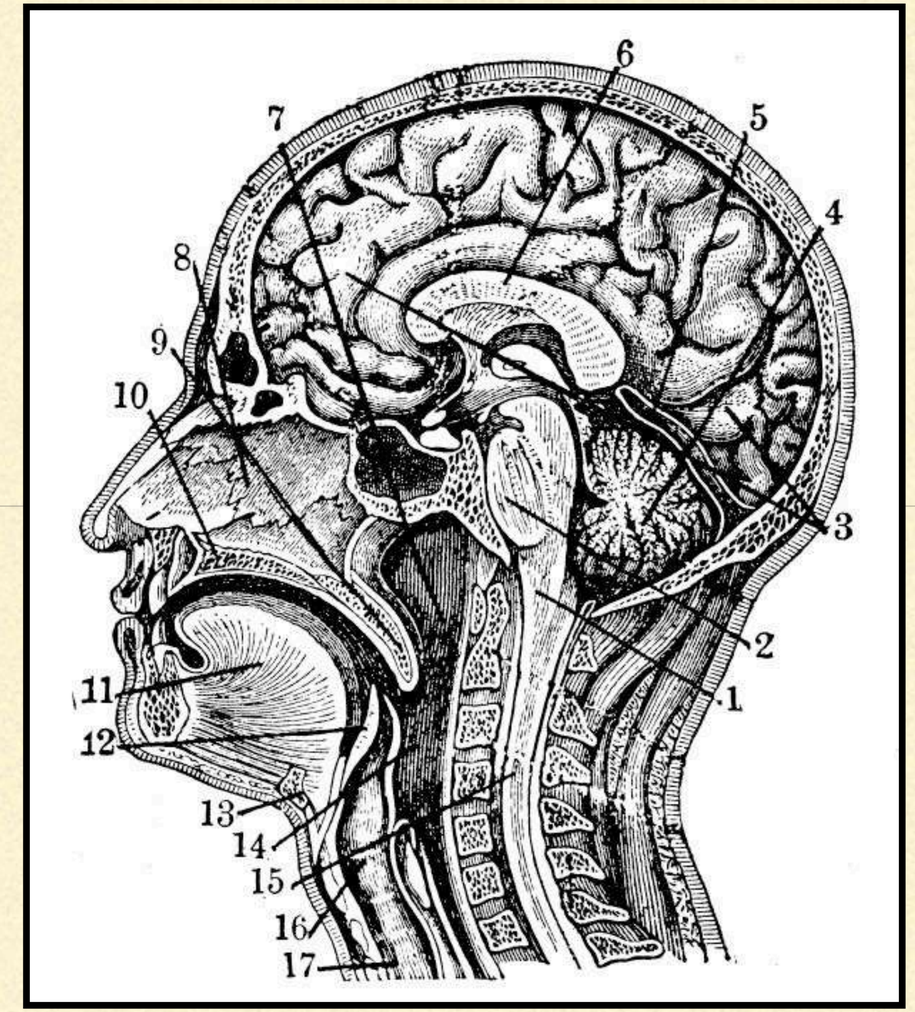
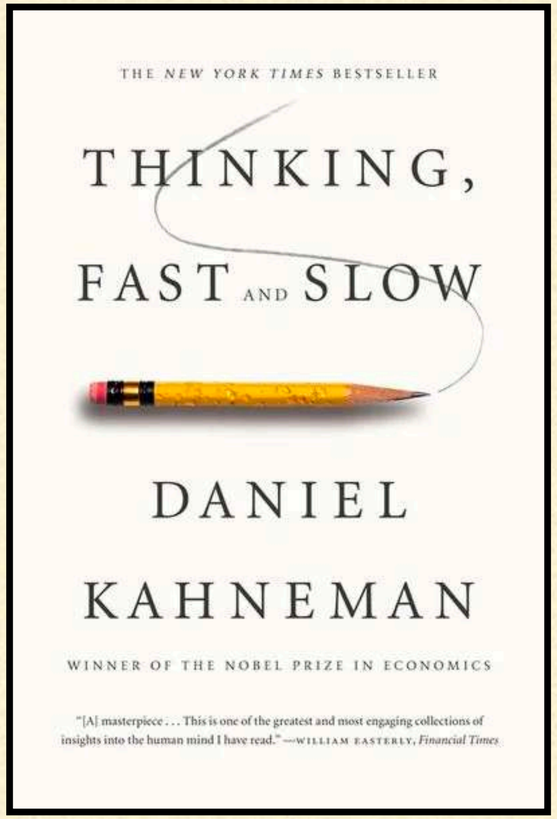
STRATEGIC **DECISION MAKING** FOR ENGINEERS

Nicolas Seriot

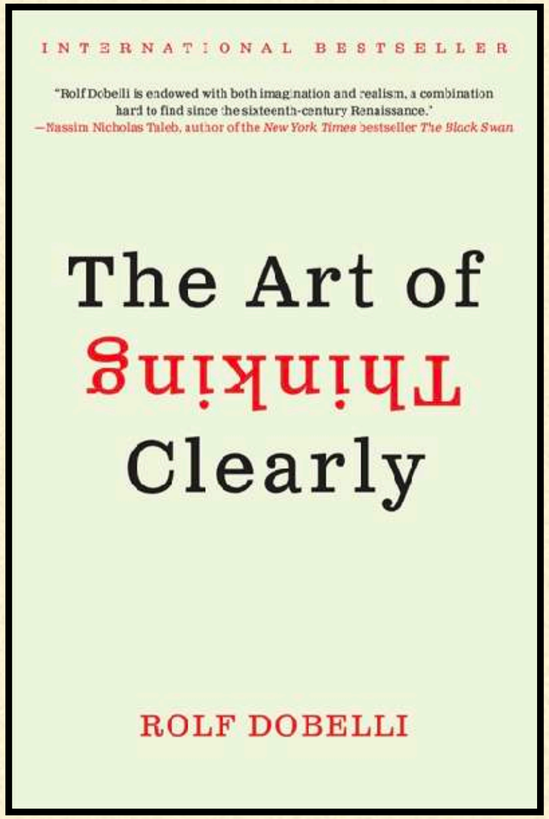
November 17th



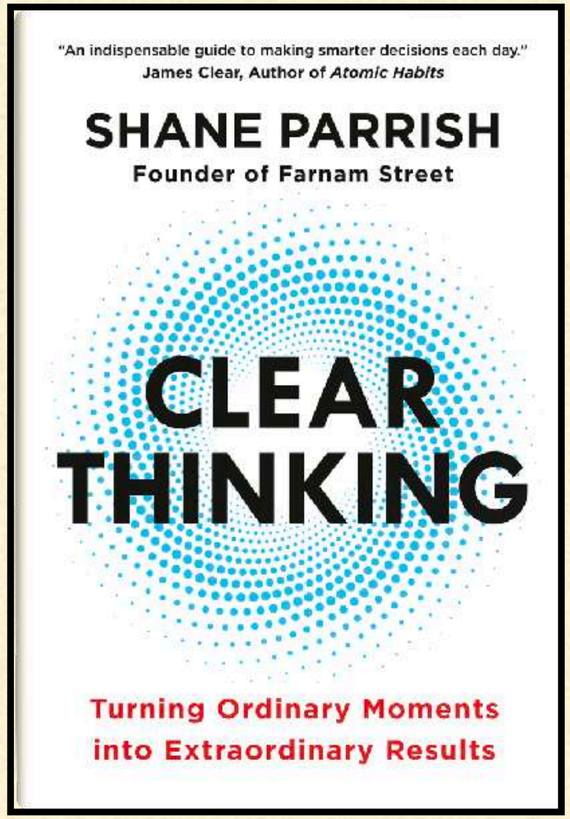
Swissquote



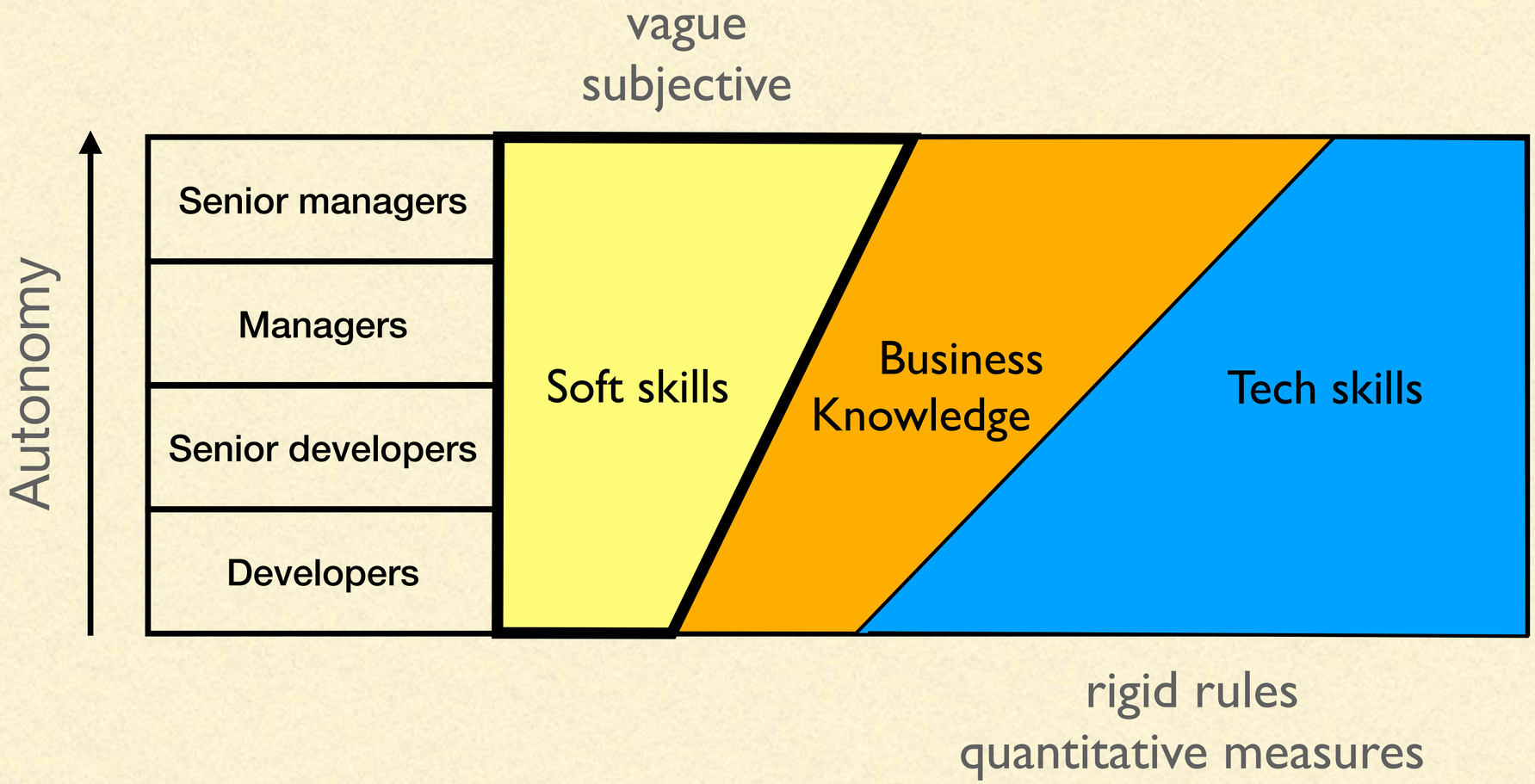
2011



2011



2023


vague
subjective
Autonomy
Senior managers
Managers
Senior developers
Developers
Soft skills
Business
Knowledge
Tech skills
rigid rules
quantitative measures

