Rational or Normal?

Saurabh Singal | Ankam Partners | 29 Jan 2011

What Works…

$$\varepsilon_{mix} := \left[\nu_1 \cdot \left(\varepsilon_1^{\frac{1}{3}} \right) + \nu_2 \cdot \left(\varepsilon_2^{\frac{1}{3}} \right) \right]^3 \quad \textit{where} \quad \nu_1, \nu_2 \quad \textit{are the volume fractions of materials 1 and 2,}$$

and .. $\varepsilon_1, \varepsilon_2$ *are the full complex (two component) dielectric constants of the full density materials 1 and 2 .*

Note : $\varepsilon_1 := \varepsilon'_1 - j \cdot \varepsilon''_1 \qquad \varepsilon_2 := \varepsilon'_2 - j \cdot \varepsilon''_2$

Note that $\nu_1 + \nu_2 := 1.$ *and the density of the mixture is* $\rho_{mix} := \rho_1 \cdot \nu_1 + \rho_2 \cdot \nu_2$

and that $\frac{\rho_{mix}}{\rho_1} := \nu_1 + \left(\frac{\rho_2}{\rho_1} \right) \cdot \left(\nu_1 - 1 \right)$

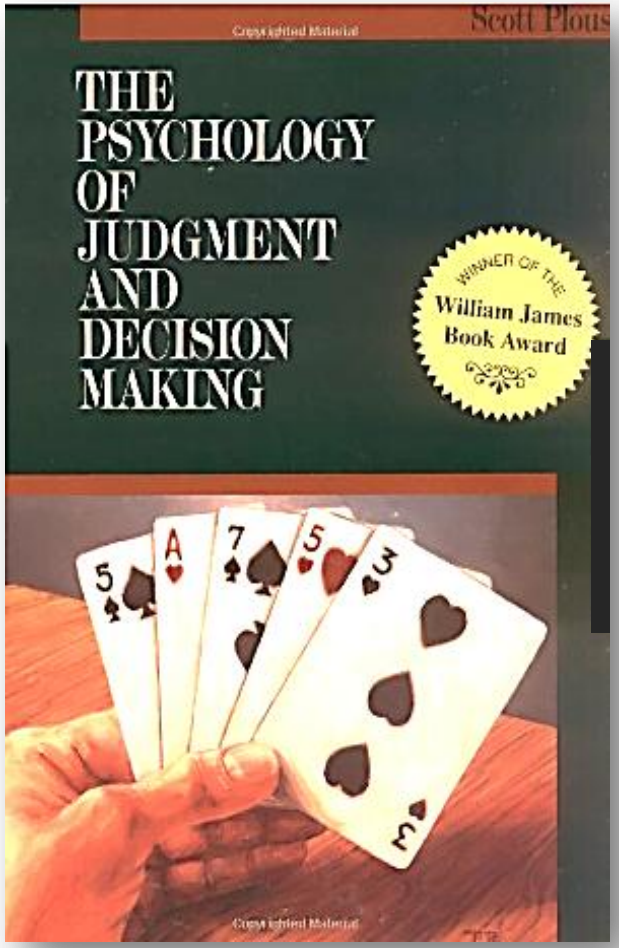
$$\varepsilon_{mix} := \left[\nu_1 \cdot \left(\varepsilon_1^{\frac{1}{3}} \right) + \left(1 - \nu_1 \right) \cdot \left(\varepsilon_2^{\frac{1}{3}} \right) \right]^3$$

People in Standard Finance are **Rational.**

People in Behavioral Finance are **Normal.**

- Meir Statman

Book by Scott PLOUS



Let's Play …1

- **What were the 5 cards you just saw on the cover of the book ?**

Let's Play …1

- **The mind sees what it wants to see!**
- **There is no "3 of Hearts". Just a card which is 3 with black coloured heart shapes…**

Let's Play…2. NIFTY Index

Year	(A) % return	(B) % of +ve Days
2006		
2007		
2008		
2009		
2010		

Let's Play…2. NIFTY Index

Year	% return	% of +ve Days	+ve Weeks	+ve Months
2006	40%	60%	36	11
2007	54%	57%	34	9
2008	-52%	48%	21	6
2009	74%	55%	33	9
2010	18%	54%	34	9

It is difficult to keep count without effort.

- Most market professionals that I asked this had a fair idea of the annual percent returns.
- But most did not have a good estimate of the percent of days in each year that the index was positive.
- Small deviations from the base rate can produce large results!

How evolutionary wiring makes trading inherently tricky?

- How we handle panic or trauma
- How we handle euphoria / depression
- Pattern Recognition – good for facial recognition bad for trading
- **BAD** at computing **PROBABILITY**
- **VERY BAD** at **BAYESIAN REASONING**
- Cognitive Biases

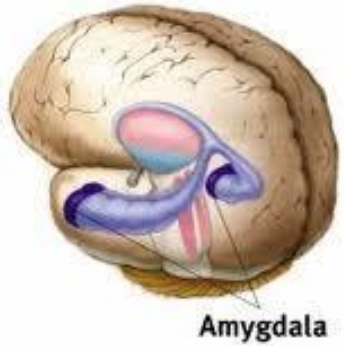
Pareidolia

- Pareidolia – seeing faces in a cloud (face on Mars)

Seeing हनुमान जी: in a tree in Singapore

Pareidolia (contd.)

Our Brain



- Amygdala – Primitive part of brain, evolved earlier than other parts
- Responsible : Fight / Flight
- Response to Trauma- panic selling
- NucleusAccumberns /Anterior Cingula Pattern Recognition

Neuro-transmitters.

