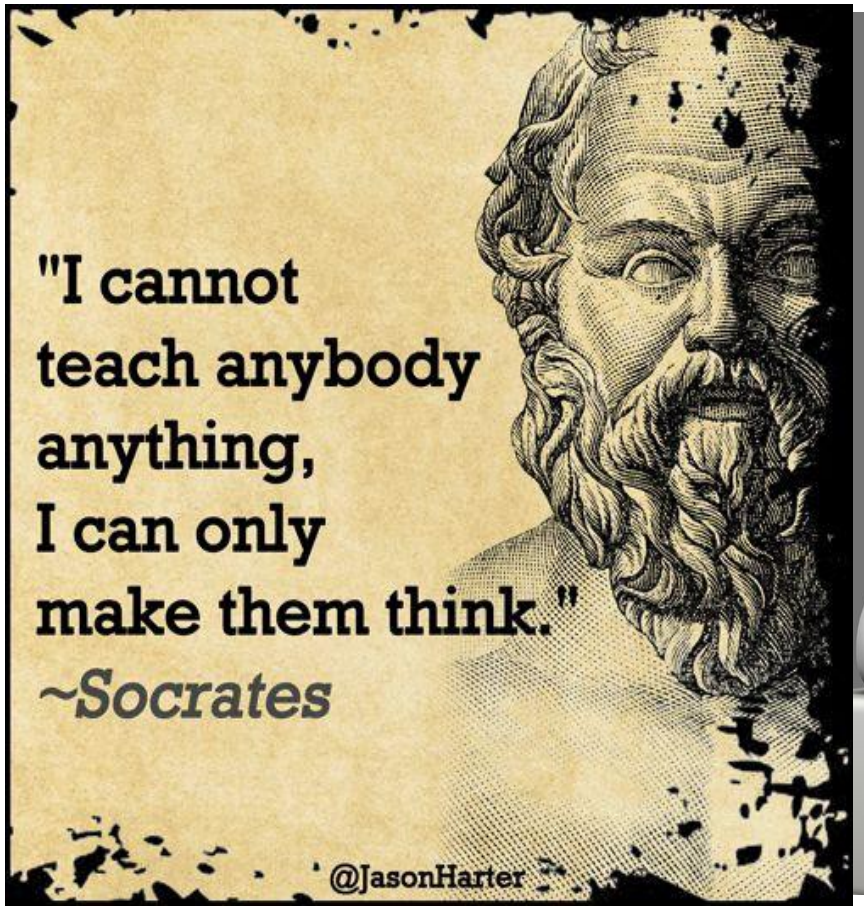
Critical Thinking Skills
ACP Hawaii
2/23/2019

William Loui, MD, FACP
University of Hawaii

Topics

- Critical thinking is at the core of Medicine
- Socratic teaching is not the same as “pimping” in AM rounds
- Unconscious Cognitive Bias affects critical thinking
- Why guidelines don’t help
- Why mnemonics don’t help
- Five step technique to overcome biases and help critical thinking
- Future of AI and Medicine

Critical Thinking & the Socratic Method



How You Can Promote Critical Thinking

- Socratic Method of Teaching
  - Oldest method of teaching
  - Promotes critical thinking and active learning
  - Involves "*guided questioning*"
    - *"Asking rather than telling"*

Morning Rounds & the Socratic Method

- Lost art to think on your feet, explain, teach
- Inefficient method to teach
- Esoteric facts & trivia
- Public Embarrassment & Shaming
- Limited knowledge
- Tangential thinking
- Intellectual bullying
- Maintain power hierarchy
- Real learning?

Socratic method vs“Pimping”

Table 1. DISTINCTION BETWEEN MEDICAL PIMPING AND THE SOCRATIC METHOD OF TEACHING

Technique	Medical Pimping	Socratic Method of Teaching
Goals	Evaluate students	Connect new knowledge to existing knowledge
	Establish hierarchal order	Teach
	Teach	
Setting	One on one focus of questions	Group learning
Types of questions	Factual, pertaining to history, eponyms, lists, esoteric	Probing and leading: making connections
Example	What is tertiary hyperparathyroidism?	What is the mechanism for hypercalcemia in some lung cancers?

Eric R. Carlson. Pimping Versus Socratic Method of Teaching. J Oral Maxillofac Surg 2017.

Social Science Findings

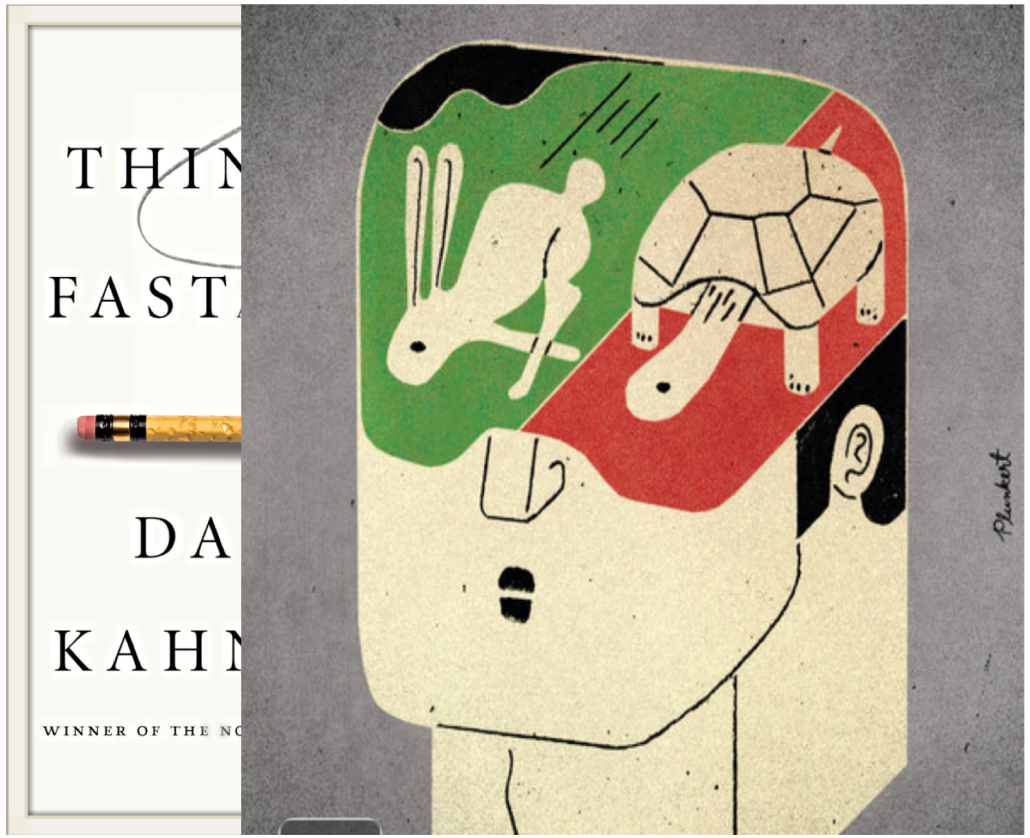
- People can make poor choices with incomplete information.
- People can make bad decisions even with full information because of unconscious biases.
- Cognitive biases interfere with critical thinking!
- Peer pressure affects individual thinking
- Problems with Group think
- Thinking takes too much effort, I'll just go into surgery.
- Here's a 5 step tool to help solve problems.

