
AI + DIGITAL INNOVATION IN HEALTHCARE

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AI – Health Technology Disrupter

- AI predictive analytics in US health systems
 - 64% have dedicated team or individual responsible for AI algorithms
 - Most common sepsis ID & hospital readmission risk prediction
 - ~Half built their own AI predictive algorithms
 - Commercial vendors increasingly being used
- Goals
 - Reduce variability
 - Improve outcomes
 - Reduce burnout
 - Address provider shortages
 - Reduce errors
 - Improve workflow (triaging, billing etc.)
 - Reduce costs



- Rojas, J. C., Rohweder, G., Guptill, J., Arora, V. M. & Umscheid, C. A. Predictive Analytics Programs at Large Healthcare Systems in the USA: a National Survey. *J. Gen. Intern. Med.* <https://doi.org/10.1007/s11606-022-07517-1> (2022).



Prediction Models

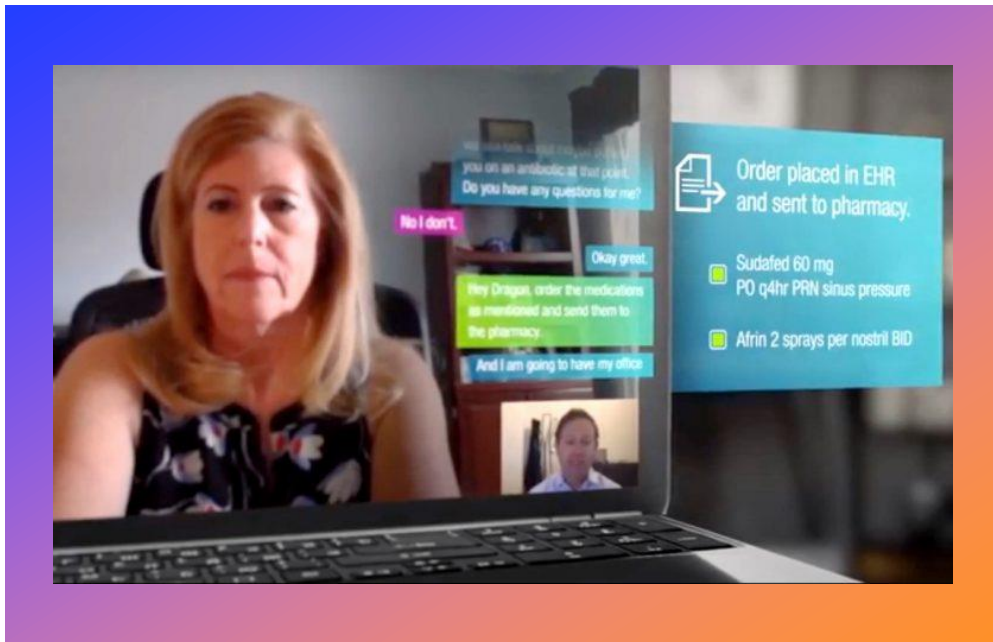
- Statistical based - logistic regression models, decision tree models etc.
 - Gail Model Breast Cancer Risk
 - Sepsis
 - Adverse drug events
 - Patient decompensation
- Moving to SVM, ML, DL
 - Uses more variables
 - More personally tailored
 - More accurate?
 - Widely used AI to detect sepsis only IDed 7% of 2552 patients with sepsis resulting in delayed antibiotic administration & failure ID 1709 patients with sepsis that hospital identified through other means

When to Use	Pearls/Pitfalls	Why Use
Age Valid for women 35-85 years old.	63	years
First menstrual period	Unknown 7-11 years old 12-13 years old >13 years old	
First live birth	Unknown No births <20 years old 20-24 years old 25-29 years old ≥30 years old	
First-degree relatives with breast cancer Include only mother, sisters and daughters	Unknown 0 1 >1	
Previous breast biopsy	Unknown 0 1 >1	
Race/ethnicity	White African-American Hispanic Asian-American	

1.7%
5-year breast cancer risk
Compared with 1.9% for the average 63 year old woman