Decision Making

Ability to make sound judgments and decisions

Can be trained and improved

- We make ~ 35000 decisions every day (Sahakian & Labuzetta, 2013)
- As knowledge workers, we're paid to produce decisions
- Conscious or not
  Consequential or not
  Alone of in a group
- Each decision eventually makes our lives easier or harder
- A lot of time spent correcting poor decisions
- "Life is a sum of all our choices" – Albert Camus

1. HOW OUR BRAIN WORKS

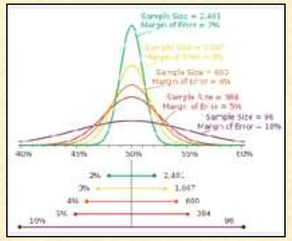
2. HOW TO MAKE
BETTER DECISIONS

Priests and oracles

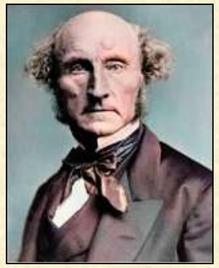
Trade

Gambling

Law of large numbers, binomial distributions



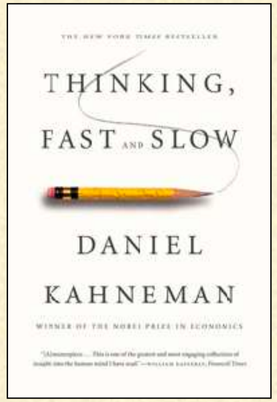
Classical economists: man is a rational, self-interested economic agent



0 | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000

Daniel Kahneman
Princeton Prof. psychology
2002 Nobel Prize in Economics

The Prospect theory
Human decision-making is not always rational



THE PROSPECT THEORY

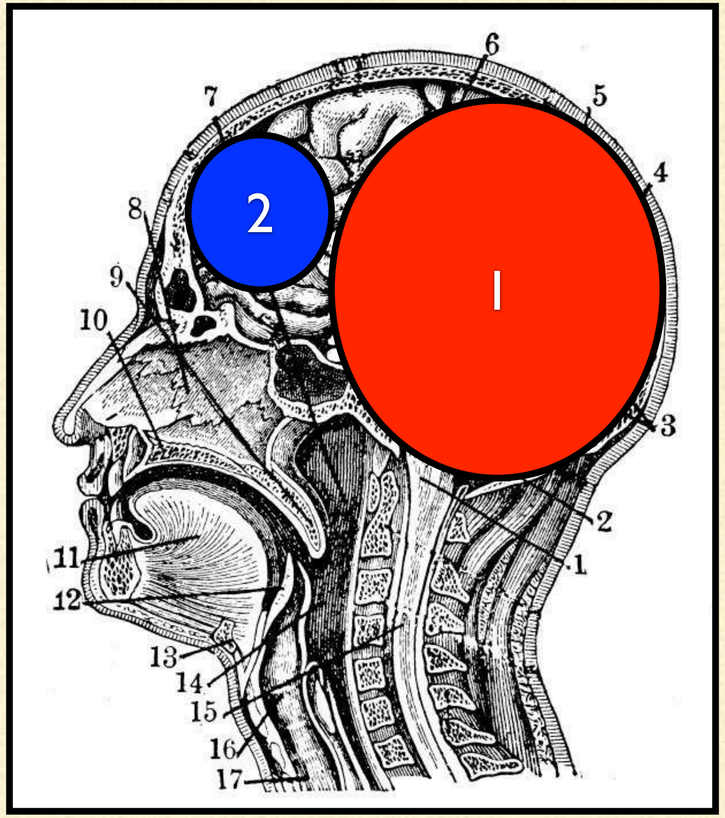
sure gain
is preferred

probabilistic loss
is preferred

DUAL MODEL

System 2

Slow
Controlled
Requires efforts
Logical

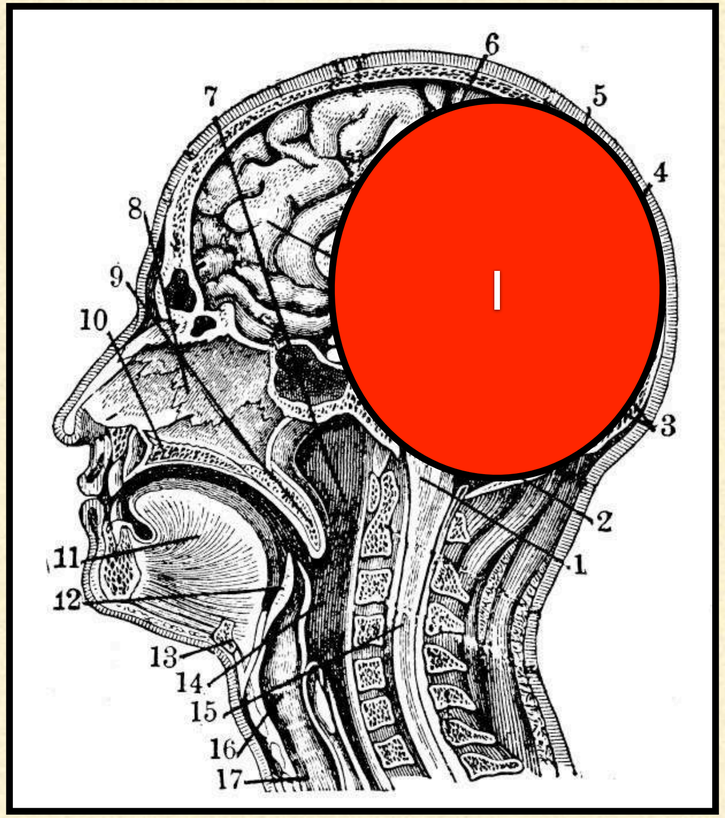


System 1

Fast
Automatic
Emotional and Intuitive
Based on pattern recognition

Manages constant data stream from our senses (eg. voice recognition)

SYSTEM 1 – HEURISTICS



System 1

Heuristics

Simple, imperfect rules for deciding.
Reduce cognitive load.

THE BAT AND THE BALL

A bat and a ball cost 1.10 CHF in total.

The bat costs 1.00 CHF more than the ball.

How much does the ball cost?

(Frederick, 2005)

MACHINES AND WIDGETS

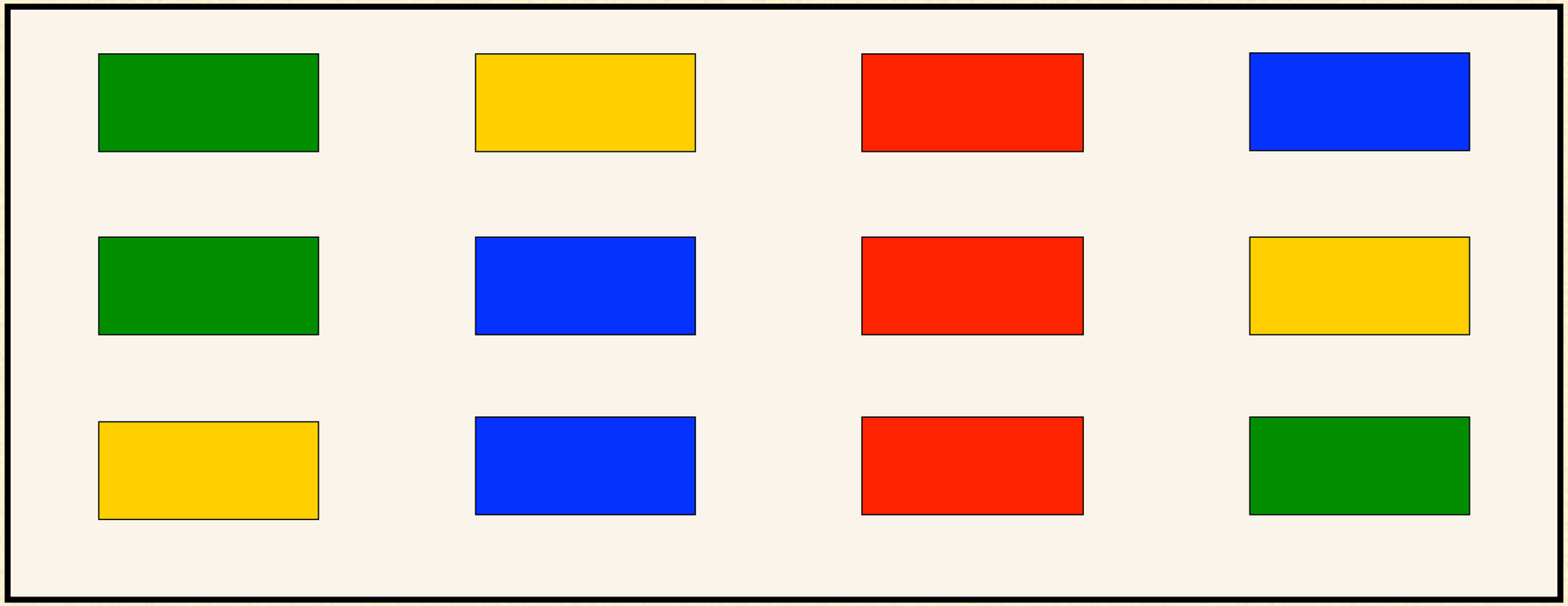
5 machines take 5 minutes to make 5 widgets

How long does is take 100 machines
to make 100 widgets?