“Cogito, ergo sum”

- “I think, therefore I am.”
- Rene Descartes b. 1596

Thinking Fast & Slow

Daniel Kahneman, Nobel Prize winner in Economics 2002



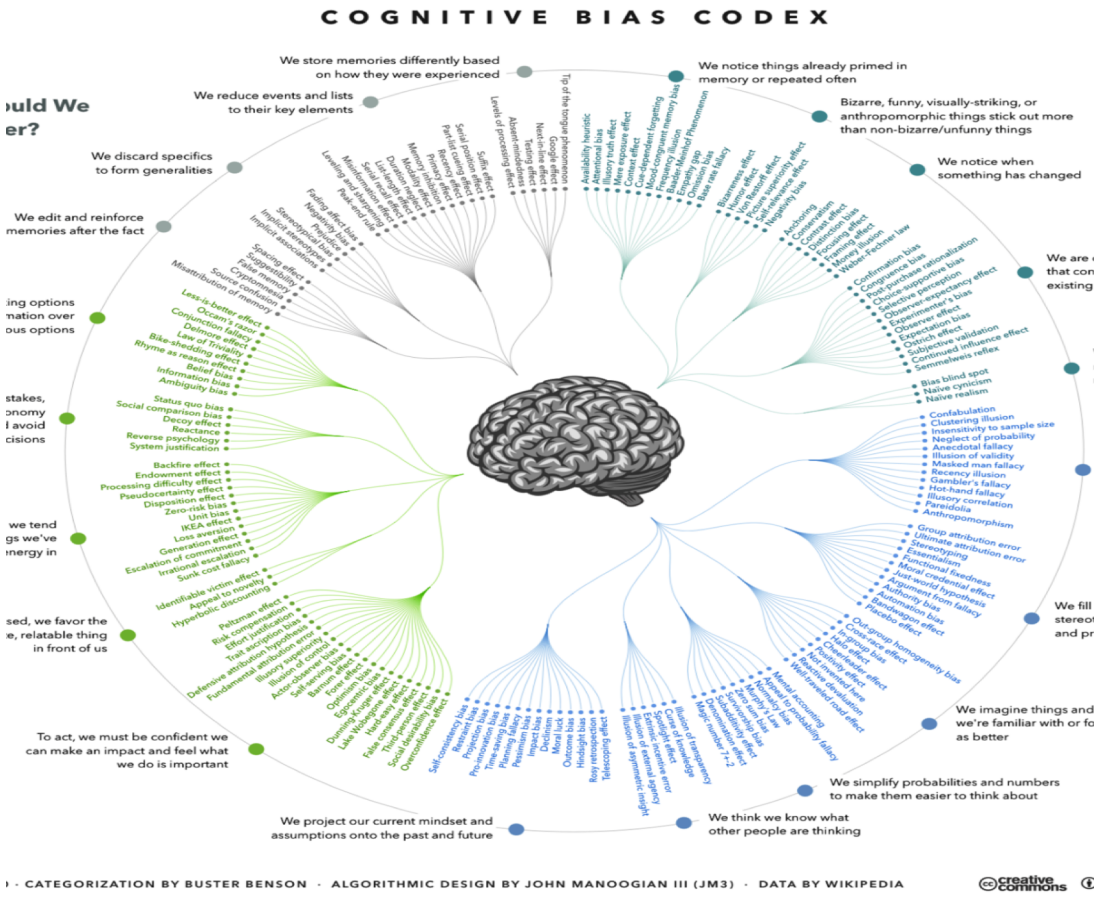
System 1 & System 2 thinking

(Fast & Slow)

- Unconscious biases influence our decision making
- Anchoring bias
- Confirmation bias
- Sunken cost bias
- Loss Aversion
- Illusion of Validity
- Optimism bias

Cognitive Bias: 4 Categories in Medicine

- **Biases from too much information**
  - Too many tests
- **Not enough meaning**
  - Facts without context are merely trivia
- **Need to act quickly**
  - Performance pressure
- **Limits of memory**
  - “We live in an age where everything is recorded and little is remembered.”



Different Types of Bias Alter Critical Thinking

Confirmation Bias

- Finding facts that support your beliefs
- Ignoring contradictory facts

Anchoring Bias

- Relying too heavily, or "anchor," on one piece of information for decisions
- “I saw a similar case last month”

Availability Bias

- Thinking of examples that come readily to mind are more representative than is actually the case.

Sunken Cost Bias

- The additional cost is less of a factor than the initial cost.
- If you’ve already publicly committed to a diagnosis, then you’re less likely to change to another even if the initial dx was wrong.

Optimism Bias

- People tend to overestimate positive than negative outcomes
- Doctors tend to think they are more correct than wrong.

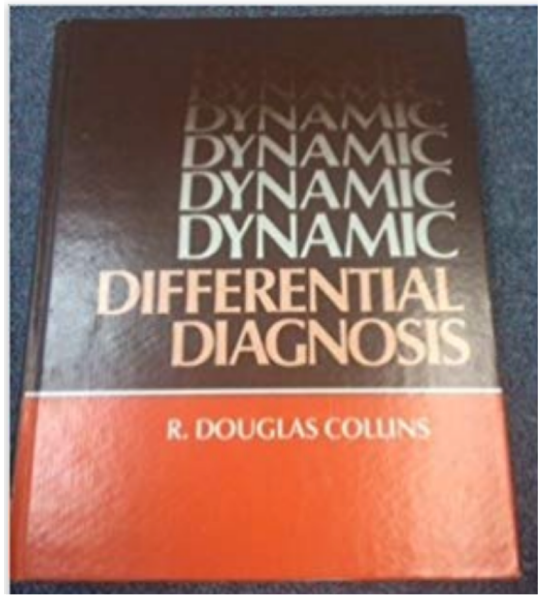
Guidelines Do NOT Replace Critical Thinking

- Experts have made these guidelines
- A lot of thought has gone into developing guidelines.
- Corollary: “I don’t have to think, I will follow the guidelines!”