- Dopamine – a neurotransmitter that produces Euphoria.
- Positive responses of dopamine neurons are observed when an unexpected reward is presented.
- Dopamine neurons are depressed when the expected reward is omitted.
- We learn to repeat behaviours that lead to maximizing rewards. Dopamine provides a teaching signal to parts of the brain responsible for acquiring new behaviour

Dopamine

- Hormone like substance produced by the hypothalamus in the brain. Mainly associated with *pleasure system*. Released in response to, or in anticipation of, pleasurable stimuli.

- Unexpected GOOD results

  -> ***more*** Dopamine released-> **Euphoria**.

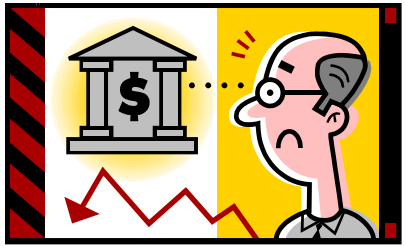
  And vice versa.

- This explains Lottery Effect – pay much more than fair price for games with very large returns vs. games with moderate returns.

- Over reaction (de Bondt)
- Under reaction (PEAD; price momentum)

Neuro-transmitters.

- Serotonin – anxiety;
- Examples
  - under trading
  - overtrading (Loss aversion)

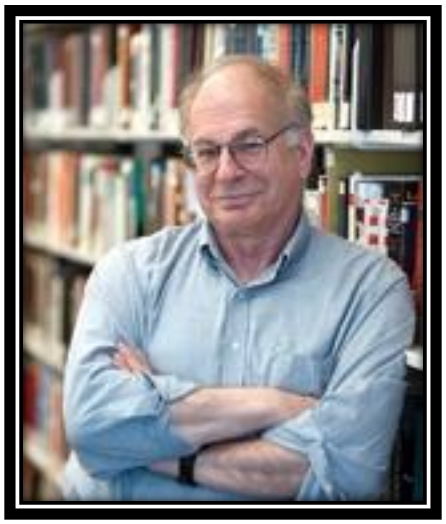


- Serotonin has strong associations with depression in regards to a negative environment

Daniel Kahneman

Nobel Prize in 2002

Example of Israel Air force Instructor



Because we tend to reward others when they do well and punish them when they do badly, and because there is regression to the mean, it is part of the human condition that we are statistically punished for rewarding others and rewarded for punishing them.

-Daniel Kahneman

How Behavioural Finance Differs from Classical Economics & Finance

Simple Model of Economic behavior

Homo economicus

- Rational Man
- Economic Self-Interest governs decisions
- Perfect Information

Rational Model - how decisions should be made

Real World - how decisions are actually made.

Bounded Rationality

- Economists Veblen, John Maynard Keynes and Herbert Simon criticise *Homo economicus* as an actor with too great of an understanding of macroeconomics and economic forecasting in his decision making.

- They stress *Uncertainty* and *Bounded Rationality* in the decision making, rather than full information and Perfect knowledge.

- Bounded Rationality - People "*satisfice*" not optimize. Limits on both Knowledge and on Cognitive ability.

Heuristics

- People use *Heuristics* – Rules of Thumb.
- *Advantage* - They reduce time and effort needed to make good decisions. Rough approximations are usually good enough.
- *Disadvantage* - in certain instances, this leads to Systematic Biases.