(Frederick, 2005)

READING VS. NAMING COLORS

Name colors aloud as fast as you can:



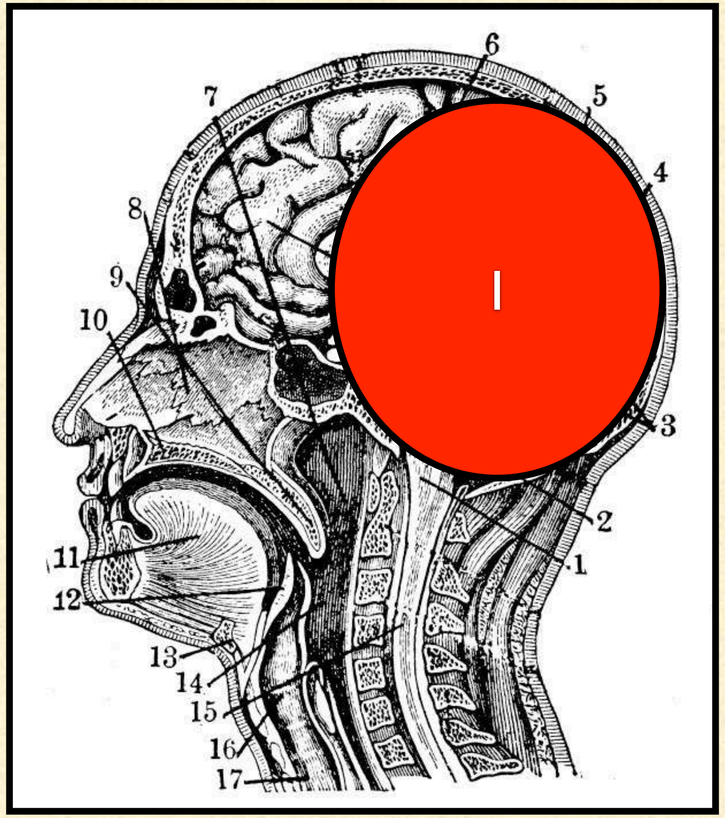
READING VS. NAMING COLORS

Name colors aloud as fast as you can:

Rouge	**Bleu**	**Vert**	**Jaune**
Jaune	**Vert**	**Bleu**	**Rouge**
Vert	**Rouge**	**Jaune**	**Bleu**

The Stroop effect: System 1 (reading) is interfering with System 2 (naming)
(Stroop, 1929)

SYSTEM 1 – COGNITIVE BIASES



System 1

Cognitive biases

Systematic errors in thinking, affecting decisions and judgments

Self-serving bias
Emotional bias
Social biais
Inertia bias
Anchoring bias
Sunk cost fallacy
Monte Carlo fallacy
Survivor bias
Confirmation bias
Affiliation bias
Halo effect
…

SELF-SERVING BIAIS / EGO BIAS

- Tendency to rearrange the world in a way that **enhance our self-image**.
- Recruitment: “Tell me about a choice or a mistake that you’ve made and eventually changed your mind”

EMOTIONAL BIAS

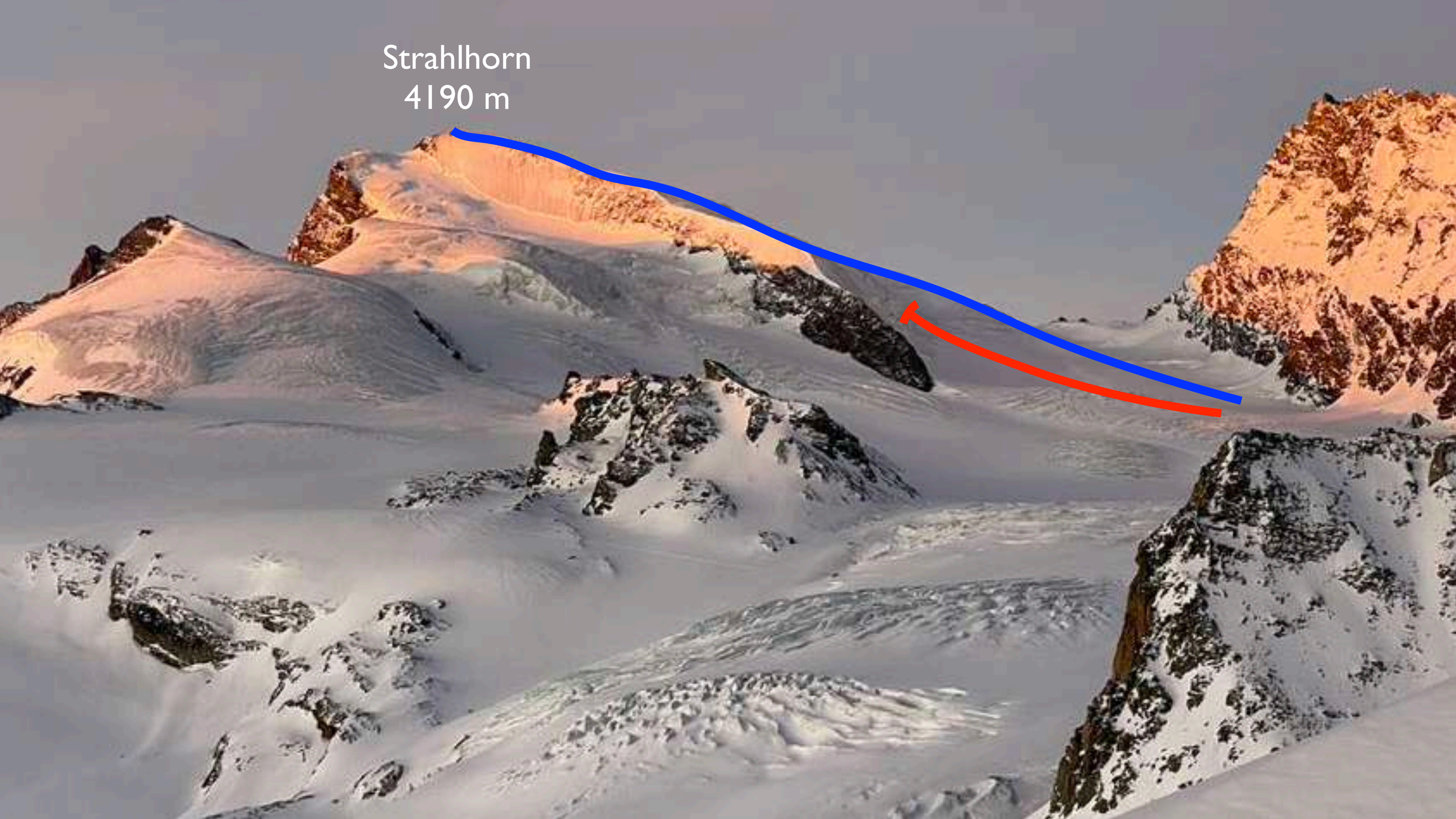
- **Reacting impulsively**, driven by emotions such as fear, anger or urgency
- Increased by sleep deprivation, hunger, alcohol, unfamiliar environment and process
- Did you ever regret sending a WhatsApp or an email?

SOCIAL BIAS

- **Conform** to the norms of our larger **social group**
- **Fear of being an outsider** or disappointing people
- Outsource our thoughts and beliefs to others
- What would have been our **position during slavery**?

INERTIA BIASES

- We resist to change, **prefer what is familiar**, even if wrong, harmful or inefficient
- Keeps us in bad jobs and relationships
- **Rely on old, suboptimal standards**

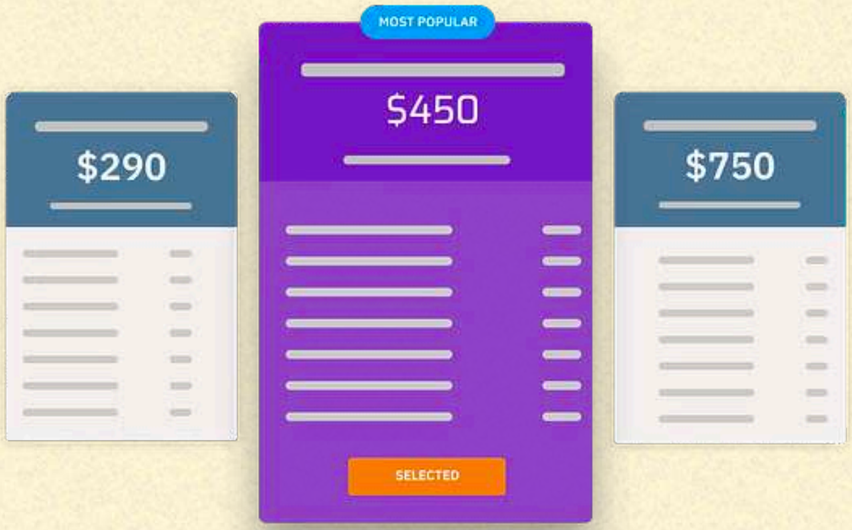

Strahlhorn
4190 m

SUNK COST FALLACY

- **Not stopping a loosing activity**
- Vietnam war, losing investment, bad relationships
- No matter how much you have already invested, only your assessment of the future costs and benefits counts.

ANCHORING BIAS / FRAMING

three-tiered pricing models

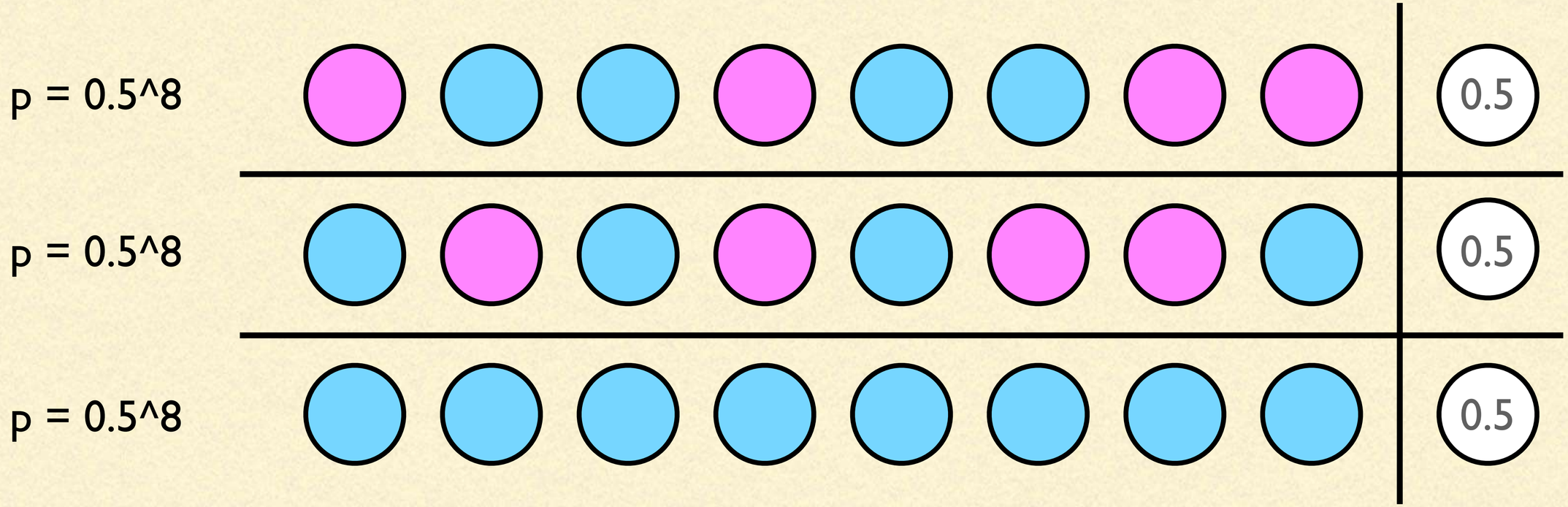


The middle option
feels just right!

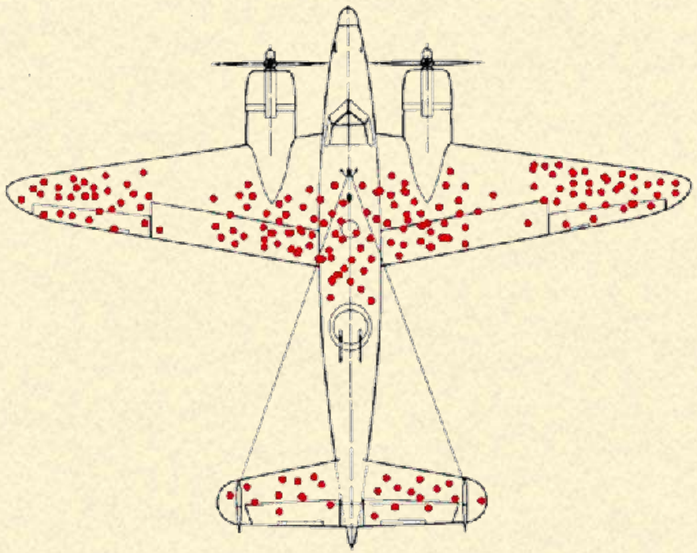
Scrum Planning Poker mitigates the *anchoring bias*, having developers provide estimates without anchoring on the first estimate. It does not prevents from *optimism bias*, though.

