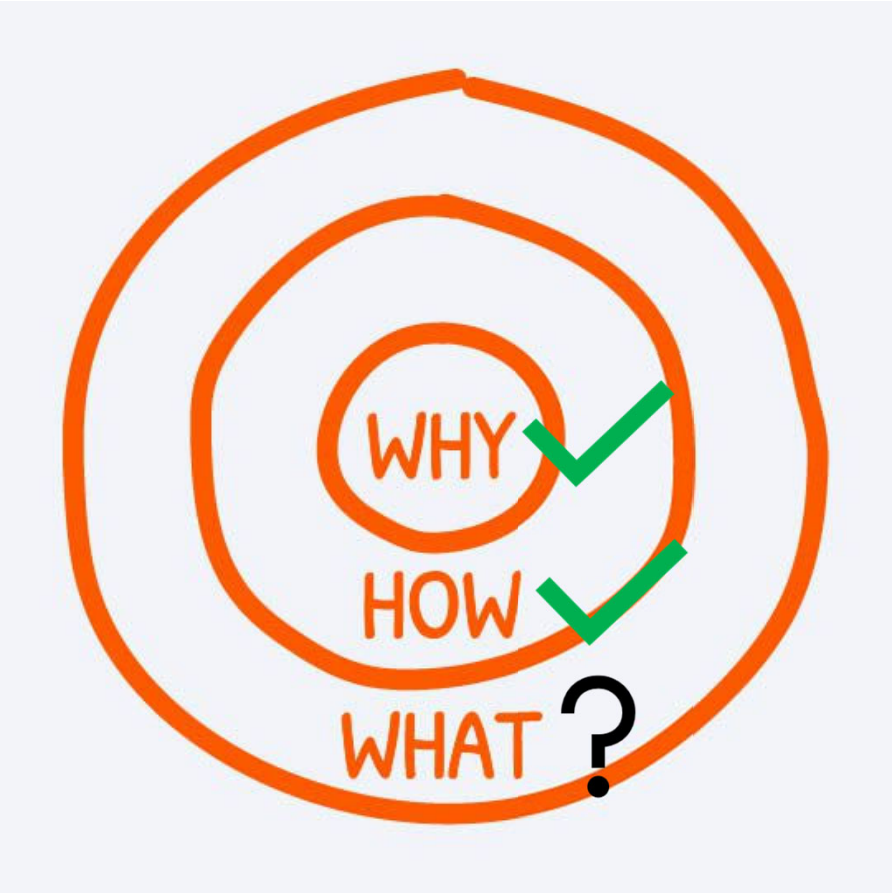
Problem

Solution	System 1	System 2
Passive, Automation, Unsupervised		
Cognition, Redundancy, Supervised		

Problem

Solution

	System 1	System 2
Passive, Automation, Unsupervised	Perfect	Dangerous
Cognition, Redundancy, Supervised	You Don't Like Your Folks	Perfect