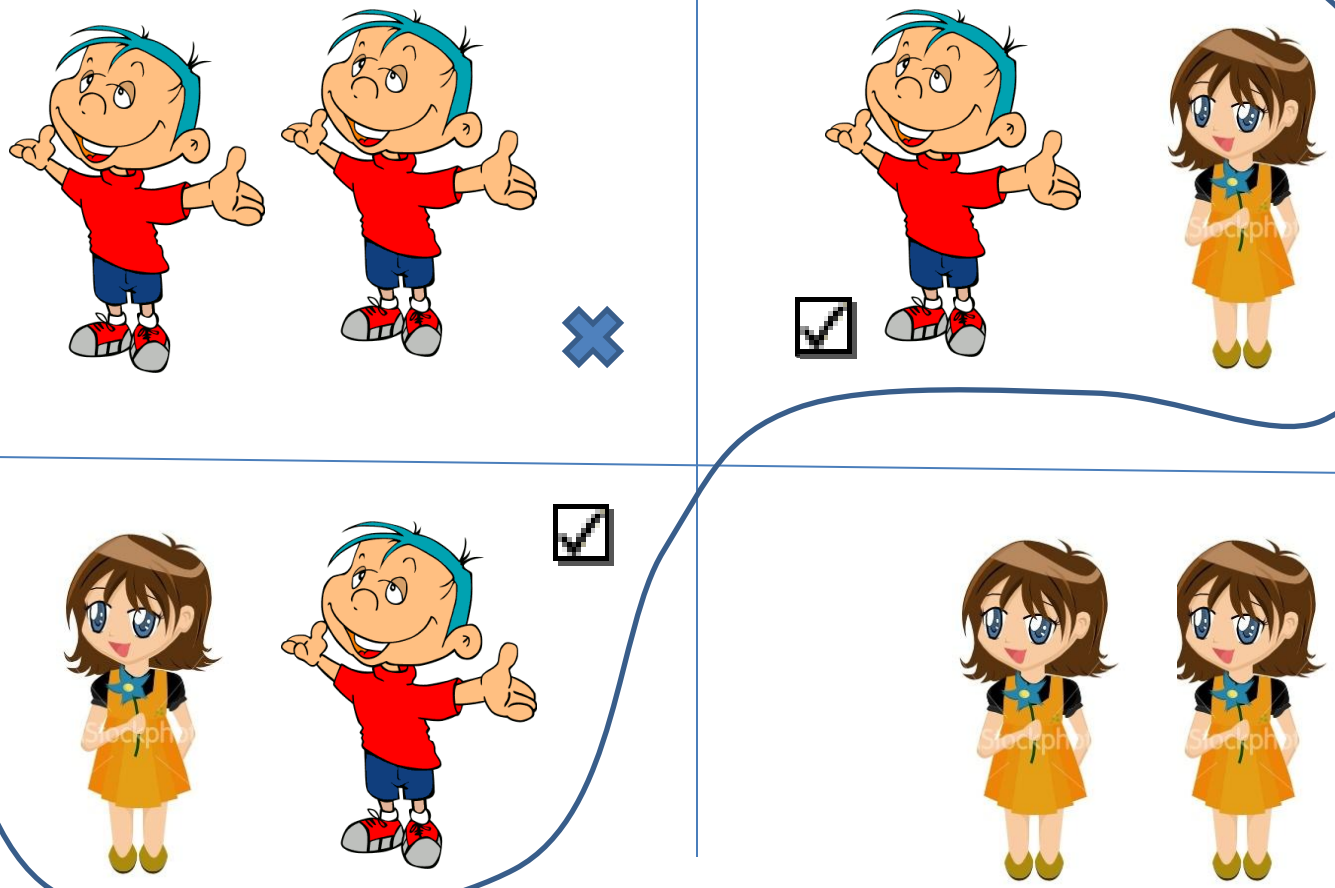
Probability Weighting

- People overweigh low probabilities and under weigh high probabilities
- Ignore events of extremely low probability
- Treat extremely high probability events as certain.
- Decision models such as Prospect Theory use Probability Weighting functions.

Let's Play…3

- A new neighbor moves in next door. You learn that he has two children.
- You see that one of the children is a boy.
- What is the probability that the other child is a girl?

Let's Play…3



The Winner's Curse

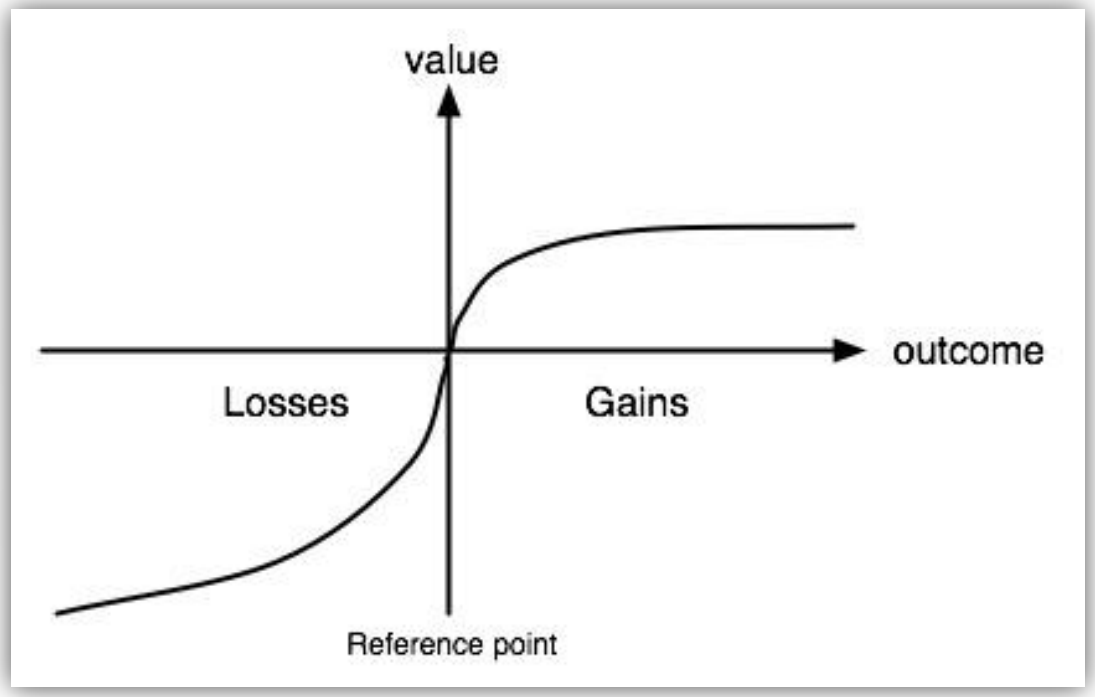
- The winner in an auction quite often pays more than the fair value.
- The more the number of bidders, the greater chance that the winner will overpay.
- This is also true in corporate takeovers.

Prospect Theory

- Value Function normally concave for gains (implying *risk aversion*), commonly convex for losses (risk seeking)
- Value Function is steeper for losses than for gains (*loss aversion*) Thus, losses "loom larger" than gains. For instance, a loss of Rs. 500 is felt more than a gain of Rs.500.
- Most people hate to lose. People are risk averse in terms of gains but risk-seeking in terms of losses.

Value Function

- Concave for Gains and Convex for Losses



Prospect Theory Illustrated

Problem 1: In addition to what you have, you are given Rs 100. You now have to choose between alternatives A and B

- Alternative A: A 50% chance of gaining Rs 100.
- Alternative B: A sure gain of Rs 50

☞ 84% respondents chose B, the **sure (GAIN)** thing.

Problem 2: In addition to what you have, you have been given Rs 200 and have to choose between alternative C and D

- Alternative C: A 50% chance of losing Rs 100
- Alternative D: A sure loss of Rs 50.