RANDOMNESS / MONTE CARLO FALLACY

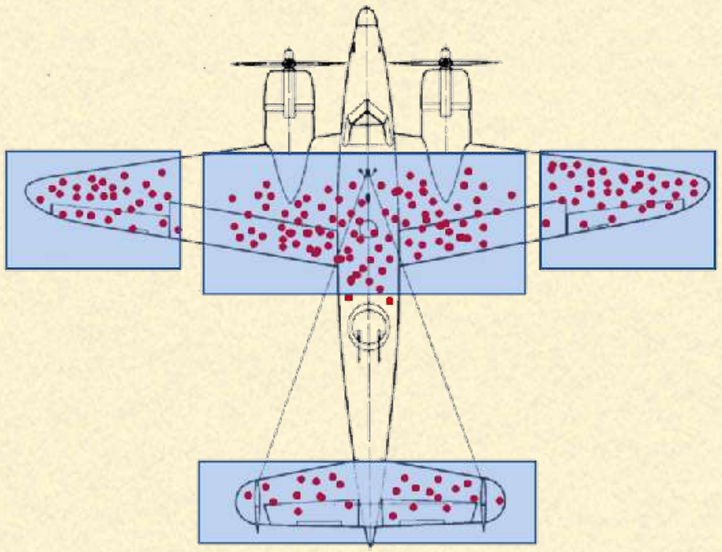
In a hospital, which sequence of births (boy/girl) is most likely?



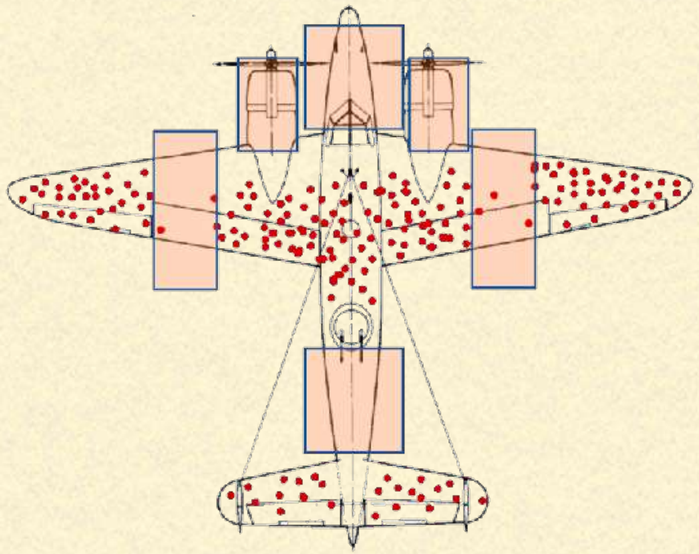
SURVIVOR BIAS / SELECTION BIAS



Bullet holes in
returning planes



Initial guess
shield the holes



Correct approach
shield the engines
so that all planes can return


100% des gagnants
ont tenté leur chance
LOTO


GILLES DELBOS ROBERT RIBLET
100%
DES PERDANTS
ONT TENTÉ
LEUR CHANCE
L'affaire des jeux de grattage
game over
SEUIL

CONFIRMATION BIAS

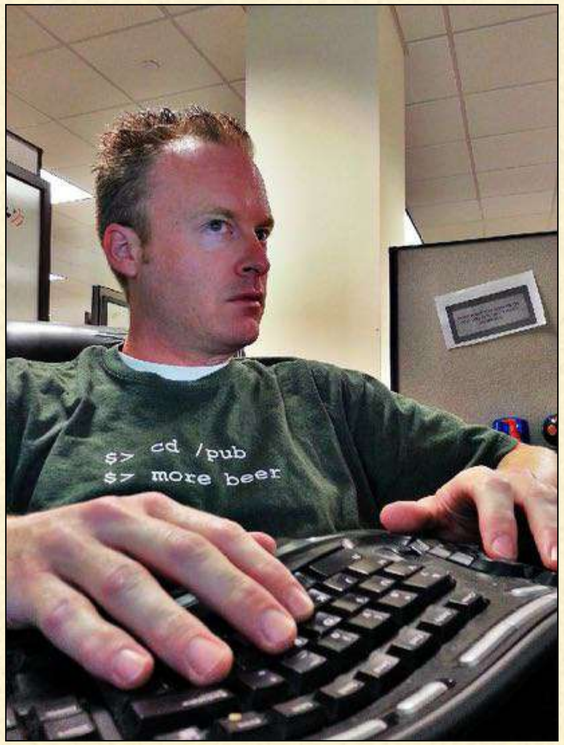
- Considering only information that reinforce our initial belief or conclusion, discard other info
- Eg. Politics, Vaccines, Nuclear Plants…
- We tend to **test programs** with consistent data and write working test cases only. Mitigate with **malformed data**, writing **failing test cases**, performing security **pen tests** and external audits

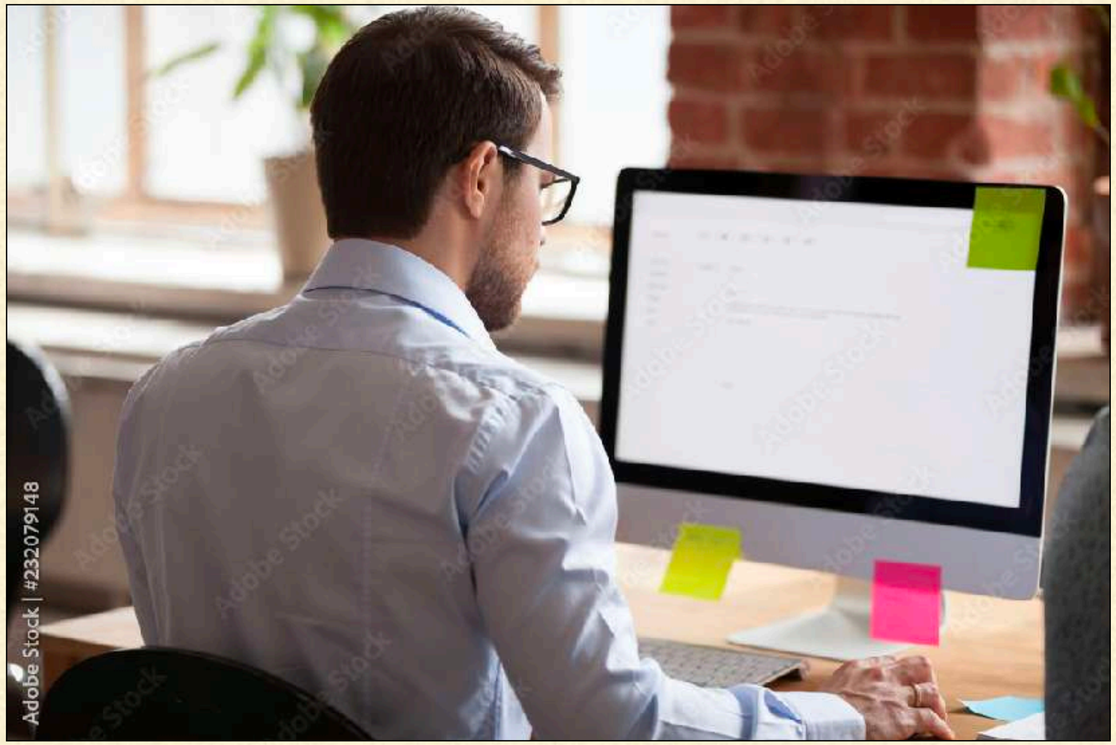
AFFILIATION BIAS

- Evaluate a person on the basis of his/her affiliations rather than on the merits of the behavior itself
- iOS vs. Android
  …

HALO EFFECT

Who is the most technically competent ?