- Guidelines are a good start.
- Guidelines can be evidence based
- ***BUT guidelines don’t make you brilliant. They just help you act less stupid.***

Mnemonics

- R. Douglas Collins 1981



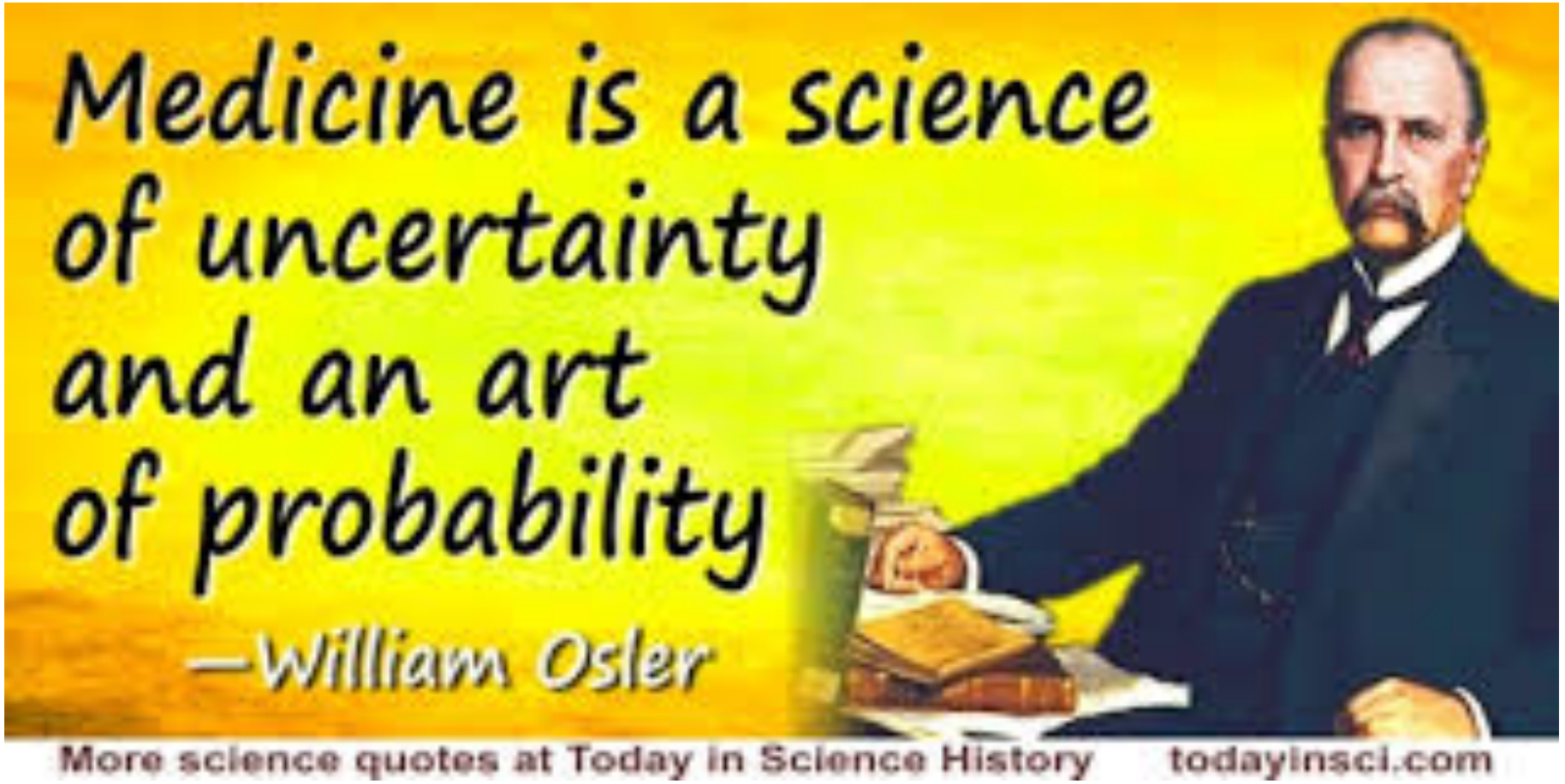
VINDICATE		
V	Vascular	
I	Infectious	
N	Neoplastic	
D	Degenerative	
I	Iatrogenic	Intoxication
C	Congenital	
A	Autoimmune	
T	Traumatic	
E	Endocrine	Metabolic

Mnemonics & DDX

- “VINDICATE”
  - Vascular
  - Infectious
  - Neoplastic
  - Degenerative/Drugs
  - Iatrogenic/Inflammatory
  - Congenital
  - Autoimmune
  - Trauma
  - Endocrine

- Tangential thoughts
  - Availability bias
  - Anchoring bias
- Doesn’t prioritize
- No relation to prior probabilities
- Another memory trick
- Not critical thinking
- Confirmation bias

William Osler



Prior probability

- Bayes Theorem
- Common things occur commonly.
- Key to finding fish: Be in the right place at the right time