☞ This time 70% chose the **uncertain (LOSS)** alternative.

Prospect Theory

- Both problems are numerically equivalent.
- But people ***do not*** behave in the way traditional theory posits they ***should***.
- Given the chance to lock in a smaller gain versus a risky gamble with either no gain or an even higher gain, the majority choose the sure gain.
- Given the chance to lock in a sure loss versus a gamble where they could either avoid the loss totally or land up with a bigger loss, people would like to take the gamble.

Prospect Theory (contd.)

- We have an irrational tendency to be less willing to gamble with profits than with losses.
- People feel a stronger impulse to avoid losses than to acquire gains.
- This means selling quickly when we earn profits but not selling if we are running losses.
- People often persist with losing stocks and sell their winners far too early to lock in a gain.

Cognitive bias 1. **Frame Dependence**: The General's Dilemma

- Imagine you are the commander in the army threatened by a superior force. Your staff says your soldiers will be caught in an ambush in which 600 of them will die unless you lead them to safety by one of two available routes.

- If you take route A, 200 soldiers will be saved.

- If you take route B, there is a 1/3 chance that 600 soldiers will be saved and a 2/3 chance that none will be saved.

- **Which route should you take?**

Cognitive bias 1. **Frame Dependence**: The General's Dilemma

- Imagine that you are once again a commander in the army, threatened by a superior force.
- Once again, if you take route A, 400 soldiers will die.
- If you take route B, there is a 1/3 chance that no soldiers will die and a 2/3 chance that 600 soldiers will perish.
- **Which route do you choose?**

Cognitive bias 1. **Frame Dependence**: The General's Dilemma

Research by Kahneman and Tversky showed that most people would choose :

- Route A in the first scenario because you would save 200 lives,
- But the same people end up choosing route B in scenario B because there is a 1/3 chance no lives are lost.

Cognitive bias 1. **Frame Dependence**: The General's Dilemma

- The scenarios have the **same end result** in each option - but the two scenarios are framed differently.
- In one, the emphasis on how many lives are saved and the respondents want to be cautious and save as many lives as possible.
- In the second case, the emphasis is on how many lives are lost and most people try to gamble or be adventurous to avoid the certain death of 400.

Cognitive bias 2. **Mental Accounting**

- Richard Thaler coined the term, defining it as "the inclination to categorise and treat money differently depending on where it comes from, where it is kept and how it is spent".

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- **"Honey , I lost <u>only</u> 5 dollars....."**
- Gamblers who lose their winnings feel they lost nothing**.**

Cognitive bias 2. **Mental Accounting :** Gambling with Earned Money vs. Won Money

- People have a tendency to treat different cash flows differently depending on the source of the cash flow. A lot of people would not gamble with "hard earned money", but if they bet 5 rupees and win 10,000 thousand rupees with it, they might be less averse to gambling with all 10,000 rupees.

- Money is money, but many people would not mind betting or losing money that was won this way. While traditional finance suggests people should not distinguish between rupees in different pockets, in reality people do make the distinction.

Cognitive bias 2. **Mental Accounting :** Theatre Ticket

- *Scenario A.*
  - Ticket Price = 1000 INR
  - Ticket is Lost
  - Will you buy another or go back home ?
  - **MOST PEOPLE WILL GO BACK HOME**

- *Scenario B.*
  - Standing in the queue to buy the ticket
  - You lost some money = 1000 INR
  - Will you buy the ticket or go back home ?
  - **MOST PEOPLE WILL CONTNUE TO STAY IN QUEUE AND BUY A TICKET**

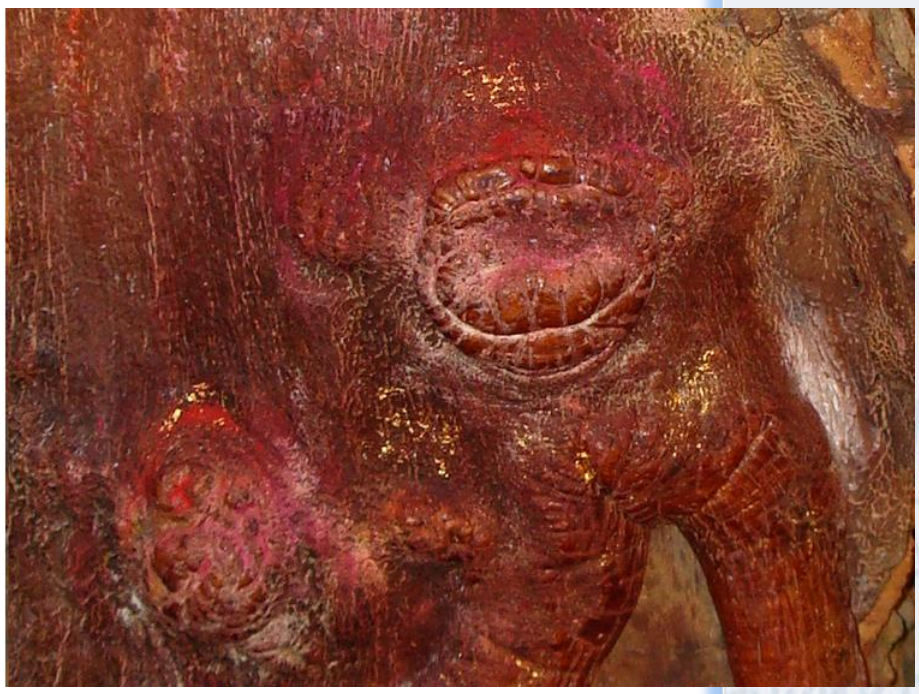
Cognitive bias 2. **Mental Accounting :** Theatre Ticket

- It turns out that several people would go home in scenario A but the same people would pull out another 1000 rupees in scenario B. In reality the outcomes are identical - you have lost 1000 rupees and if you want to see the theatre you need to pay another 1000 rupees. But people often have ***"mental accounts"*** - in this case a mental account for entertainment, for which they may be willing to spend 1000 but not 2000 rupees.