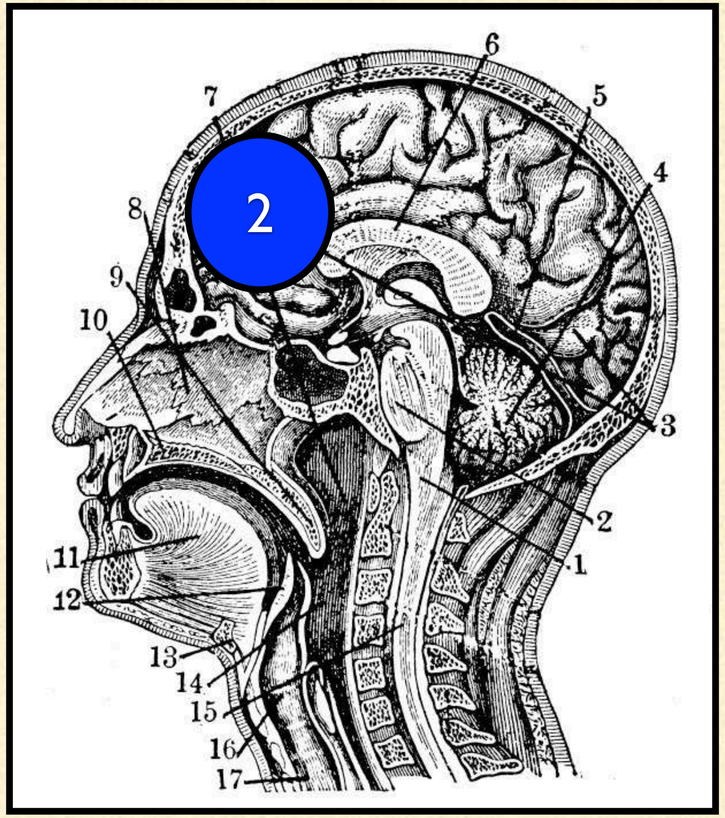


Tendency to use infer a global evaluation from a specific trait

1. HOW OUR BRAIN WORKS

2. HOW TO MAKE BETTER DECISIONS

LEVERAGE SYSTEM 2



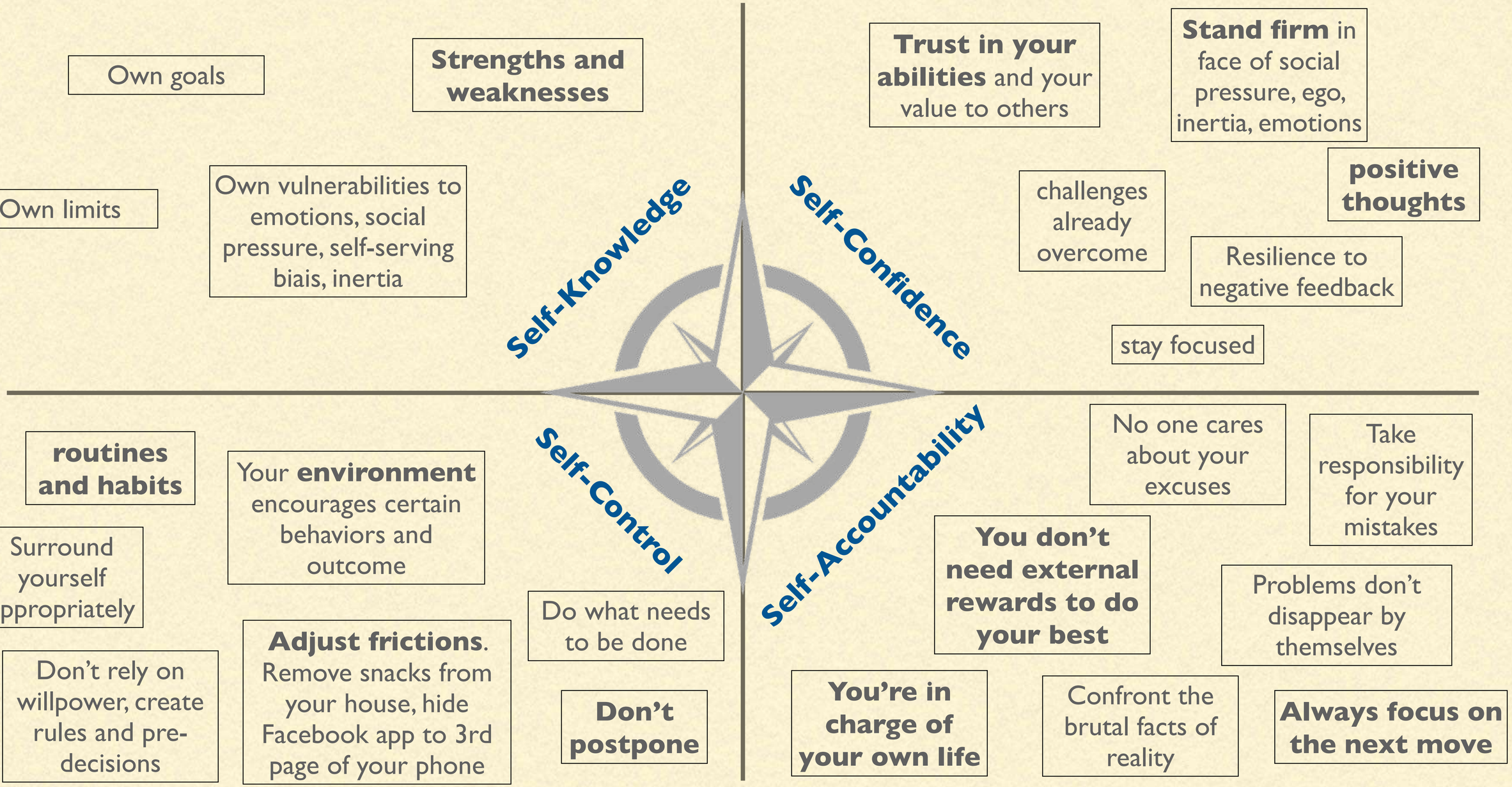
System 2

Awareness of System 1

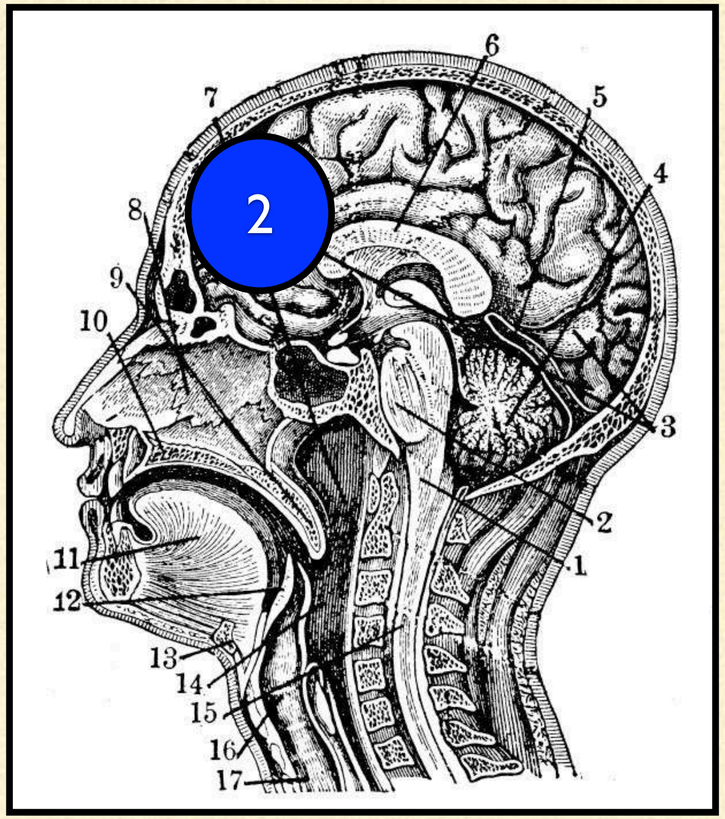
Safeguards

Improve System 1
(intuition and pattern matching)

Decision Making Process


Own goals
Strengths and weaknesses
Own limits
Own vulnerabilities to emotions, social pressure, self-serving biais, inertia
Self-Knowledge
Trust in your abilities and your value to others
Stand firm in face of social pressure, ego, inertia, emotions
positive thoughts
challenges already overcome
Resilience to negative feedback
stay focused
Self-Confidence
routines and habits
Your environment encourages certain behaviors and outcome
Surround yourself appropriately
Don't rely on willpower, create rules and pre-decisions
Adjust frictions. Remove snacks from your house, hide Facebook app to 3rd page of your phone
Do what needs to be done
Don't postpone
Self-Control
No one cares about your excuses
Take responsibility for your mistakes
You don't need external rewards to do your best
Problems don't disappear by themselves
You're in charge of your own life
Confront the brutal facts of reality
Always focus on the next move
Self-Accountability

LEVERAGE SYSTEM 2



Awareness of System 1

Safeguards

Improve System 1 (develop intuition and pattern matching)

Decision Making Process

MENTAL MODELS – SOFTWARE ENG.

Version control

Functions and parameters

Refactoring

Singletons

Iterators

Interfaces

Asynchronicity

Redundancy

Parallelism

Complexity classes

Testability

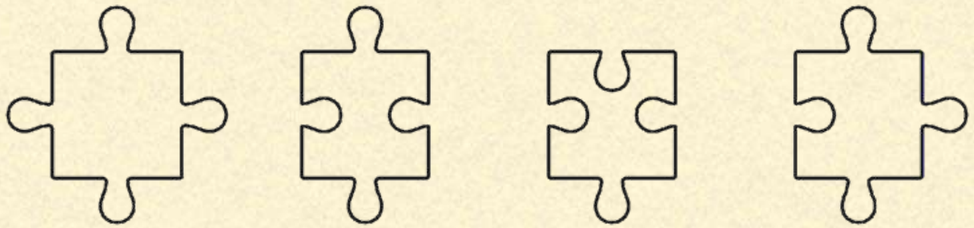
Separation of concerns

Logic vs. UI

Observers

Change log

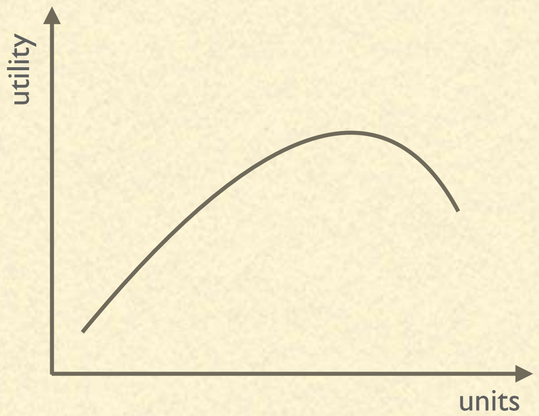
MENTAL MODELS



- Complement **expertise** with schemas or patterns or blueprints, **simplifying the complexity** into something that we can understand and think about

- **Multiplication by zero**
  Tech skill x 0 soft skills = 0
  Strength x 0 health = 0

- **Utility** (Marginal, Diminishing, Increasing)
  Usefulness of addition varies with scale
  Eg. giving water to a thirsty man has diminishing marginal utility



The Core Mental Models

1. The Map is Not the Territory
2. Circle of Competence
3. First Principles Thinking
4. Thought Experiment
5. Second-Order Thinking
6. Probabilistic Thinking
7. Inversion
8. Occam's Razor
9. Hanlon's Razor

Microeconomics

1. Opportunity Costs
2. Creative Destruction
3. Comparative Advantage
4. Specialization (Pin Factory)
5. Seizing the Middle
6. Trademarks, Patents, and Copyrights
7. Double-Entry Bookkeeping
8. Utility (Marginal, Diminishing, Increasing)
9. Bribery
10. Arbitrage
11. Supply and Demand
12. Scarcity
13. Mr. Market

Human Nature and Judgment

1. Trust
2. Bias from Incentives
3. Pavlovian Association
4. Tendency to Feel Envy & Jealousy
5. Tendency to Distort Due to Like or Dislike
6. Denial
7. Availability Heuristic
8. Representativeness Heuristic
9. Social Proof (Safety in Numbers)
10. Narrative Instinct
11. Curiosity Instinct
12. Language Instinct
13. First-Conclusion Bias
14. Overgeneralization from Small Samples
15. Relative Satisfaction/Misery Tendencies
16. Commitment & Consistency Bias
17. Hindsight Bias
18. Sensitivity to Fairness
19. Overestimating Consistency of Behavior

Military and War

1. Seeing the Front
2. Asymmetric Warfare
3. Two-Front War
4. Counterinsurgency
5. Mutually Assured Destruction

Biology

1. Natural Selection and Extinction
2. Adaptation and Red Queen Effect
3. Ecosystems
4. Niches
5. Self-Preservation
6. Replication
7. Cooperation
8. Hierarchical Organization
9. Incentives
10. Energy Output Minimization

Numeracy

1. Distributions
2. Compounding
3. Sampling
4. Randomness
5. Regression to the Mean
6. Multiplying by Zero
7. Equivalence
8. Surface Area
9. Global and Local Maxima

Physics and Chemistry

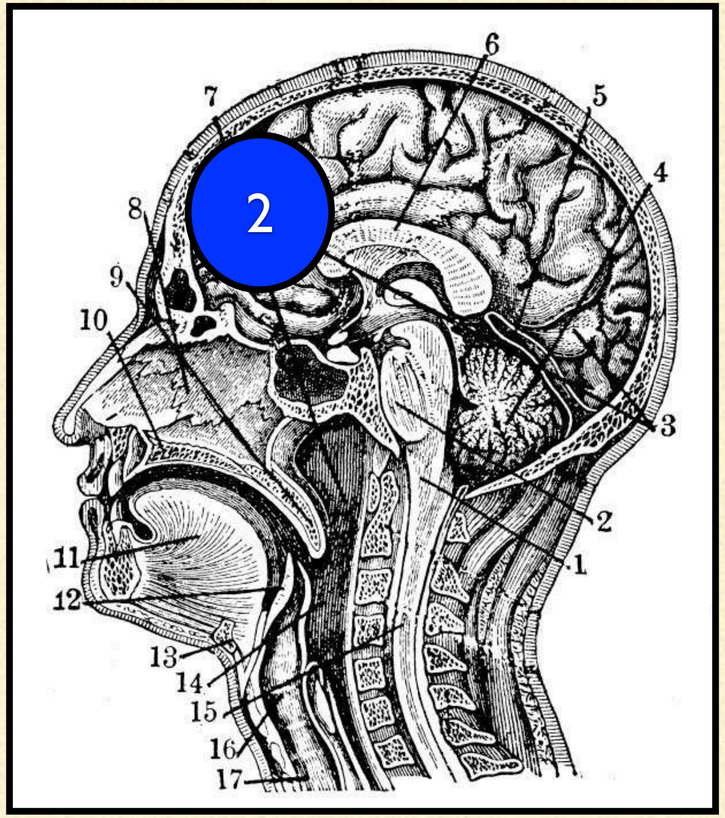
1. Relativity
2. Reciprocity
3. Thermodynamics
4. Inertia
5. Friction and Viscosity
6. Velocity
7. Leverage
8. Activation Energy
9. Catalysts
10. Alloying

Systems Thinking

1. Feedback Loops
2. Equilibrium
3. Bottlenecks
4. Scale
5. Margin of Safety
6. Churn
7. Algorithms
8. Critical mass
9. Emergence
10. Irreducibility
11. Law of Diminishing Returns

https://fs.blog/mental-models

LEVERAGE SYSTEM 2



Awareness of System 1

Safeguards

Improve System 1

Decision Making Process

1. Define

2. Gather

3. Generate

4. Evaluate

5. Decide!

6. Execute

7. Review

- Separate problem definition from resolution phase
- **The root problem**: what do you want to achieve exactly?
- Eg. Animal shelters
  Build additional facilities?
  Or make sure families can keep the pets?
- Eg. Bad sales.
  Bad marketing or bad product?
- Eg. Too much support in a dev team
  Add another dev? Or leverage 2nd level?