Prior Probability

Likelihood of the evidence 'E' if the Hypothesis 'H' is true

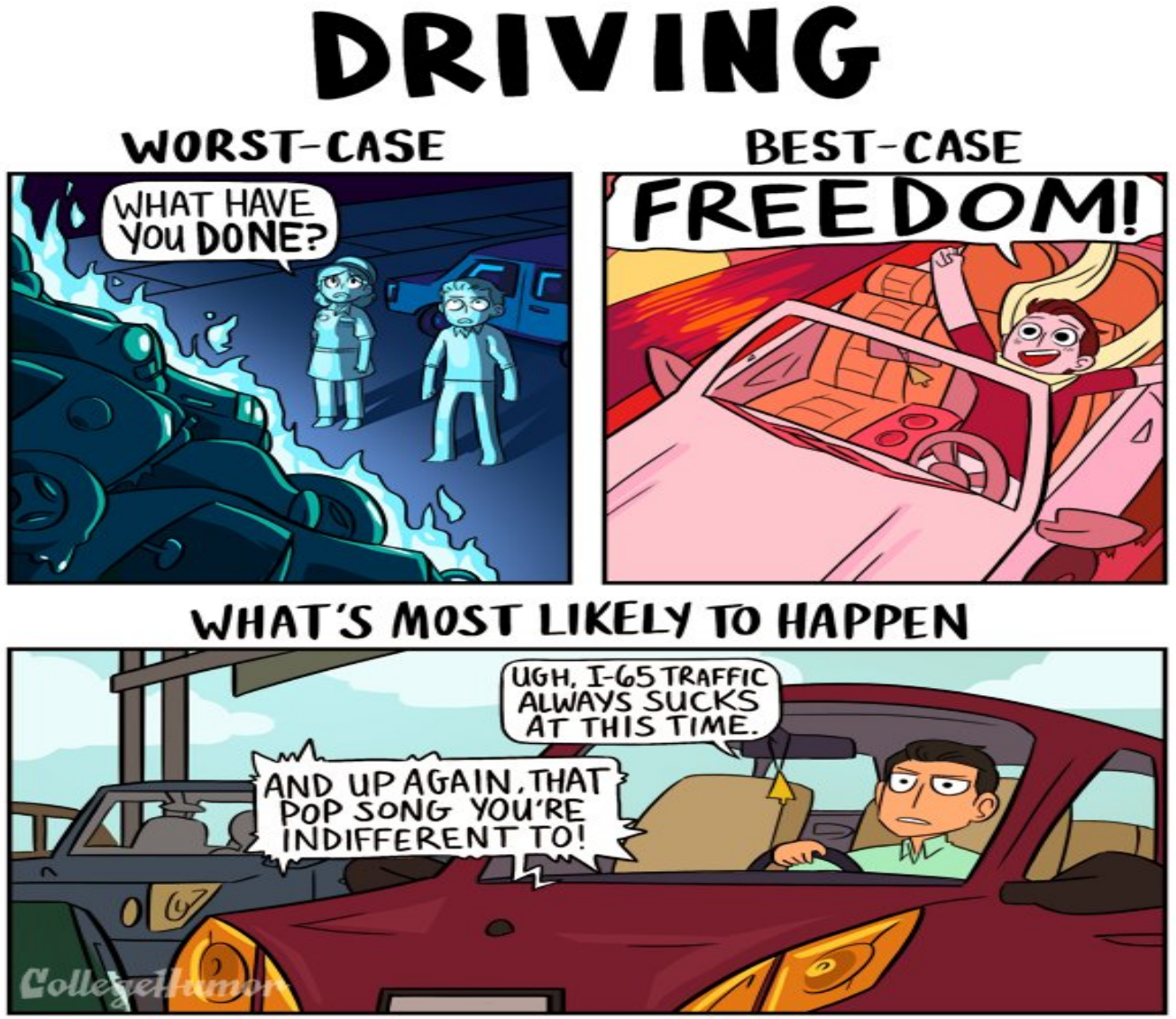
$$P(H|E) = \frac{P(H) * P(E|H)}{P(E)}$$

Posterior Probability of 'H' given the evidence

Priori probability that the evidence itself is true

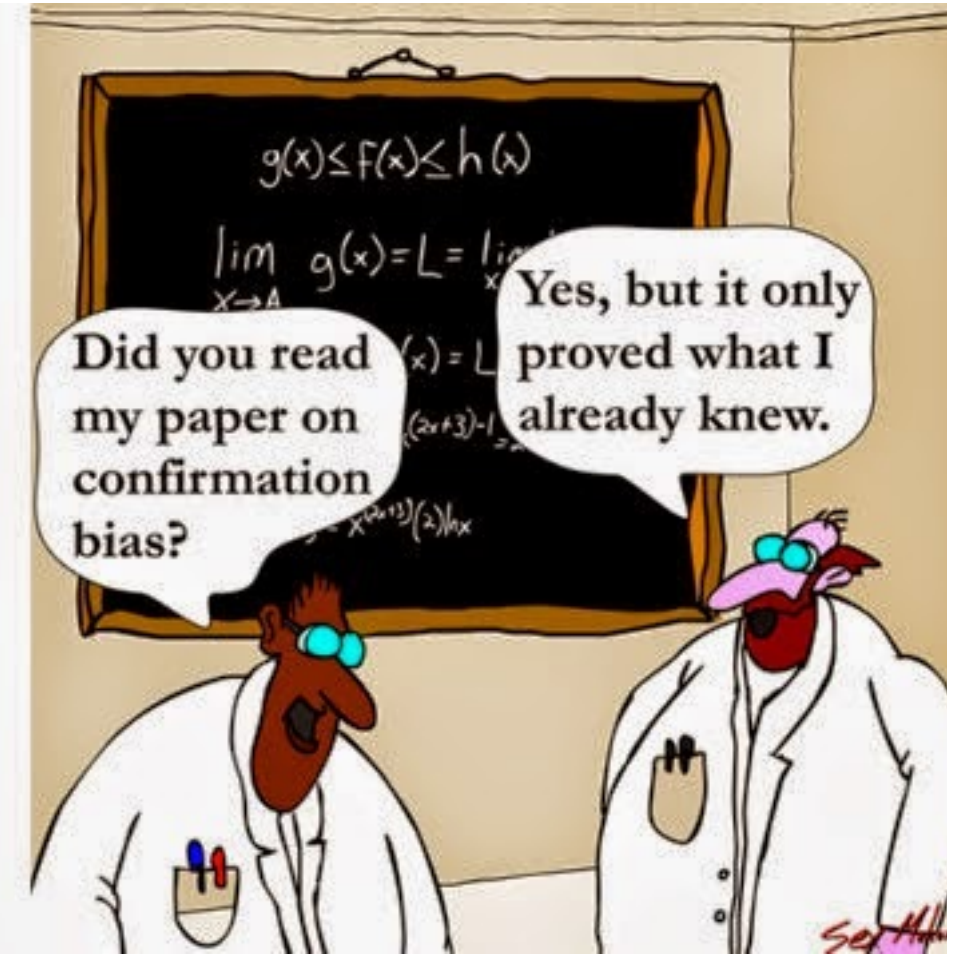
Outcomes Analysis

- What's the worst case scenario?
- What's the best case scenario?
- What else can happen?