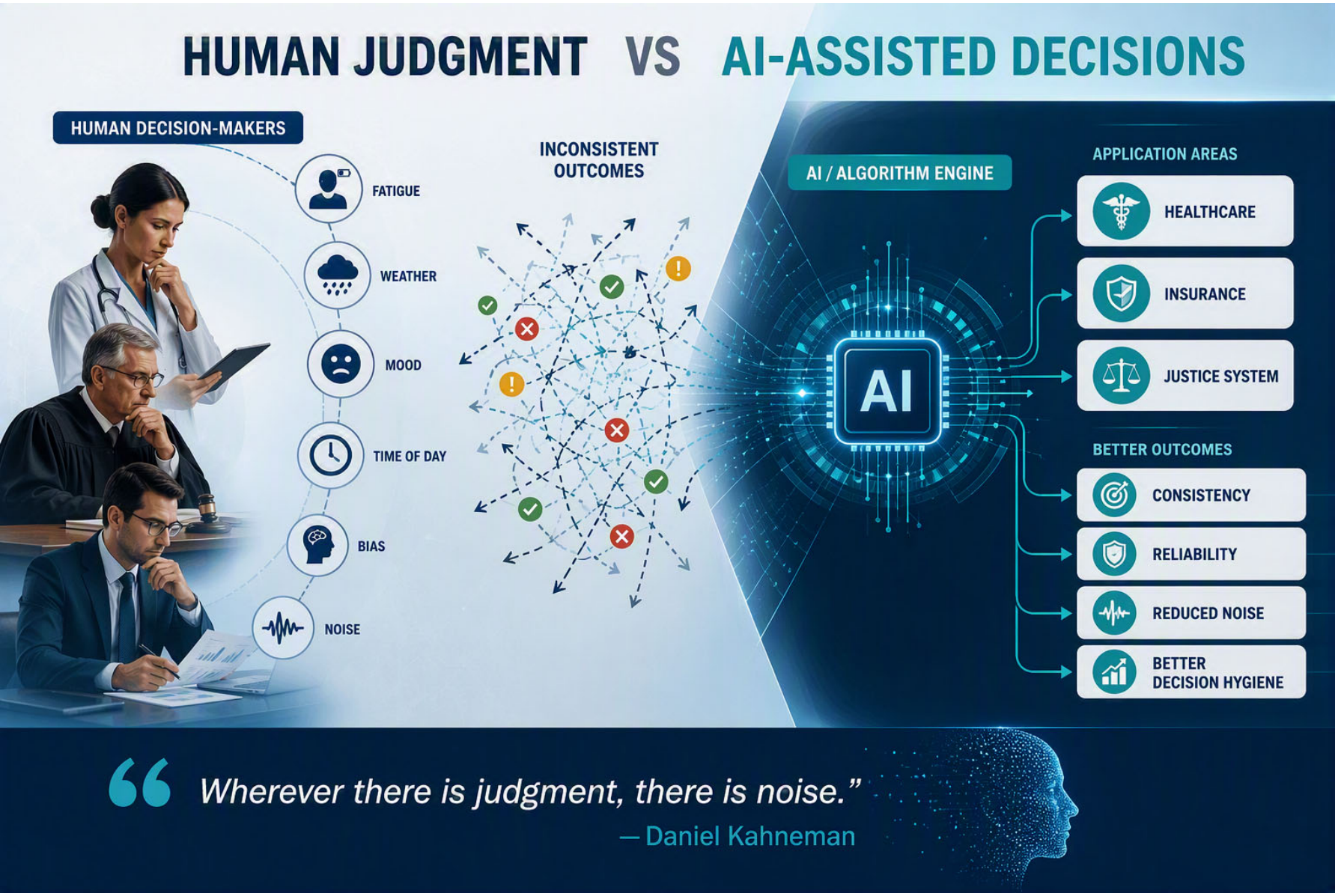
AI in Healthcare

https://simonsinek.com/golden-circle/

Human Supervision

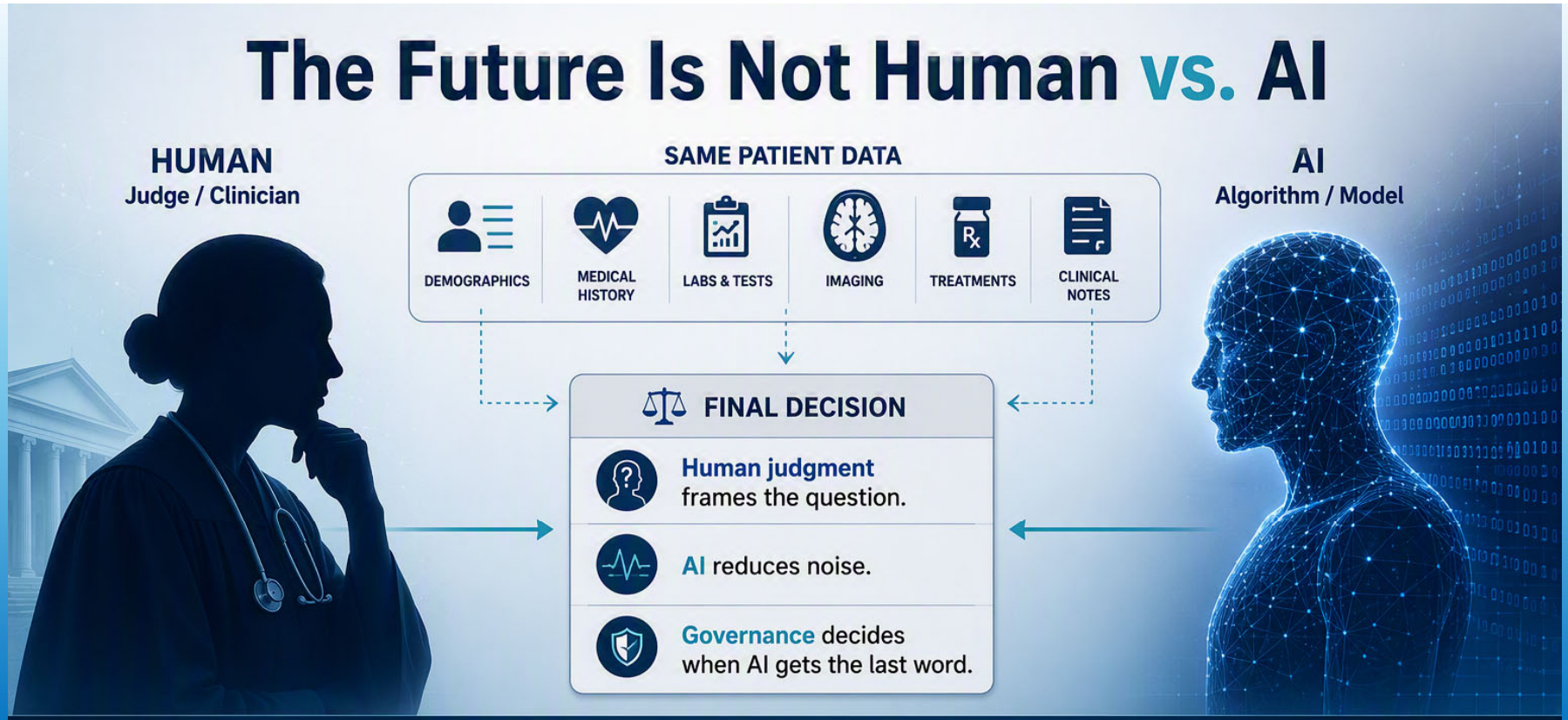
Value

	Needed	Not Needed
High (Tasks We Don't Want AI to Replace)	Augmented Expertise	Automated Annoyances
Low (Tasks We Want AI to Replace)	AI Friction	Set and Forget



[The Transformative Ideas of Daniel Kahneman. By Hidden Brain Staff, April 1, 2024]

The Future Is Not Human vs. AI