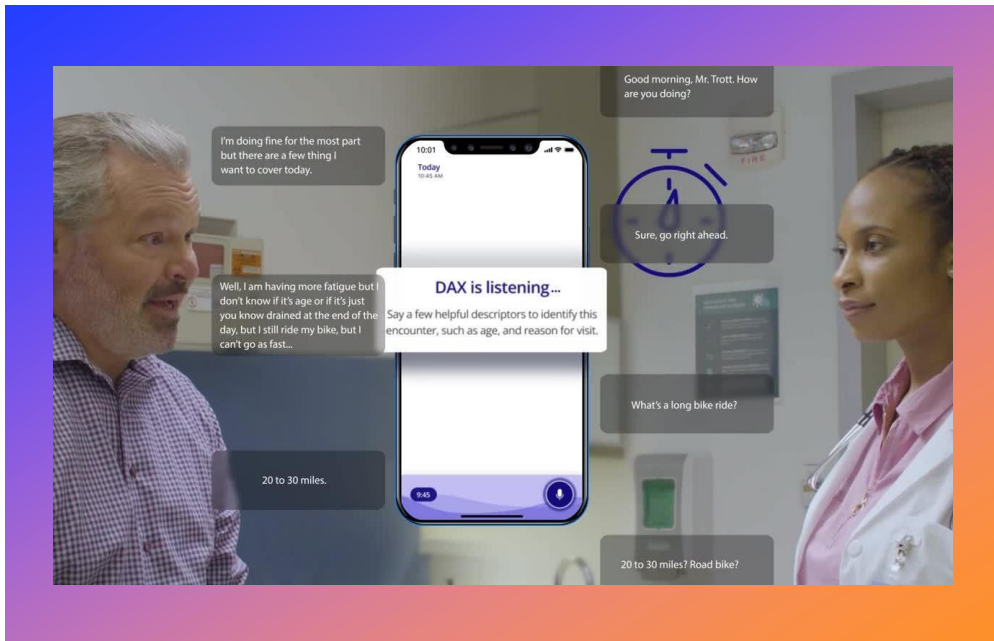
7.4%
Lifetime breast cancer risk
Compared with 8.3% for the average 63 year old woman

Copy Results  Next Steps 



Ambient Clinical Intelligence

- **Advanced, voice-enabled AI: automatically document patient encounters & free-flowing conversation between physician, patients & families**
- **Give patient full attention & ACI creates complete, accurate clinical notes directly in EHR to review & sign**
- **Additional tech can analyze, predict, place orders etc.**
- **Reduce provider burnout, reduce errors**





Embodied AI

- **Robots, virtual assistants, other intelligent systems**
- **Sensors import data from surroundings that AI systems analyze & learn from interactively until goal reached**
- **Develops abstract representation & understanding spatial &/or temporal dimensions world to solve complex tasks**

AI EMR

Predictive analyses

Data visualization

NLP

Security & privacy

Pre-existing condition mapping

Prognosis & diagnosis

Data fetching from wearables

Data normalization (interoperability)

Patient matching (wrong patient)

Automatic reminders (no shows, FU)