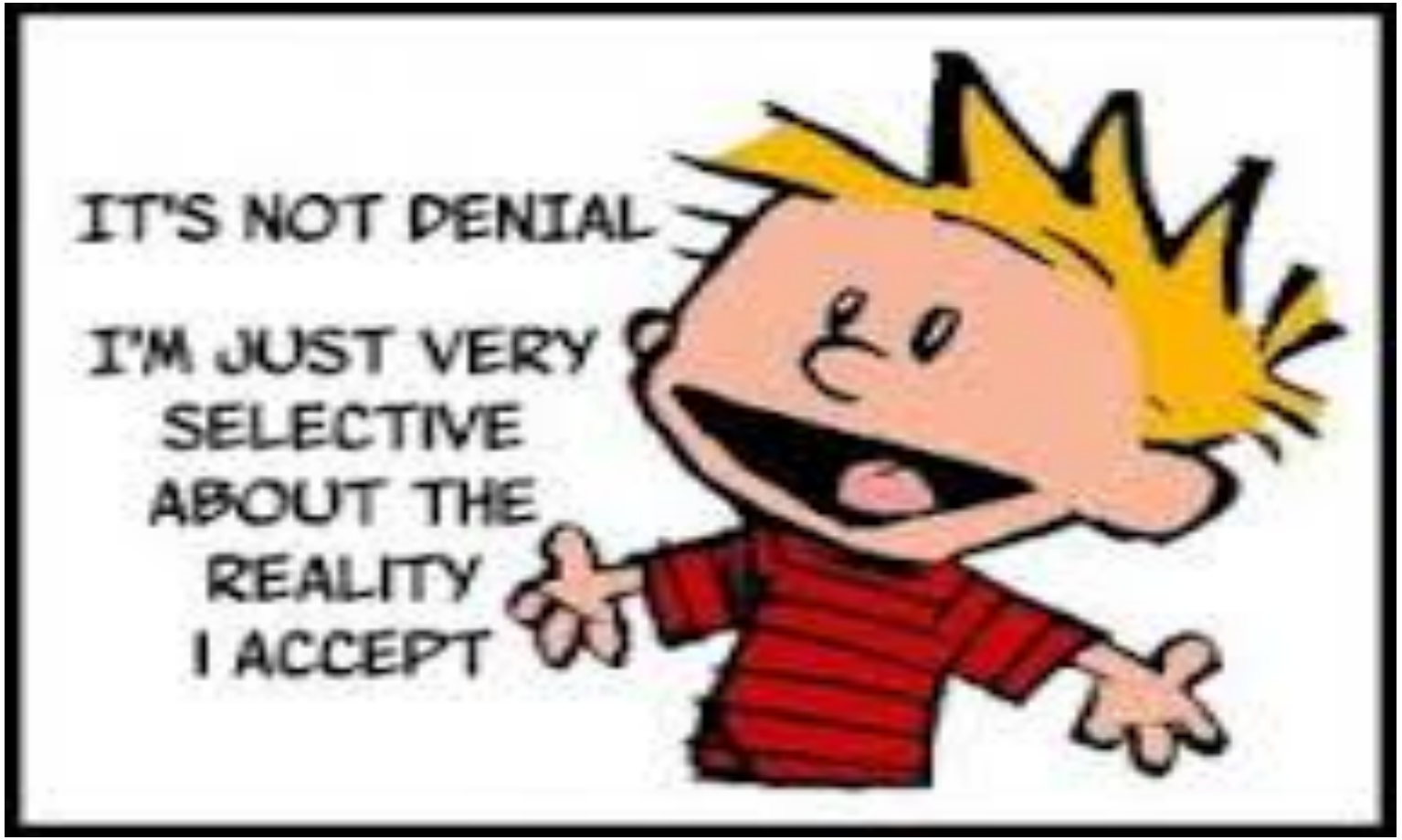


Confirmation Bias

- Doctors have initial diagnoses within 2 minutes
- Confirmatory data emphasized
- Contradictory data ignored
- *“We see and hear what fits our expectations.”*



Cognitive Dissonance



Cognitive Dissonance

A Solution:

How to Solve any problem in 5 easy steps

- This works for Medical problems

or

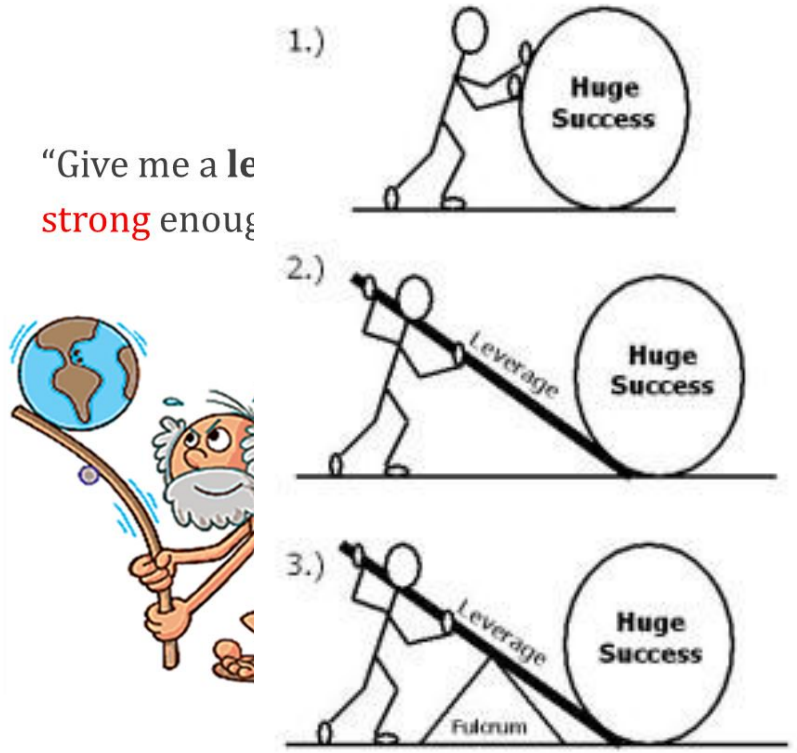
- Figuring out which car to buy

or

- Choosing a restaurant

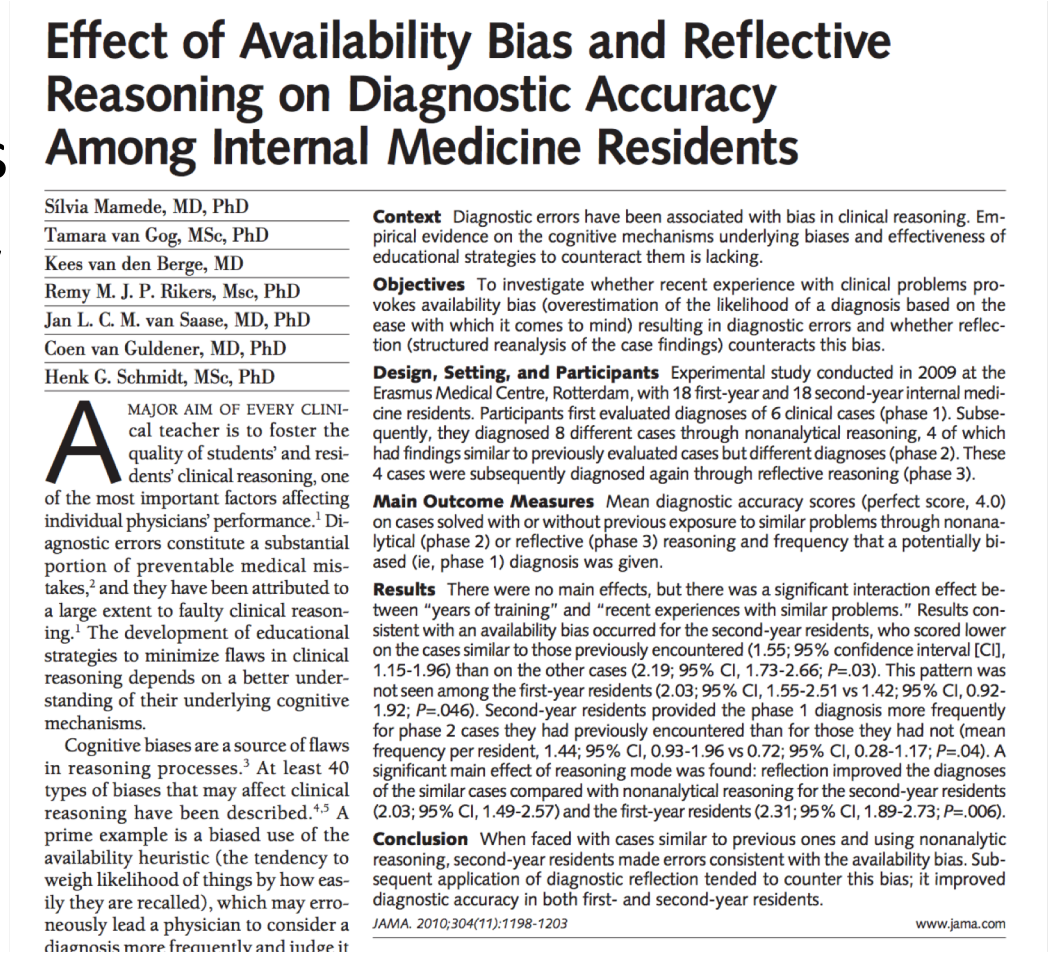
or

- Choosing a mate



Using Positive & Negative Facts to make a Dx

- JAMA article 2010
- IM residents in Netherlands
- Double Entry accounting by the Dutch in 1500s
- Ben Franklin listed positive & negative facts in making decisions
- Helps avoid bias and improves reasoning



Effect of Availability Bias and Reflective Reasoning on Diagnostic Accuracy Among Internal Medicine Residents

Sílvia Mamede, MD, PhD
Tamara van Gog, MSc, PhD
Kees van den Berge, MD
Remy M. J. P. Rikers, Msc, PhD
Jan L. C. M. van Saase, MD, PhD
Coen van Guldener, MD, PhD
Henk G. Schmidt, MSc, PhD

A MAJOR AIM OF EVERY CLINICAL teacher is to foster the quality of students' and residents' clinical reasoning, one of the most important factors affecting individual physicians' performance.[1] Diagnostic errors constitute a substantial portion of preventable medical mistakes,[2] and they have been attributed to a large extent to faulty clinical reasoning.[1] The development of educational strategies to minimize flaws in clinical reasoning depends on a better understanding of their underlying cognitive mechanisms.

Cognitive biases are a source of flaws in reasoning processes.[3] At least 40 types of biases that may affect clinical reasoning have been described.[4,5] A prime example is a biased use of the availability heuristic (the tendency to weigh likelihood of things by how easily they are recalled), which may erroneously lead a physician to consider a diagnosis more frequently and judge it

Context Diagnostic errors have been associated with bias in clinical reasoning. Empirical evidence on the cognitive mechanisms underlying biases and effectiveness of educational strategies to counteract them is lacking.

Objectives To investigate whether recent experience with clinical problems provokes availability bias (overestimation of the likelihood of a diagnosis based on the ease with which it comes to mind) resulting in diagnostic errors and whether reflection (structured reanalysis of the case findings) counteracts this bias.

Design, Setting, and Participants Experimental study conducted in 2009 at the Erasmus Medical Centre, Rotterdam, with 18 first-year and 18 second-year internal medicine residents. Participants first evaluated diagnoses of 6 clinical cases (phase 1). Subsequently, they diagnosed 8 different cases through nonanalytical reasoning, 4 of which had findings similar to previously evaluated cases but different diagnoses (phase 2). These 4 cases were subsequently diagnosed again through reflective reasoning (phase 3).

Main Outcome Measures Mean diagnostic accuracy scores (perfect score, 4.0) on cases solved with or without previous exposure to similar problems through nonanalytical (phase 2) or reflective (phase 3) reasoning and frequency that a potentially biased (ie, phase 1) diagnosis was given.

Results There were no main effects, but there was a significant interaction effect between "years of training" and "recent experiences with similar problems." Results consistent with an availability bias occurred for the second-year residents, who scored lower on the cases similar to those previously encountered (1.55; 95% confidence interval [CI], 1.15-1.96) than on the other cases (2.19; 95% CI, 1.73-2.66; *P*=.03). This pattern was not seen among the first-year residents (2.03; 95% CI, 1.55-2.51 vs 1.42; 95% CI, 0.92-1.92; *P*=.046). Second-year residents provided the phase 1 diagnosis more frequently for phase 2 cases they had previously encountered than for those they had not (mean frequency per resident, 1.44; 95% CI, 0.93-1.96 vs 0.72; 95% CI, 0.28-1.17; *P*=.04). A significant main effect of reasoning mode was found: reflection improved the diagnoses of the similar cases compared with nonanalytical reasoning for the second-year residents (2.03; 95% CI, 1.49-2.57) and the first-year residents (2.31; 95% CI, 1.89-2.73; *P*=.006).

Conclusion When faced with cases similar to previous ones and using nonanalytic reasoning, second-year residents made errors consistent with the availability bias. Subsequent application of diagnostic reflection tended to counter this bias; it improved diagnostic accuracy in both first- and second-year residents.

JAMA. 2010;304(11):1198-1203 www.jama.com

Critical Thinking

Making good decisions with incomplete info!

1. Most Likely Diagnosis
2. Second Most Likely Dx
3. Best Case Scenario
4. Worst Case Scenario
5. “Zebra” diagnosis

What else could it be???

- Prior probabilities
- Easy to fix, easy to treat
- What do you NOT want to miss?
- Broad differential dx
- Systematic, Logical deduction using positive and negative facts to make a diagnosis.