- Similarly, one could add a third scenario to the two above- you own a hundred shares of Suzlon which is down 10% that day, and will your answer change now?

Cognitive Bias 3: **Illusion of Control**

- Closely related to self-attribution
- Implications for trading.
- Examples of light switch



- Some people even won a bet on the 4-D draw held on 12 September. The winning number "4309" was obtained by combining the HDB block number near the tree (430) and the order of the monkey in the Chinese zodiac (ninth).

Let's play...4.

- **The Dow Jones Industrial Average closed 1998 at 9181. As a price index, the Dow doesn't include re-invested dividends. If the Dow were redefined to reflect the re-investment of all dividends since May 1896, when it commenced at a value of 40, what would be its value?**

- From a classic paper by Meir Statman and Roger Clarke
  - **In addition to your guess, please also make a low guess and a high guess, so that you are about 90% sure that the true answer is between the ranges.**

Cognitive Bias 4. **Overconfidence**

- **The Dow Jones Industrial Average closed 1998 at 9181. As a price index, the Dow doesn't include re-invested dividends. If the Dow were redefined to reflect the re-investment of all dividends since May 1896, when it commenced at a value of 40, what would be its value?**

The answer is 652,230

Cognitive Bias 4. **Overconfidence**

- The less they know, the more confident they become!
- Forecasters in horse races- redundant information
- Forecasters in Stocks – same information repeated
- Philip Tetlock & political analysts
- Information Overload leads to overconfidence without increase in accuracy

Predictions : In Movies and Music

- **She was told early in her career, "You'd better learn secretarial work, or else get married."**

- **The manager of the Grand Ole Opera told one young singer, "You ain't going nowhere … son. You ought to go back to drivin' a truck."**

- **"We don't like their sound. Groups of guitars are on their way out," said a Decca Recording Company executive in 1962 in turning them down**

Let's play…5

- Consider the following statement.

➢ AB is a tall and handsome man. He is the son of famous parents. He married a very famous Bollywood heroine.

What is more likely ?

A) AB is a movie star.

B) AB is a movie star whose parents are also movie stars.

Cognitive Bias 5: **Representativeness**

☞Big B

तू भी AB, मैं भी AB, यह भी AB - हम सब AB

Cognitive Bias 5: **Representativeness**

- *Most people chose B, even though compounding two probabilities means the correct answer must be A.*

- The **Conjunction Fallacy -** specific conditions are more probable than general ones.

Cognitive Bias 5: **Representativeness**

- As the amount of detail increases, the probability can only decrease but apparent likelihood increases with representativeness.
- Specific scenarios appear more likely than general ones because they are more representative of how we perceive particular events.
- **Neglecting base rates is also part of representativeness.**

Let's play…6

Testing for HIV

Here **positive** test MEANS test says "**there is an infection**"

- About 0.01 % men are affected with HIV.
- If an ***infected*** man is tested, there is a 99.9% chance the test result is positive.
- If a man is ***not infected***, there is a 99.99% chance he will test negative.

What is the chance a man who tests positive is infected with the HIV virus?

Bayesian Reasoning.

$$Prob\,(Infected\,|Test\ Positive) = \frac{Prob\,(Infected\ AND\ Test\ Positve)}{Prob\,(Test\ Positive)}$$

$$= \frac{Prob\,(Test+ve\,|\,Infected) \times Prob\,(Infected)}{Prob\,(Test+ve\,|\,Infected) \times Prob\,(Infected) + Prob\,(Test+ve\,|\,NOT\ Infected) \times Prob\,(NOT\ Infected)}$$

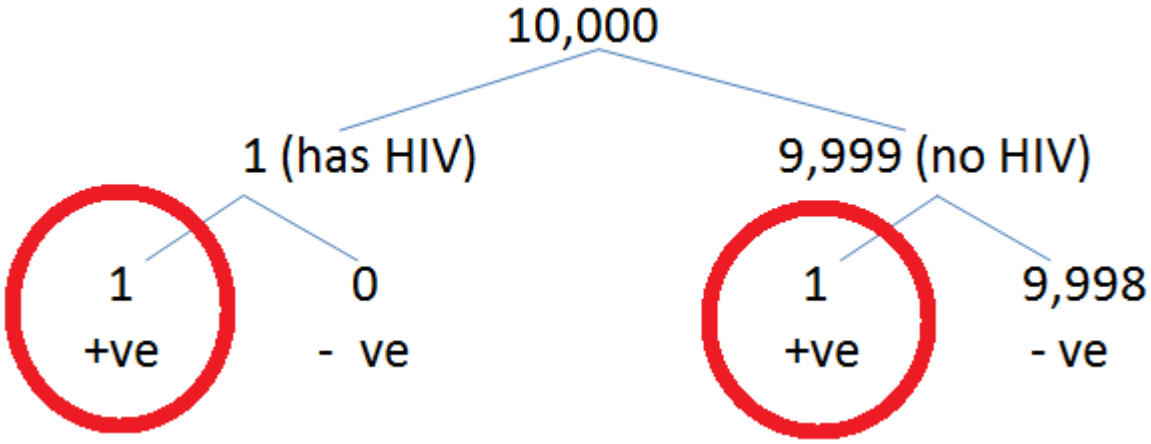
$$= \frac{99.9\% \times 0.01\,\%}{99.9\% \times 0.01\,\% + 0.01\,\% \times 99.9\%} \approx \frac{0.01\%}{0.01\% + 0.01\%} = \frac{1}{2}$$

Chance (Infected, given test is positive)

= approx 50%

Bayesian Reasoning (without tears).