HIE

Billing accuracy

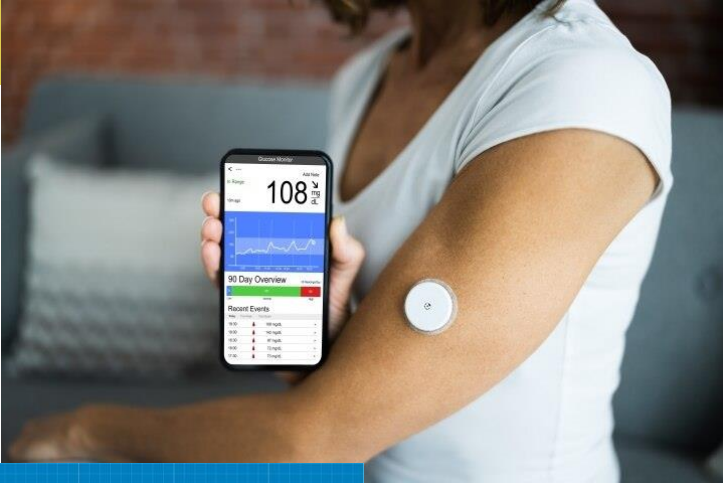
Triaging IP vs TM

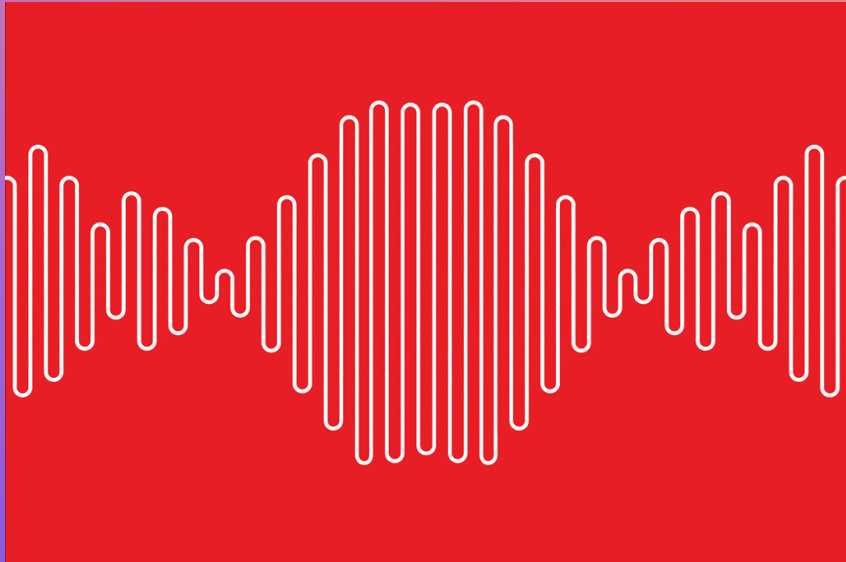
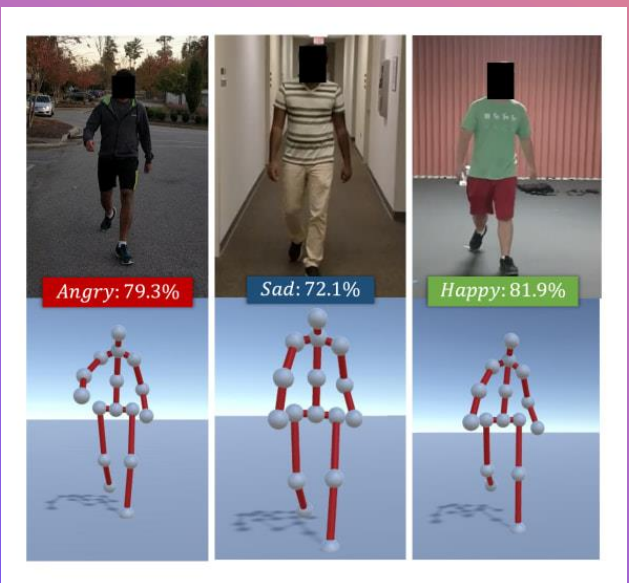
AI & Wearables