How to solve any medical problem in 5 easy steps using positive & negative facts

DDx	Evidence for the Dx	Evidence against the Dx	Test	Therapy
Most Likely Dx	(+)	(-)		
Second most likely Dx	(+)	(-)		
Best Case Scenario	(+)	(-)		
Worst Case Scenario	(+)	(-)		
Zebra Dx	(+)	(-)		

Thrombocytopenia

DDx	Evidence for the Dx	Evidence against the Dx	Test	Therapy
Most Likely Dx				
Second most likely Dx				
Best Case Scenario				
Worst Case Scenario				
Zebra Dx				

Thrombocytopenia

DDx	Evidence for the Dx	Evidence against the Dx	Test	Therapy
Most Likely Dx *ITP*				
Second most likely Dx *DIC*				
Best Case Scenario *Splenic Sequestration*				
Worst Case Scenario *TTP*				
Zebra Dx *HIV*				

Thrombocytopenia

DDx	Evidence for the Dx	Evidence against the Dx	Test	Therapy
Most Likely Dx ***ITP***	Low plts	Schistocytes		
Second most likely Dx ***DIC***	Low plts Schistocytes	Normal PT, PTT, fibrinogen		
Best Case Scenario ***Splenic Sequestration***	Low plts	Normal spleen size. No portal HTN No cirrhosis		
Worst Case Scenario ***TTP***	Low plts Schistocytes	No neuro sxs, fever, purpura, hemolytic anemia		
Zebra Dx ***HIV***	Low plts	No risk factors		

Thrombocytopenia

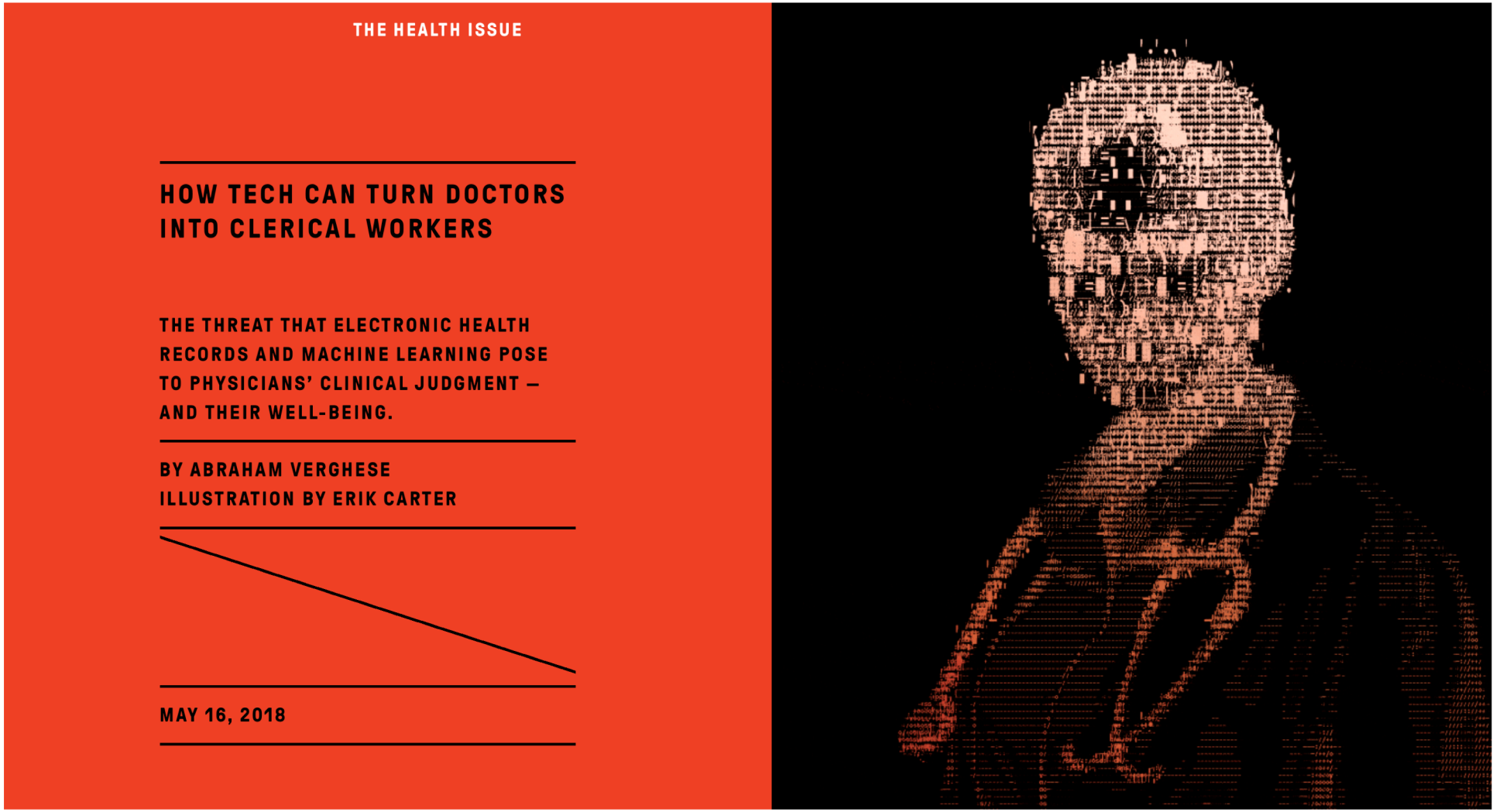
DDx	Evidence for the Dx	Evidence against the Dx	Test	Therapy
Most Likely Dx ***ITP***	**Low plts**	**Schistocytes**	**Antiplatelet antibodies**	**Steroids, IVIG, Sx**
Second most likely Dx ***DIC***	**Low plts Schistocytes**	**Normal PT, PTT, fibrinogen**	**Blood smear PT, PTT, fibrinogen**	**Treat the cause of DIC**
Best Case Scenario ***Splenic Sequestration***	**Low plts**	**Normal spleen size. No portal HTN No cirrhosis**	**Spleen scan**	**Observe**
Worst Case Scenario ***TTP***	**Low plts Schistocytes**	**No neuro sxs, fever, purpura, hemolytic anemia**	**Blood smear**	**Plasma exchange**
Zebra Dx ***HIV***	**Low plts**	**No risk factors**	**HIV**	**HAART**

Occam's Razor

- William of Ockham
- Franciscan Friar b.1265

- Principle of Parsimony
- *Entia non sunt multiplicanda praeter necessitatem.*
- *(More things should not be used than are necessary)*
- KISS
  - Keep It Simple Stupid