1. Define

2. Gather

3. Generate

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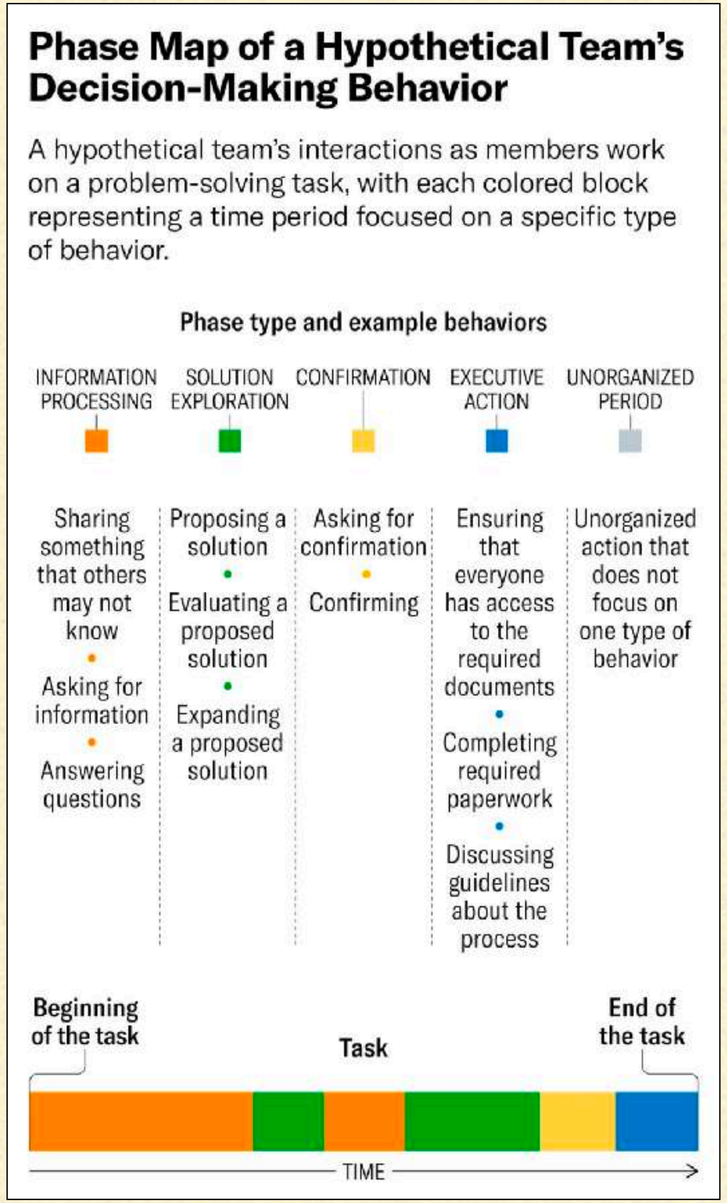
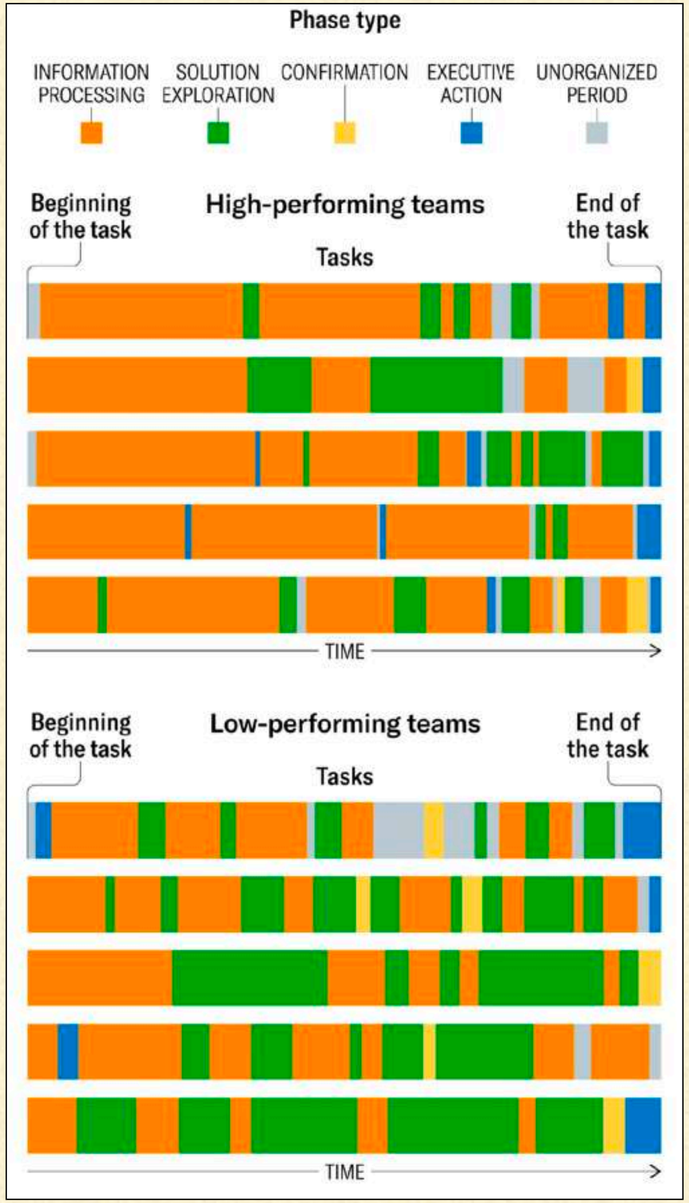




Avoid **Solution fixation trap**

Gather and **share** all available information before considering solutions.

Write them down.