24 HOUR REAL-TIME HEALTH MONITORING

- Steps
- Calories
- Blood oxygen
- Heart rate





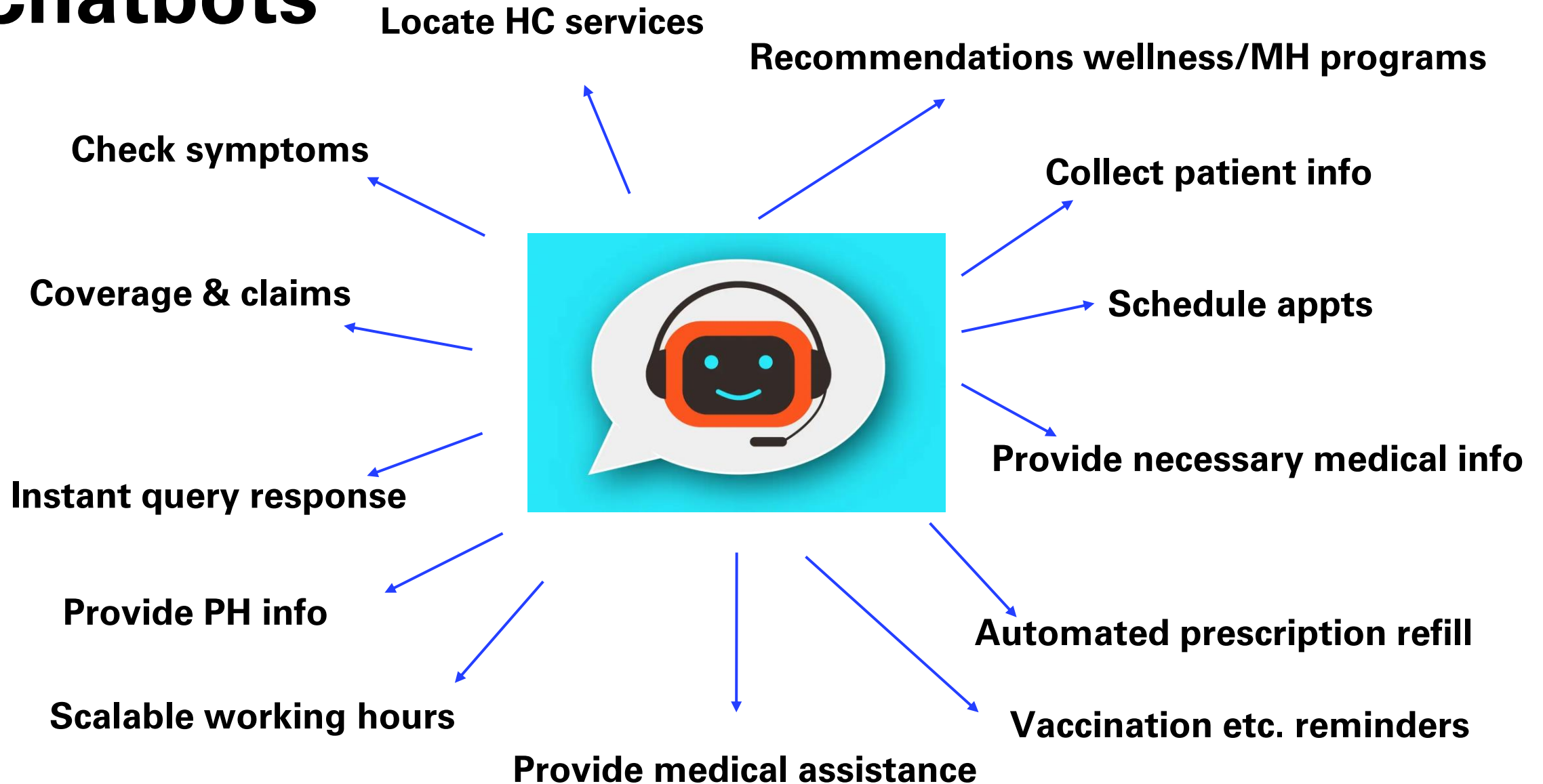
BIOMARKERS

COMPUTER MENTAL HEALTH ANALYSIS

- FOREHEAD
frowned
- EYES
lowered corners
- LIPS
compressed

POSSIBLE CONDITION:
depression
stress
sadness

Chatbots



happify™

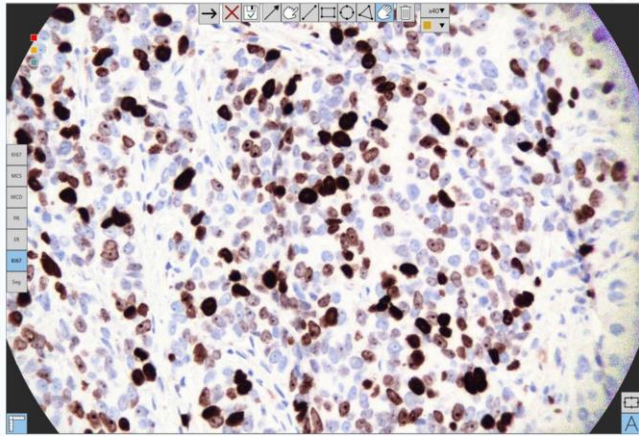
Biomarkers You Can Measure Using
Binah.ai's Technology