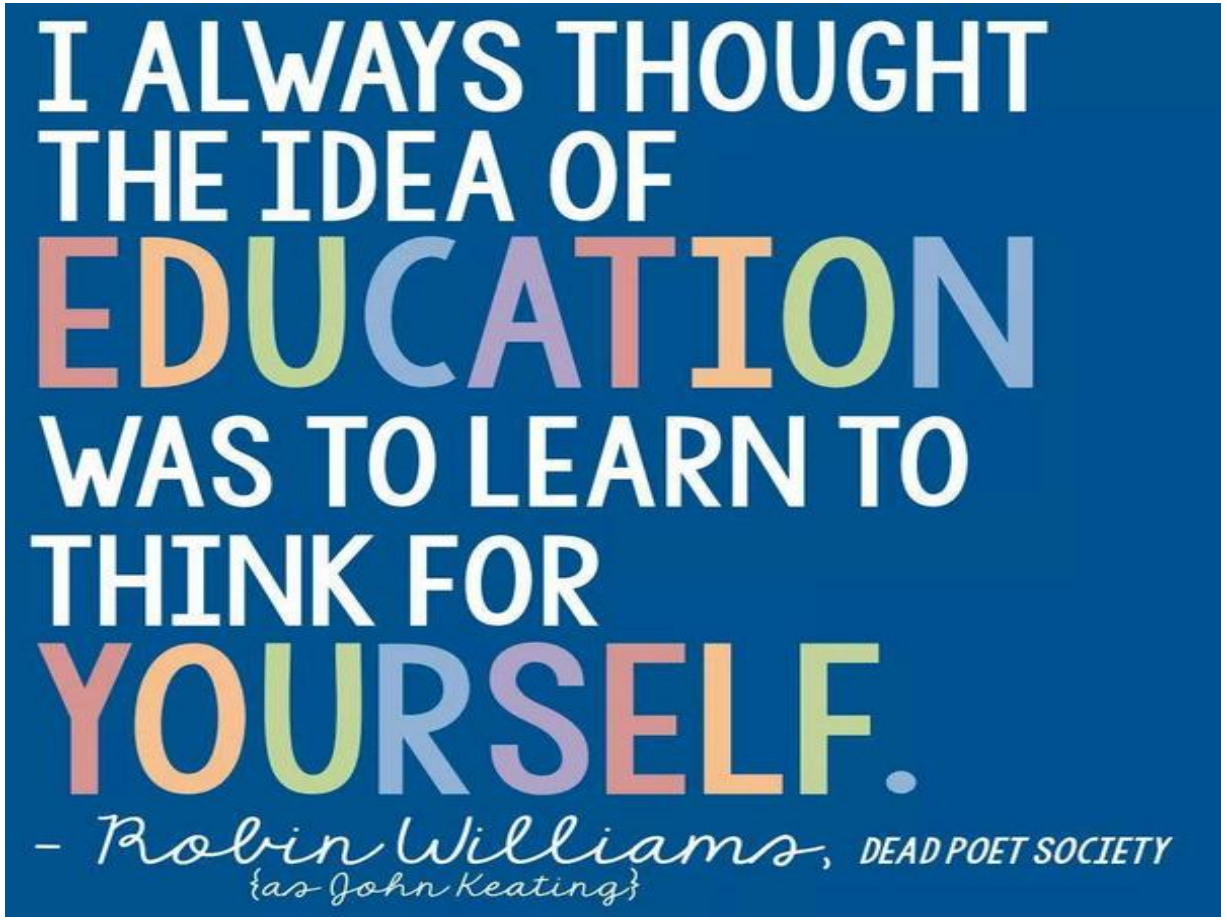
Artificial Intelligence & Medicine



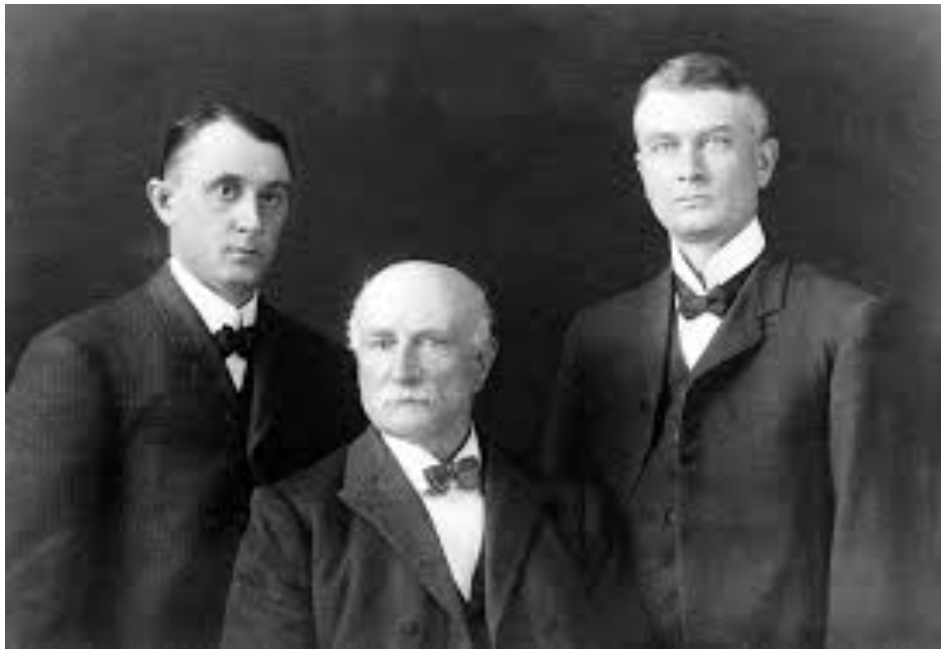
Summary

- Critical thinking is at the core of Medicine
- Socratic teaching is not the same as “pimping” in AM rounds
- Unconscious Cognitive Bias affects critical thinking
- Why guidelines don’t help
- Why mnemonics don’t help
- Five step technique to overcome biases and help critical thinking
- Future of AI and Medicine

Summary


I ALWAYS THOUGHT
THE IDEA OF
EDUCATION
WAS TO LEARN TO
THINK FOR
YOURSELF.
- Robin Williams, DEAD POET SOCIETY
{as John Keating}

Mayo Clinic Wisdom



"My own experience has been that the public will forgive you an error in treatment more readily than one in diagnosis..." - *Dr. Will Mayo*

The Defense Against the Dark Arts:

How to defend yourself against pimping

- Be prepared
- Talk about a lecture given earlier in the year by a specialist.
- Quote a higher authority
- Cite an obscure reference in a prestigious journal
- Keep dancing by requesting more information
- Answer a question with a question that you can answer.
- T-cell NHL

Time to Reflect

- **I am a:**
  - Medical student
  - 1st year Resident
  - 2nd year Resident
  - 3rd year Resident
  - Internal Medicine (Internist)
  - Other specialty
- **My Med School was**
  - In the US
  - International
- **I am**
  - Categorical resident
  - Transitional or Preliminary resident
  - Board eligible Internist
  - Board certified Internist
  - Other
- **I have been out of training:**
  - Practicing Medicine 1-5 yrs
  - Practicing Medicine 6-10 yrs
  - Practicing Medicine 11-20 yrs
  - Practicing Medicine >20 yrs
- **Have you been taught this 5 step method before?**
  - Yes
  - No
- **Have you used this before?**
  - Yes
  - No
- **I found this to be**
  - Very helpful
  - Somewhat helpful
  - Neutral
  - Not helpful
  - Very useless