https://hbr.org/2023/10/is-your-team-caught-in-the-solution-fixation-trap

1. Define

2. Gather

3. Generate

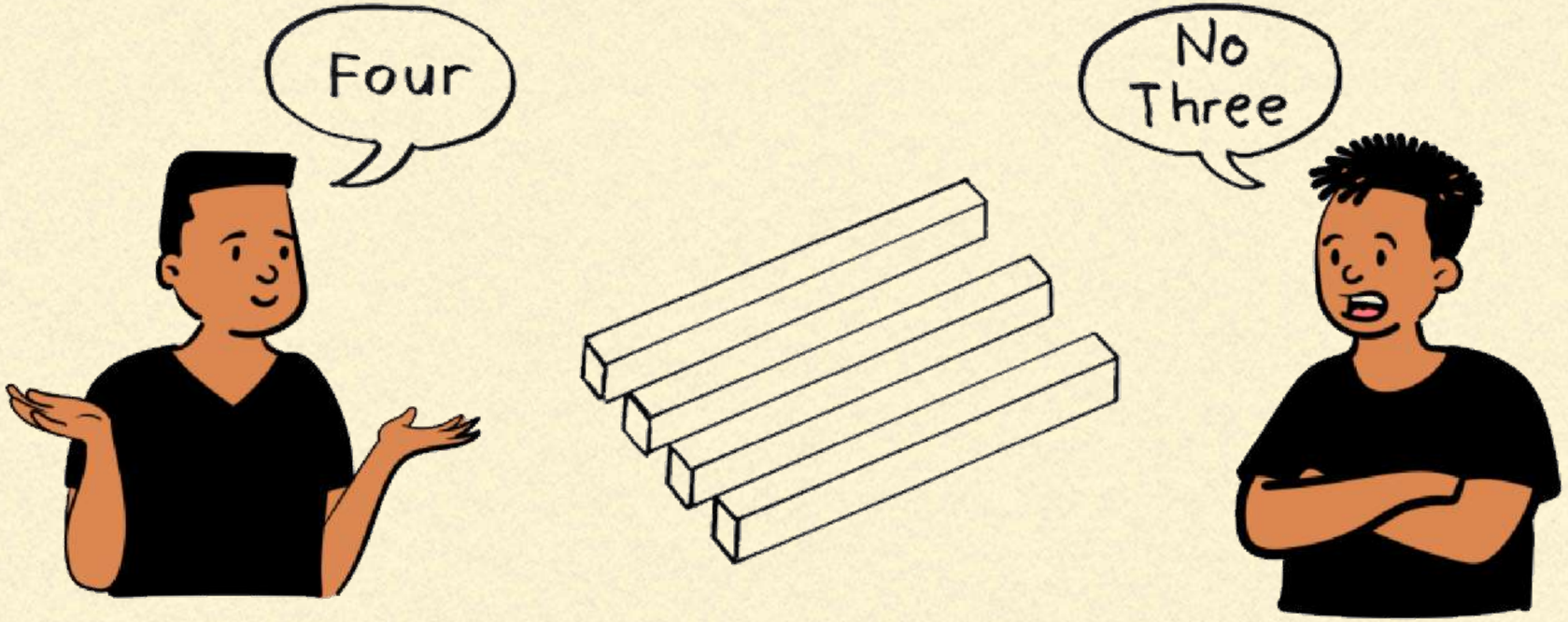
4. Evaluate

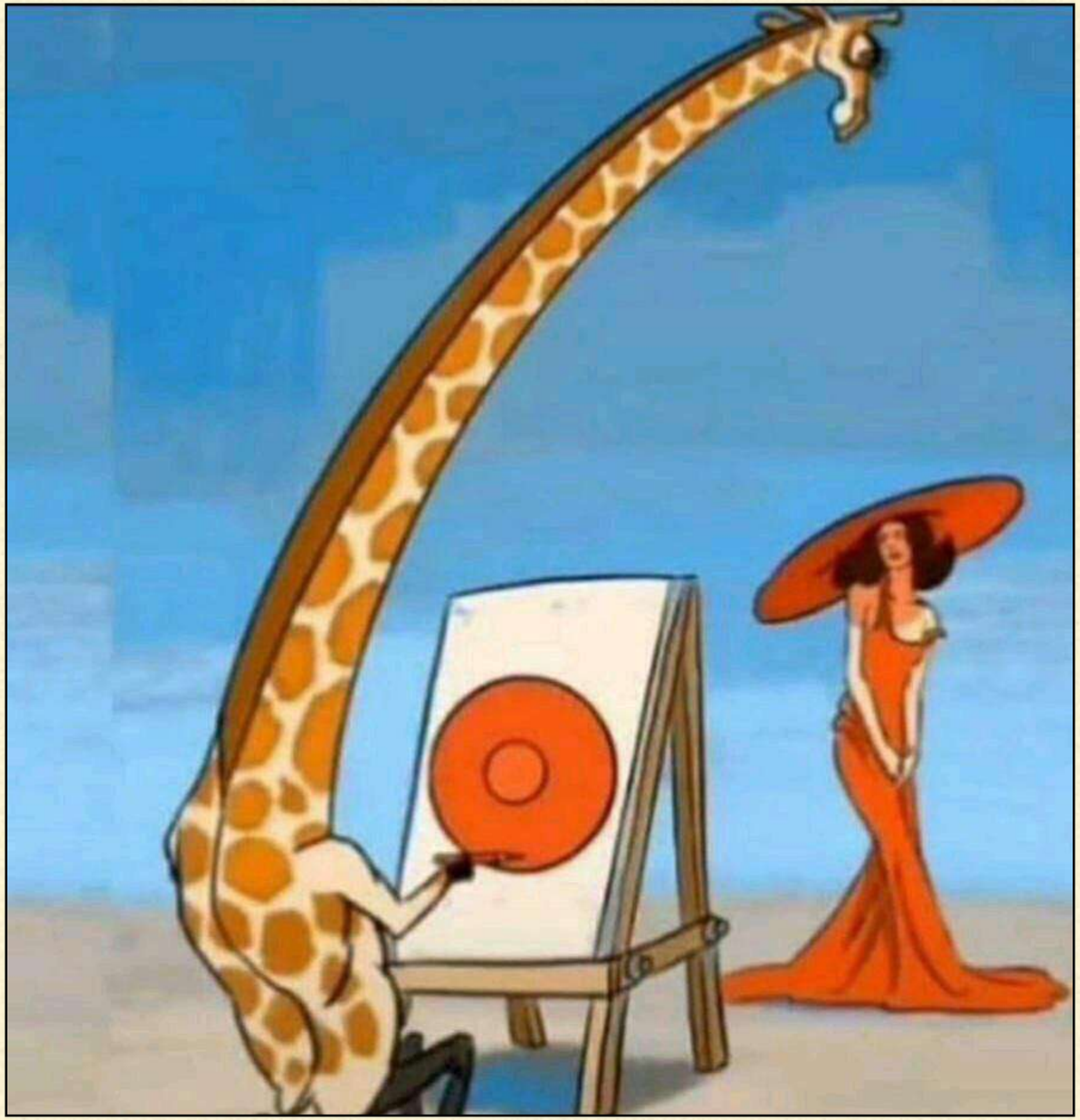
5. Decide!

6. Execute

7. Review

- Look for high quality information and sources. Gather information without judgment
- **What do others know that you don't?**
- We experts see things we're trained to see (System 1) and miss other relevant things (eg. doctors)
- **Seek out disconfirming evidences**, data or personal opinions, dive in into surprising things


Four
No
Three



1. Define

2. Gather

3. Generate

4. Evaluate

5. Decide!

6. Execute

7. Review

- Imagine non-binary solutions
- ➡ stay in your job + attend evening classes
- ➡ client does't have enough budget? Offer a discount, but sell a longer commitment.
- We can always improve current situation, even if it's not perfect

1. Define

2. Gather

3. Generate

4. Evaluate

5. Decide!

6. Execute

7. Review

- **Risks and impacts**, **short and long term**
- Likelihood of desired outcome
- What could go wrong? Consider **margins of safety**.
  eg. Bridge, personal finance, software projects, …
- **Opportunity cost**, what if we don't do X?
- Hidden trade-offs, at the expense of what?
  eg. Commuting for a remote house
- Second/Third Order thinking. And next?

"Failure comes from a failure to imagine failure"

1. Define

2. Gather

3. Generate

4. Evaluate

5. Decide!

6. Execute

7. Review

The art of decision: **balance speed and accuracy**

1. Define

2. Gather

3. Generate

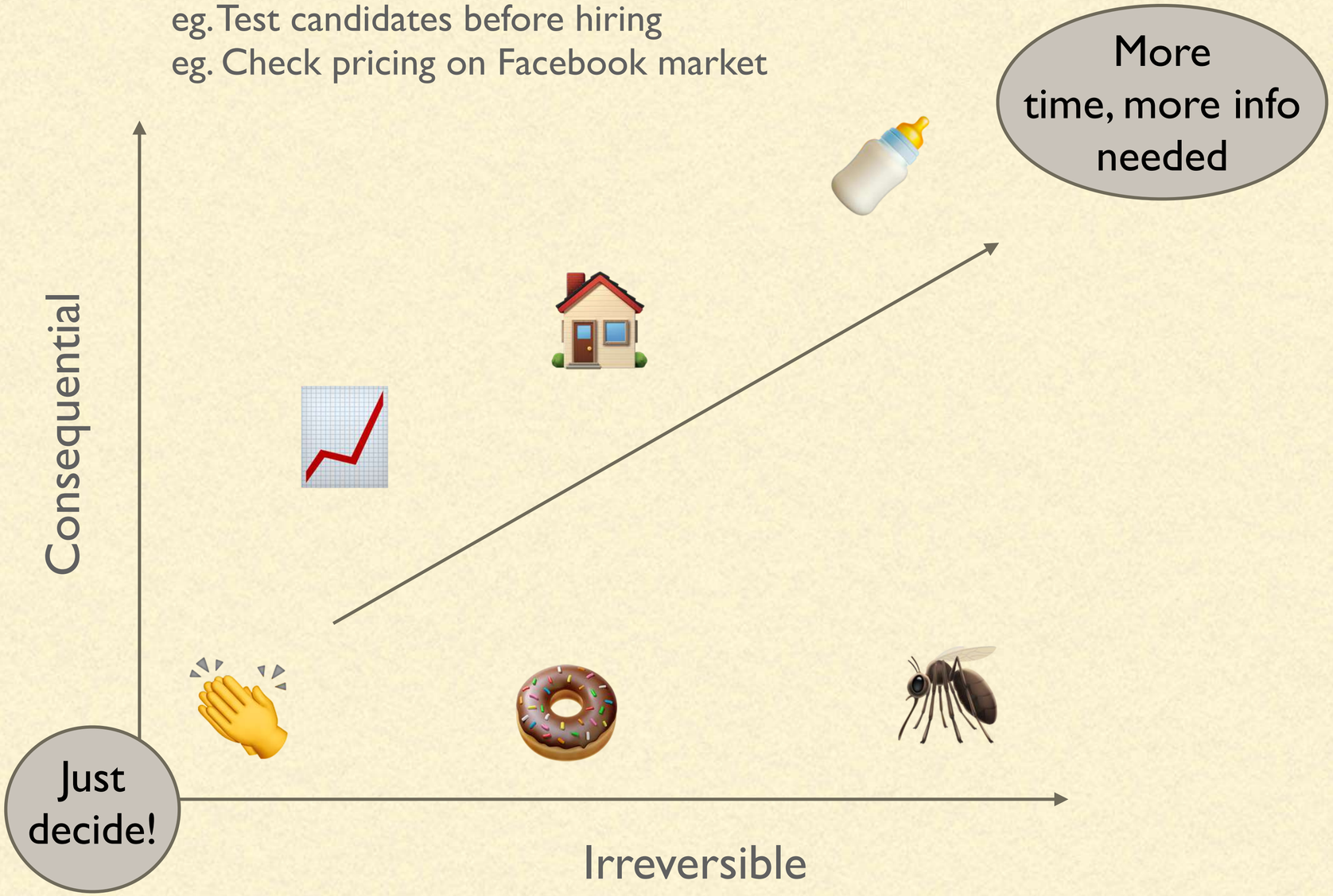
4. Evaluate

5. Decide!

6. Execute

7. Review

Run low-risk experiments
eg. Test candidates before hiring
eg. Check pricing on Facebook market



1. Define

2. Gather

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WHEN TO DECIDE?

When new information is not helping anymore.

It just brings overconfidence and confirmation biais

Start losing opportunities

WHEN TO BE CAUTIOUS?

1. Under Stress
Sleep, hunger, breakup, anger, pain, …

2. Distracted
too focused on one thing -> blind on other things

3. In a Group
Natural tendency to agree with the group

4. In a Rush
Focusing on something, forgetting others

5. Unfamiliar Environment or Routine
eg. new office, new process, …

6. Lead by Authority
Pilots or CEO can also make mistakes

7. Information Overload
Too much info cannot be processed

1. Define

2. Gather

3. Generate

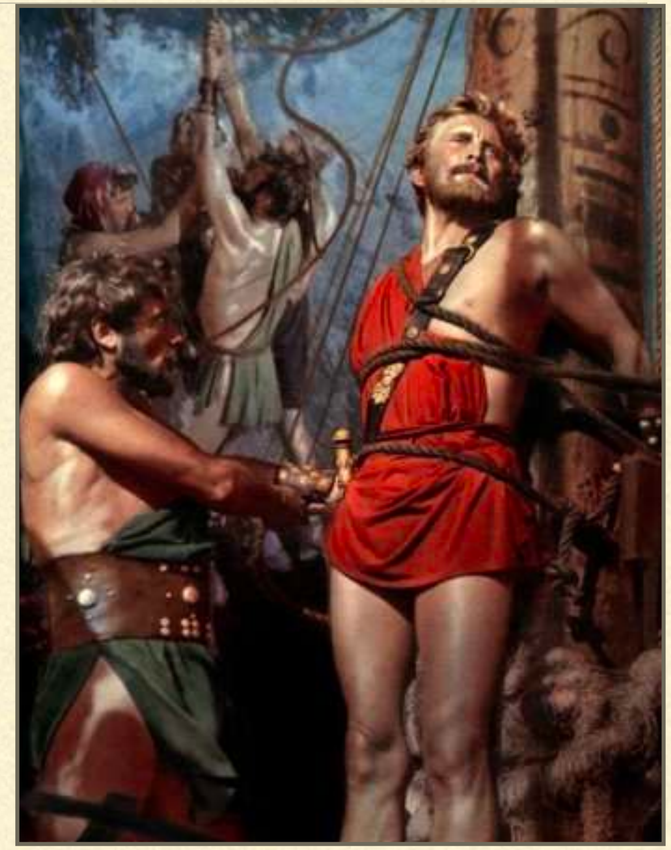
4. Evaluate

5. Decide!

6. Execute

7. Review

- Stress affects cognitive capacities.
  How to act under pressure?
- **Decide in advance** when to turn around to survive. The summit it not worth a life.
- Notice positive and negative signs, or the absence of thereof.



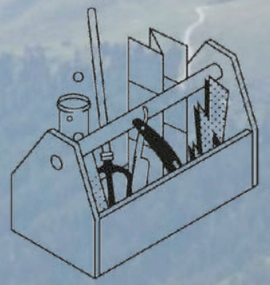
Kirk Douglas / Ulysse tied to the mast to resist the enchanting singing of sirens.