Wake up easy with
Sleep Cycle

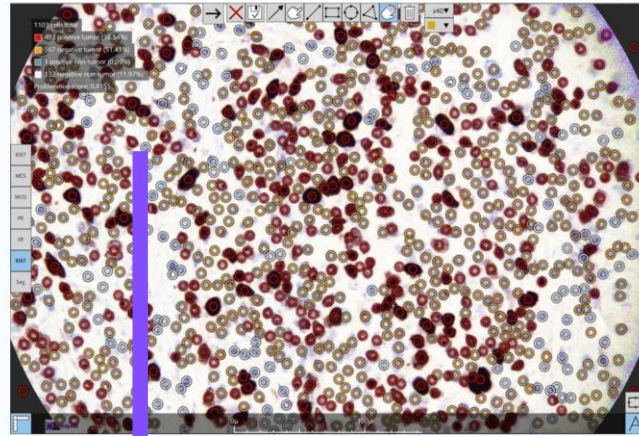
79% of Americans
prefer managing
healthcare experiences
with technology

over two million people.

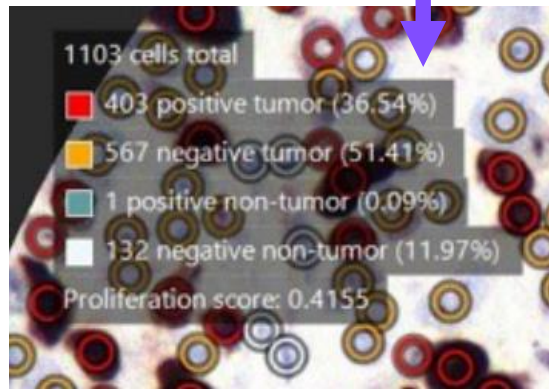




Ki-67 image



Mindpeak AI algorithms







BREATHING
RACE INTO
THE
MACHINE



*The Surprising Career of the Spirometer
from Plantation to Genetics*

LUNDY BRAUN

> [Am J Respir Crit Care Med.](#) 2023 Apr 15;207(8):978-995. doi: 10.1164/rccm.202302-0310ST.

Race and Ethnicity in Pulmonary Function Test Interpretation: An Official American Thoracic Society Statement

Nirav R Bhakta, Christian Bime, David A Kaminsky, Meredith C McCormack, Neeta Thakur, Sanja Stanojevic, Aaron D Baugh, Lundy Braun, Stephanie Lovinsky-Desir, Rosemary Adamson, Jonathan Witonsky, Robert A Wise, Sean D Levy, Robert Brown, Erick Forno, Robyn T Cohen, Meshell Johnson, John Balmes, Yolanda Mageto, Cathryn T Lee, Refiloe Masekela, Daniel J Weiner, Charlie G Irvin, Erik R Swenson, Margaret Rosenfeld, Richard M Schwartzstein, Anurag Agrawal, Enid Neptune, Juan P Wisnivesky, Victor E Ortega, Peter Burney

> [N Engl J Med.](#) 2020 Aug 27;383(9):874-882. doi: 10.1056/NEJMms2004740. Epub 2020 Jun 17.

Hidden in Plain Sight – Reconsidering the Use of Race Correction in Clinical Algorithms

Darshali A Vyas¹, Leo G Eisenstein¹, David S Jones¹

> [Lancet Digit Health](#). 2022 Jun;4(6):e406-e414. doi: 10.1016/S2589-7500(22)00063-2.

Epub 2022 May 11.

AI recognition of patient race in medical imaging: a modelling study

Review

> [J Am Coll Radiol](#). 2023 Sep;20(9):842-851. doi: 10.1016/j.jacr.2023.06.025.