Assume 10,000 men.
Of these 10,000 men, 1 is infected. He will test positive.
Of the 9,999 men, 1 tests positive (9999 X 0.0001 = 0.9999)



Two men test positive, of which only one has HIV.
So if he tests positive, there is only a 50% chance a man has HIV

Prob (infected| positive test) vs. **Prob (positive test| infected)**
Two are different (Prosecutor's fallacy)

Cognitive Bias 6: **Anchoring**

- Anchoring : the tendency to cling to irrelevant facts in the use of decision-making.

- With Genghis Khan in charge the Mongols ruled much of Central Asia before their leader led them on in an ill-fated campaign against Hungary, where he died.

- Question 1. Did these events happen before or after A.D. 151?
- Question 2. In what year did Genghis Khan die?

Cognitive Bias 6: **Anchoring**

- **Anchoring is the name of the tendency to cling to irrelevant facts in the use of decision-making.**
- **The first question is nothing more than an anchor.**
- **It is just there to put a date in your mind.**
- **Perhaps, it did not even seem right – too early. But it tends to weigh down your answer.**
- **Genghis Khan actually died in 1227 A.D.**

Cognitive bias 6: **Anchoring :** Housing Appraisal

- A group of randomly selected house brokers were taken to a house and asked to appraise its value. In addition the brokers received a ten-page information packet about the house, including a list price of $65,000.

- The average appraisal value that the group of brokers came up with: $67,800.

Cognitive bias 6 . **Anchoring** : Housing Appraisal (contd.)

- Then a second group of brokers were taken to the same house and given the same tour and the information package, but with one difference. The list price mentioned was $84,000.

- This time the average appraisal price returned by the brokers had moved to $75,190.

☞ **This was more than $7,000 higher**

Cognitive bias 6. **Anchoring** : Wheel of Fortune

- Even when we know that we are susceptible to Anchoring, we are still not free from the effect.
- A wheel of fortune containing numbers from 1 to 100 was spun
- People were asked if the percentage of African countries in the United Nations was higher or lower than the number on the wheel.
- They were then asked to give their guess as to this percentage.

Cognitive bias 6. **Anchoring**: Wheel of Fortune (contd.)

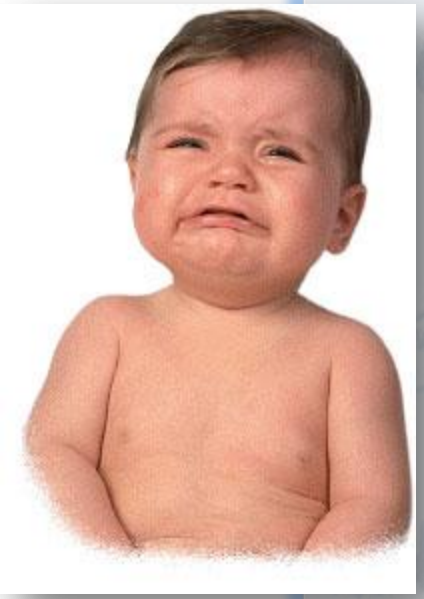
- The number on the wheel influenced the guesses
- For the group that got 10 as the number on the wheel, the median guess was 25;
- For the group that received 65 on the wheel, the median guess was 45.
- Finance: analyst predictions or consensus for earnings or target price act as misleading anchors.

Cognitive bias 7: **Recency Bias**

- Tendency to more prominently recall the recent events.
- Free recall test : Primacy effect and recency effect
- Objects listed last and first are recalled more often than the ones in the middle - U shaped curve
- Chase the latest fads in investments.
- Invest in recently top performing funds but this outperformance might not persist

DEPRESSION BABIES

- Depression Babies: Do macroeconomic Experiences Affect Risk Taking? Paper by Malmendier & Nagel, 2009.
- Experiences of early life have very long lasting impact.
- Those who saw the crash of 1987 and lost money missed the long upswing in the 1990's.
- Those who made money being short in Oct 1987 fared even worse they often were short. (last two points are anecdotal based on my interactions with several traders; there is no scientific study to back my claim).



Cognitive Bias 8: **Availability Bias**

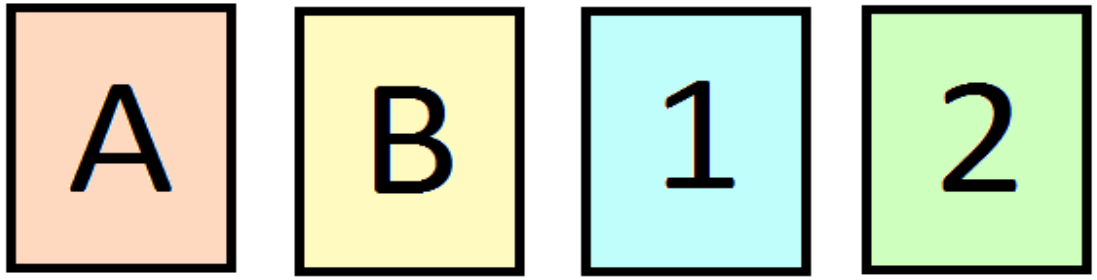
- Death from Shark Attacks vs. lightning? The movie Jaws.
- People assess the probability of an event by the ease with which instances or occurrences can be brought to mind.
- Relative frequency of words that begin with the letter ***K*** (example *knowledge*) versus those where ***K*** (example, *token*) is the third letter.
- Most people guess the first is greater – even though the latter is three times more likely. Easier to recall or generate words beginning with a particular letter.