The question is not whether we trust AI.
The question is whether we can design systems more trustworthy than unaided judgment.

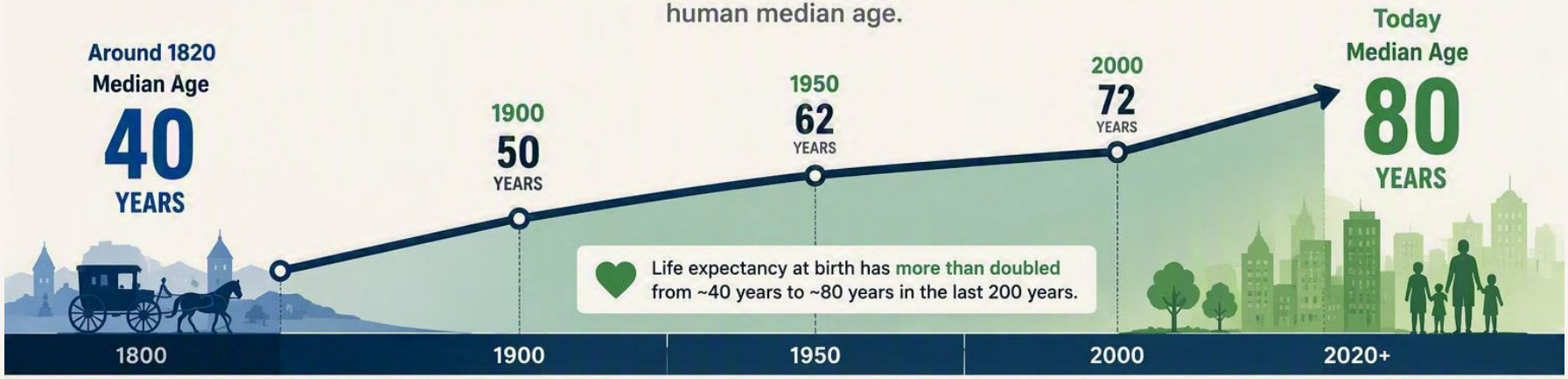
> ***Kahneman's words:*** *The research suggests quite strongly that when you have a judge and an algorithm that are looking at the same data, with some exceptions, it's better to have the algorithm have the last word. And this is very non-intuitive.*