Epub 2023 Jul 27.

Judy Wawira Gichoya¹,
Leo Anthony Celi⁵, Li-C
Shih-Cheng Huang⁹, P
Saptarshi Purkayastha⁴
Laleh Seyyed-Kalantari

"Shortcuts" Causing Bias in Radiology Artificial Intelligence: Causes, Evaluation, and Mitigation

Imon Banerjee¹ Kamanasish Bhattacharjee² John I Burns³ Hari Trivedi⁴

Editorial

> [Radiology](#). 2023 Nov;309(2):e232666. doi: 10.1148/radiol.232666.

dkar⁷,

Racial Bias Exacerbated through AI: An Example Using Chest Radiograph Models

Boris Nikolic¹



Type 1 Thinking

- **Fast**
- **Subconscious**
- **Automatic**
- **Everyday decisions**
- **Error prone**



Type 2 Thinking

- **Slow**
- **Conscious**
- **Effortful**
- **Complex decisions**
- **Reliable**

THE COGNITIVE BIAS CODEX

What Should We Remember?

Too Much Information

To avoid mistakes, we aim to preserve autonomy and group status, and avoid irreversible decisions

To get things done, we tend to complete things we've invested time and energy in

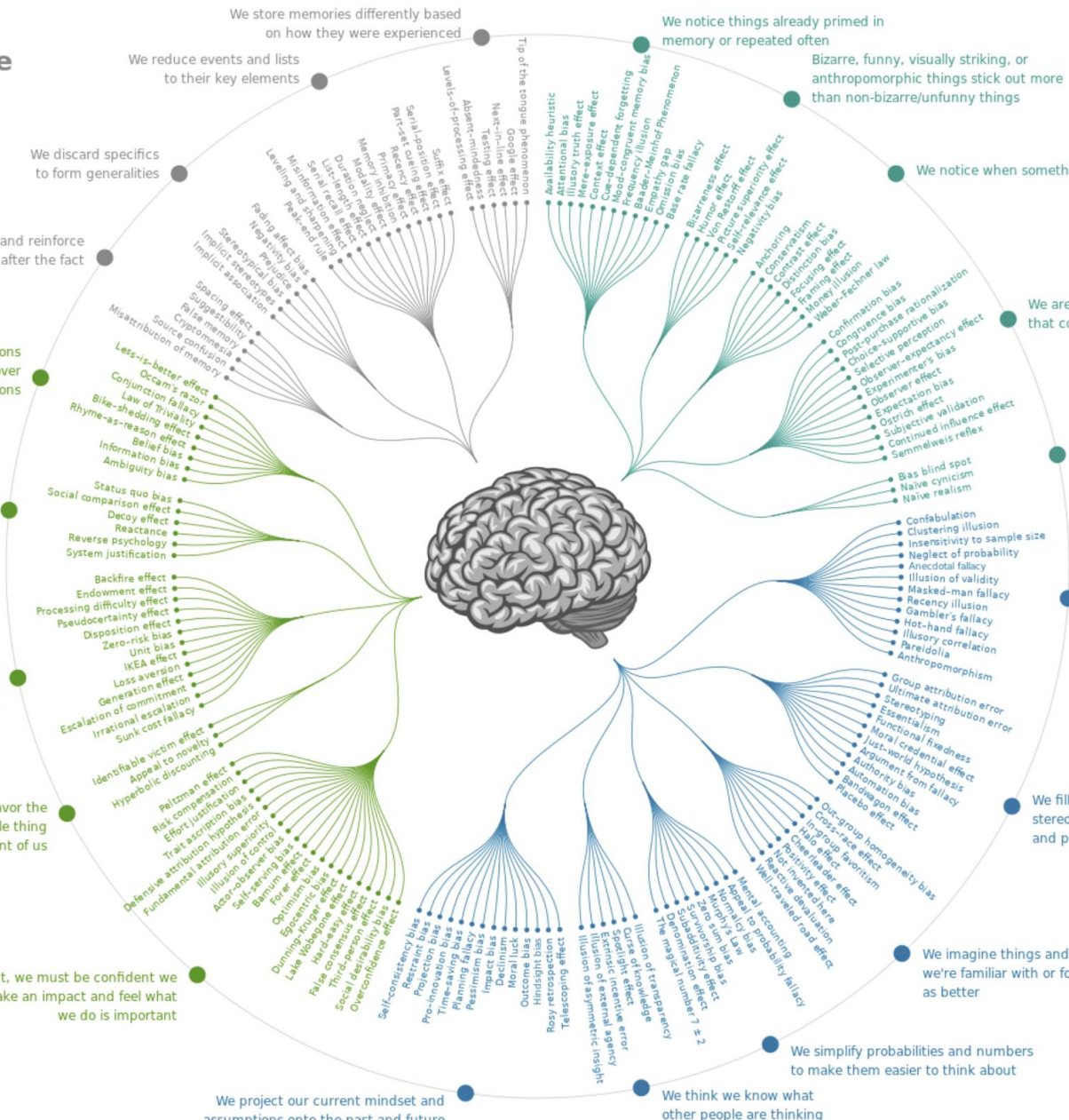
To stay focused, we favor the immediate, relatable thing in front of us