Cognitive Bias 8: **Availability Bias**

- May 2004 and Shrimati Sonia Gandhi
- Qualcom short
- Attention stocks: Christopher Gadrowski 2001 found that stocks with the most press coverage underperformed.
- Related to Recency bias

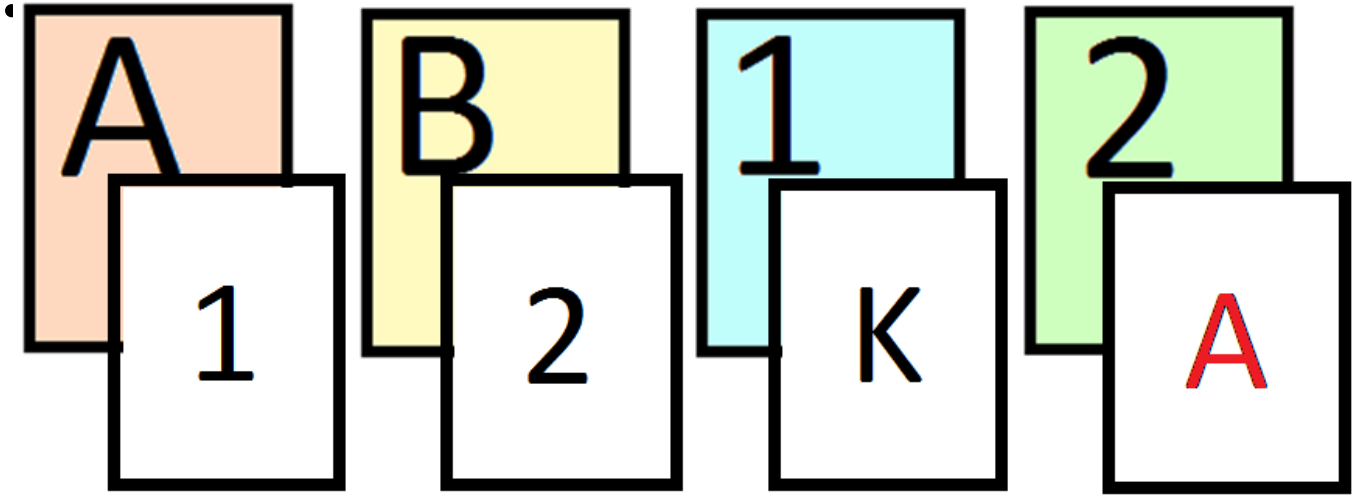
Let's Play…7

- You are given some cards and it is known that one side has a number and the other side has a letter.
- CLAIM: If there is an A on one side, there is a 1 on the other side.
- We see the following cards:



- **We need to turnover the minimum no of cards to verify or disprove the claim. Which ones?**

Cognitive bias 9: **Confirmation Bias**



Cognitive bias 9: **Confirmation Bias**

- **We need to turnover A and 2.**
- **Turning over 1 is not helpful.**
- **If you turn over 1, you are a victim of Confirmation Bias.**

Cognitive Bias 10: **Self-attribution**

- Choosing your own lottery number
- The winning number **48**
- Don’t confuse brains with a bull market!
- Excuses – if we have profits, we are skilled, otherwise unlucky.

Cognitive bias 11: **Hindsight** Bias

- **The tendency to falsely believe we had guessed an outcome correctly.**

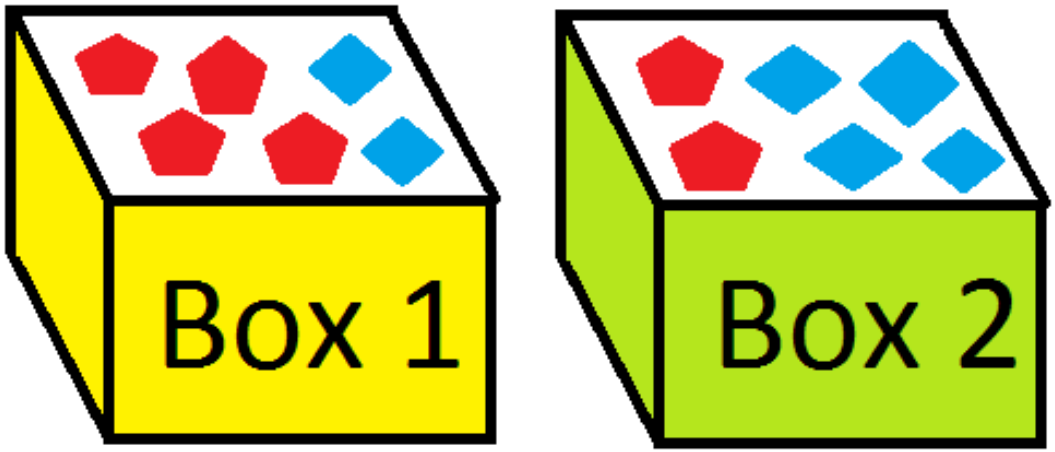
- Experiment: Guests were asked questions. Answers were revealed. Then the guests were asked to self-evaluate themselves – they scored much higher in hindsight

- Common in stock markets – "I knew it was going up!"
- Harry Hindsight is the best Trader.