Take Home Points

- Time/Quality/Cost
- Context
- Type of AI
- Evidence based use cases
- Behavioral Economics – Noise Reduction

THE 200-YEAR JOURNEY TO LONGER LIVES

Advances in public health, medicine, and living standards have **nearly doubled** human median age.



1. PIPES
Clean Water & Sanitation

Clean water, sewers, and waste disposal dramatically reduced deaths from cholera, typhoid, and other infections.

2. SHOTS
Vaccination

Vaccines eliminated or controlled deadly diseases like smallpox, polio, measles, diphtheria, and more.

3. PILLS
Antibiotics & Modern Medicine

Antibiotics, safer surgeries, anesthesia, and modern medical care turned many fatal illnesses into treatable conditions.

4. FOOD
Better Nutrition & Food Safety

More reliable food, refrigeration, pasteurization, and food safety improved nutrition and reduced foodborne illness.

5. CHILDHOOD SURVIVAL
Lower Infant & Child Mortality

Fewer babies and children die from infection, hunger, and preventable diseases—so more people live to reach old age.

PIPES → SHOTS → PILLS → FOOD → CHILDHOOD SURVIVAL

Five breakthroughs. One shared mission: more years, better lives.

The future is in human hands.

AI is a powerful tool. We choose what it's used for.

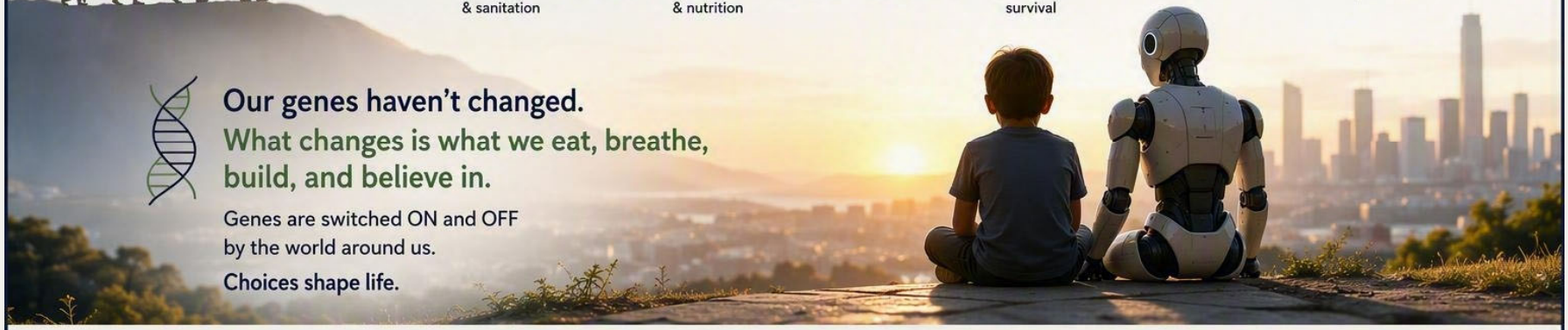
Millions of years
of human existence
~20–40
Years

Last 200 years
of human progress
~80
Years

Today
~80
Years

Clean water & sanitation | Vaccines | Food & nutrition | Medicine | Public health | Childhood survival

A healthier, longer life—together.



Our genes haven't changed.

What changes is what we eat, breathe, build, and believe in.

Genes are switched ON and OFF by the world around us.

Choices shape life.

Our trust must stay in humanity.

We understand empathy.

We hold values.

We seek meaning.

We build a better world.

AI can help us go further.

We decide where.

For millions of years, nature shaped us. | For the last 200 years, human ingenuity changed our destiny. | The next chapter is ours to write.

Let's use intelligence with wisdom. Technology with purpose. Progress with compassion.

A better future is not automatic. It is a choice. **And that choice is ours.**