To act, we must be confident we can make an impact and feel what we do is important

Need To Act Fast

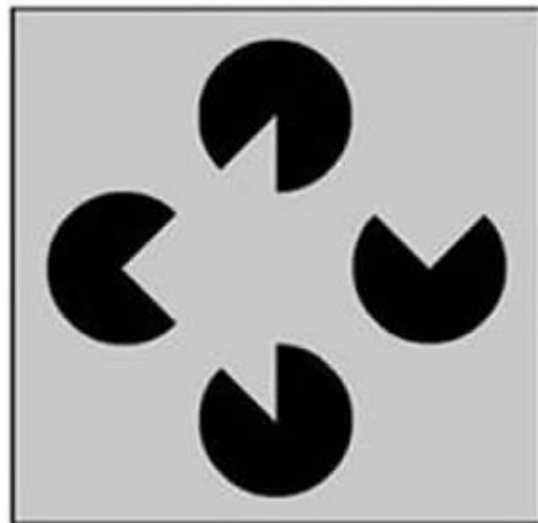
We simplify probabilities and numbers to make them easier to think about

Not Enough Meaning

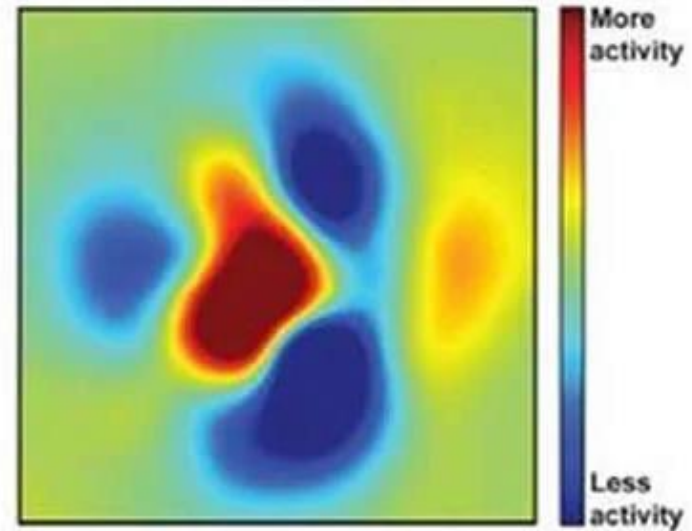




Visual illusion

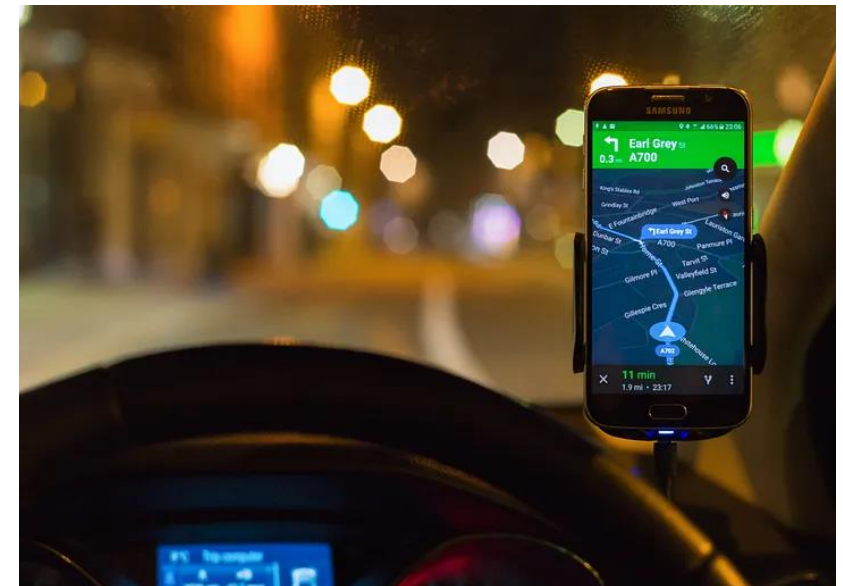
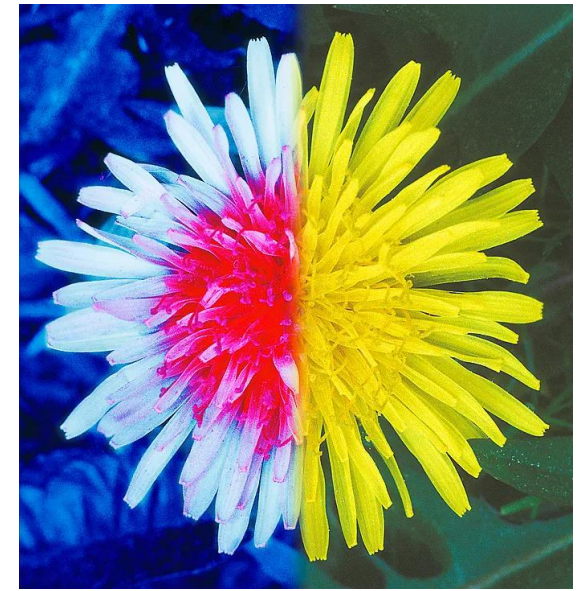


Brain activity



Challenges

- **Where to apply effectively**
 - Lack internal expertise
 - Lack understanding compliance & regulatory
 - User trust
- **Hallucinations**
- **ROI & \$\$ for implementation/infrastructure**
- **Ethical (fairness, bias) & legal (privacy, security, data & IP/ownership)**
- **Lack quality data**
- **Clinically irrelevant performance metrics**
- **Methodological research flaws**
- **Transparency & explainability**
- **Skill gaps**
- **Deskilling**



What's Needed?

- **Safe & effective AI in clinical settings requires consideration health care workforce, existing technologies, policies, & processes**
- **Aviation & defense developed framework - human-systems integration - to effectively & safely integrate machines into work environment – should leverage**
- **ONC funded EHR implementation guides called Safety Assurance Factors for EHR Resilience (SAFER) guides – can serve as model for embedding AI in EHR**
- **FDA should consider guidelines to support safe use AI-enabled medical devices**
- **Address tendency people overly trust AI, algorithm drift that results in variation in AI performance in different settings, & health care professional complacency**

- **Processes monitor AI-related patient safety issues - use test cases that represent organization's patients to assess AI for safety issues & for commercial AI developer should provide standardized set test cases all organizations can apply to implemented AI system with opportunity local customization to represent patient population differences**
- **Appropriate governance structures to address adding new AI tools, frequency monitoring to ID patient safety issues, development solutions - Joint Commission should consider basic accreditation standards**
- **If AI system may have contributed to patient harm thorough review required to examine how AI may have been involved - AI systems should capture core set metadata to support review, analysis & traceability of how AI was operating at time incident**
- **Traceability also addresses AI bias leading to inequitable patient outcomes**
- **Use sensitive personal data for analysis (& development) may require patient consent & robust security measures to protect sensitive information**





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