- Everyone knows that housing bubble was deadly !

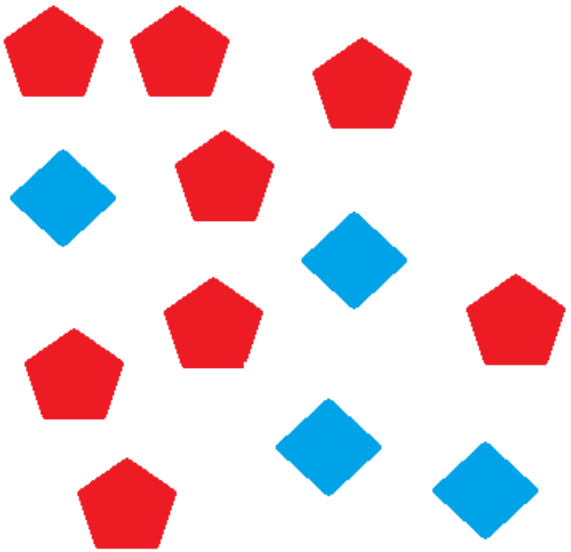
Let's Play….8

- There are two boxes containing red and blue checkers. One has 100 red and 50 blue checkers. The other has 50 red and 100 blue checkers.



Let's Play …8 : red and blue checkers

- We select a box at random
- Assume there is 50% chance of either box being selected.
- Sampling with replacement, we pull 12 checkers out of this same box
- Of the 12 checkers, 8 are red and 4 are blue.
- What is the chance we picked them from the second box?



Let's Play …8 : red and blue checkers

- The correct answer is 1/17, which is close to 6%.
- It is difficult at first blush for most of us to guess this.
- The human brain is very good at pattern recognition but poorly designed for computing probabilities.

Cognitive bias 12 : **Conservatism**

- We are often to slow to revise our beliefs in the light of new information.
- The human brain tends not to be good at Bayesian Statistics!

- **In this case the prior belief - either box is equally likely to be picked – is not revised fast enough.**

Emotional Biases

1) Endowment Effect
2) Loss Aversion (explained by Prospect Theory)
3) Regret Aversion (also by Prospect Theory)
4) Lottery Effect (once again, Prospect Theory)
5) Status Quo Bias

Emotional Bias 1: **Endowment Effect**

- The minimum selling price demand often exceeds the maximum purchase price they are willing to pay
- Significantly!
- Ownership of an asset appears to endow it with extra value.
- J.L.Knetsch and the candy bar and coffee mugs experiment.
- Samuelson and Zeckhauser: inherited securities.
- Leads to decision paralysis by holding on too long- too high a premium is demanded for disposal of existing asset.

Emotional Bias 2: **Loss Aversion**

- In a recent paper *titled Is Tiger Woods Loss Averse? Persistent Bias in the Face of Experience, Competition and High Stakes*, Devin G. Pope and Maurice E. Schweitzer suggest that even the world's top golfers suffer from biases.

Emotional Bias 2: **Loss Aversion**

- They used laser measurements on 1.6 million putts.
- Players are more risk averse when attempting birdie put (gain) vs par (breakeven) from the same position (prospect theory)
- Myopic Loss Aversion or Short Term Loss Aversion: particularly deadly in our profession.

Emotional Bias 3: **Regret aversion**

- People avoid take decisive actions because they get scared that whatever they do is going to be painful.
- People hesitate the most when the most aggressive action is called for.
- Example: buying sell offs.
- Example 2: Reluctance to sell an asset that has gone up a lot but analysis indicates is overvalued can also be an example

Emotional Bias 3: **Regret aversion**

- Example of Football Goalkeeper: Action Bias Among Elite Goalkeepers (Ofez Azart and Bar-Eli,Azar,Ritov & Keidar-Levin, Journal of Economic Psychology)
- The authors noted that goalkeepers save a lot more penalty kicks by staying put in the centre rather than jumping to the left or right.
- They concluded that this might be a reverse of action bias – they feel greater regret if they stood in the centre without jumping and let the ball go in the goal.
- If they jumped, they would console themselves by thinking that they tried their best.

Emotional Bias 4: **Lottery Effect**

- Tendency to overweigh the impact of small probabilities and also to combine this with aversion to uncertainty.
- Certainty Effect – people will overpay to eliminate risks which have very small probability of occurrence
- Lottery Effect – People will overpay for the chance to make very large gains that are highly improbable.

Net . Net.

1. The brain can outsmart itself….

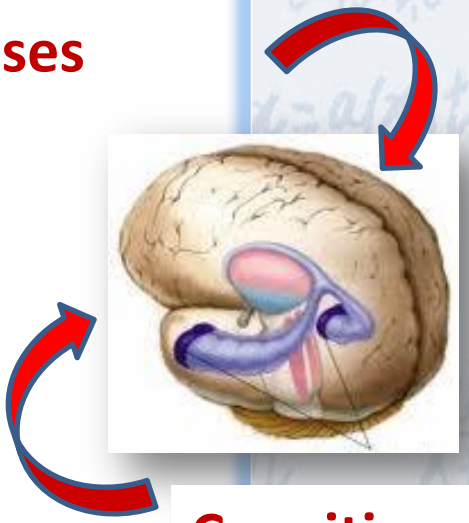
   Making us our own worst enemy!

   To avoid this : Change your opinion when facts change –

   Be a Bayesian!

2. Rules RULE.

   Carbon works best with Silicon…



= Predictive & Judgemental Errors

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