In *Ulysse*
Mario Camerini, 1954

2018 - Eiger Ultra Trail 101 K 5800 D+
2019 - X-Alpine 111 K 8500 D+
2022 - SwissPeaks 100 K 6460 D+
2023 - Scenic Trail 130 K 9500 D+
2023 - 2x Sierre-Zinal in 1 day

Mental cards toolbox, complement to physical and technical preparation

- From "this is what I have to do" to **"let's see what I can do"**
- **Anxiety means that you care**, it prepares mind and body
- **Visualize** all steps for success, images, sounds, smells, feelings
- **Anticipate** what could go wrong and **how to react** (rain, cold, injuries, ...)
- **Negative thoughts are self-sabotage**. Say hello good bye and focus.
- **I know I can handle things** if they don't get smooth.
- **Have fun and enjoy** doing the race
- **Relax and do your best**
- I may not FEEL strong, **but I AM strong**
- **It's not easier for others**
- A temporary pain for an eternal pride
- First, complete the f* race, think after



SIERRE ZINAL
LA COURSE DES CINQ 4000

1. Define

2. Gather

3. Generate

4. Evaluate

5. Decide!

6. Execute

7. Review

Good decisions ➡

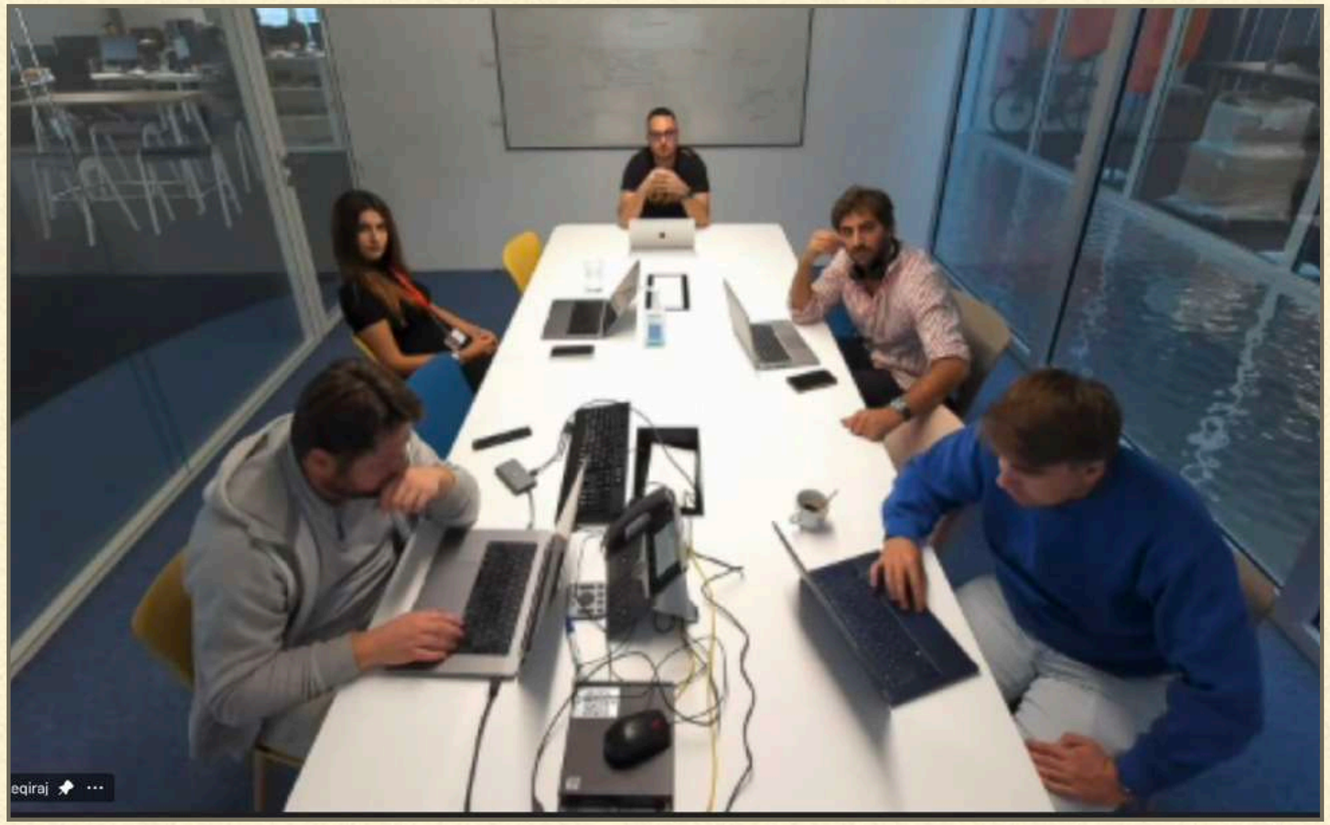
	Good Outcome	Bad Outcome
Good Process	Deserved success	Bad luck
Bad Process	Pure luck	Deserved Failure

⬅ Bad decisions

Improve your decision making skills with a **decision journal** 📝

Review decisions after 6 months, notice patterns.
Clarify your thoughts.
Make your decision-making process visible and open to scrutiny.
Allow others to see your thinking and learn from your perspective.
Allow managers to distinguish good decisions makers from mediocre ones.

GROUP DYNAMICS



- Most major decisions in organizations are made by groups
- **Groups should outperform most individual** decision makers (Ziller 1957, Forsyth 2010)
- Sharing divergent perspectives drives solution quality and creativity
- But, beware of **group think**!

- **Conformity bias** (Asch experiment)
  Members are more concerned with group acceptance than correctness.
  ➡ Seek individual ideas generation
  ➡ Seek diversity of backgrounds

- **First conclusion biais**
  Tendency to settle on first conclusions

- **Authority bias**
  Perceived authority drives people to take decisions they would otherwise not take (Milgram, Zimbardo)

- **Role identities**
  Provide a decision making framework, a logic of appropriateness. (Ashforth, Harrison, & Corley, 2008)

- **Organizational identity**
  Influence from the values and beliefs of an organization, can impede change (Kodak, …)

MITIGATE GROUPTHINK

- **Framing effect**
  Question the way that information is shared
- **Anchoring biais**
  Pay attention to the order options being voiced
- **Confirmation bias**
  Encourage disconfirming information
- **Loss-aversion bias**
  Review opinions when new information emerges

"Everyone in favor raise your hand!"

CRISIS DECISION MAKING

- Crisis situations need to be **carefully prepared**
- Prevents improvisation on the spot and emotional reactions
- Eg. lack of honestly and transparency can backfire badly
- The whole team must **know the goals**, to make decisions on their own and **adapt to changing circumstances** (eg. talk on Fukushima at LeadDev London)

WANTING WHAT MATTERS

Working harder on the wrong thing won't move you forward.

Focus on what matters.

Don't waste time on things that aren't worth it.

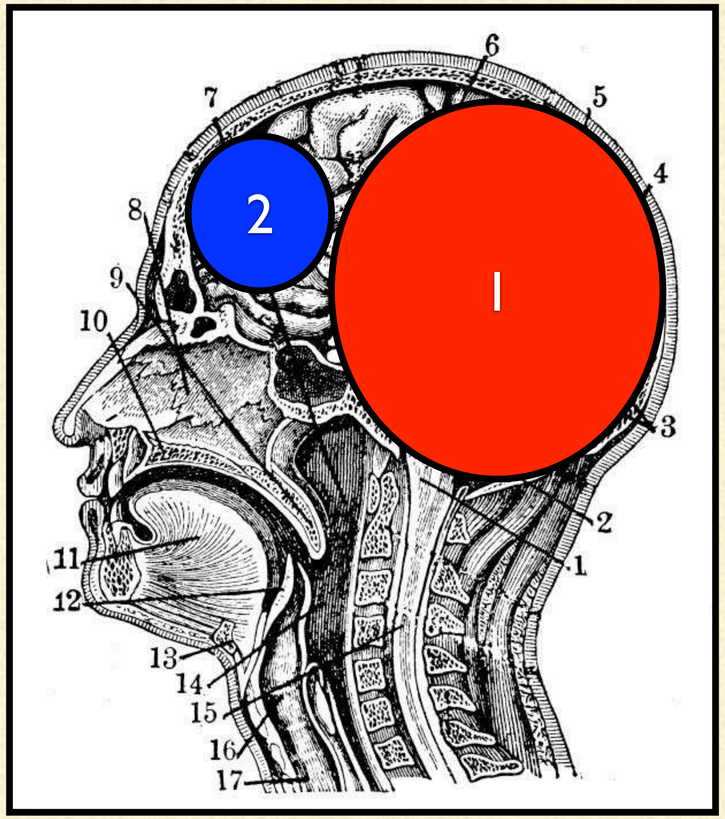
CONCLUSION

System 2

Mitigate S1

Try to improve S1

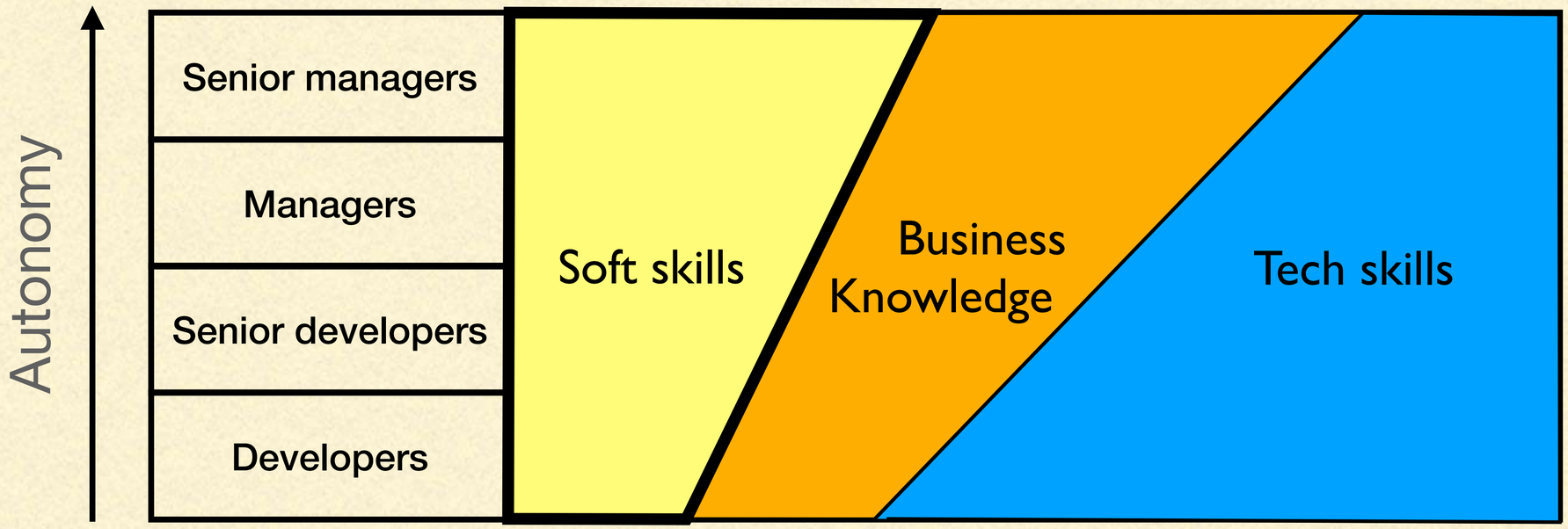
Decision Making Process

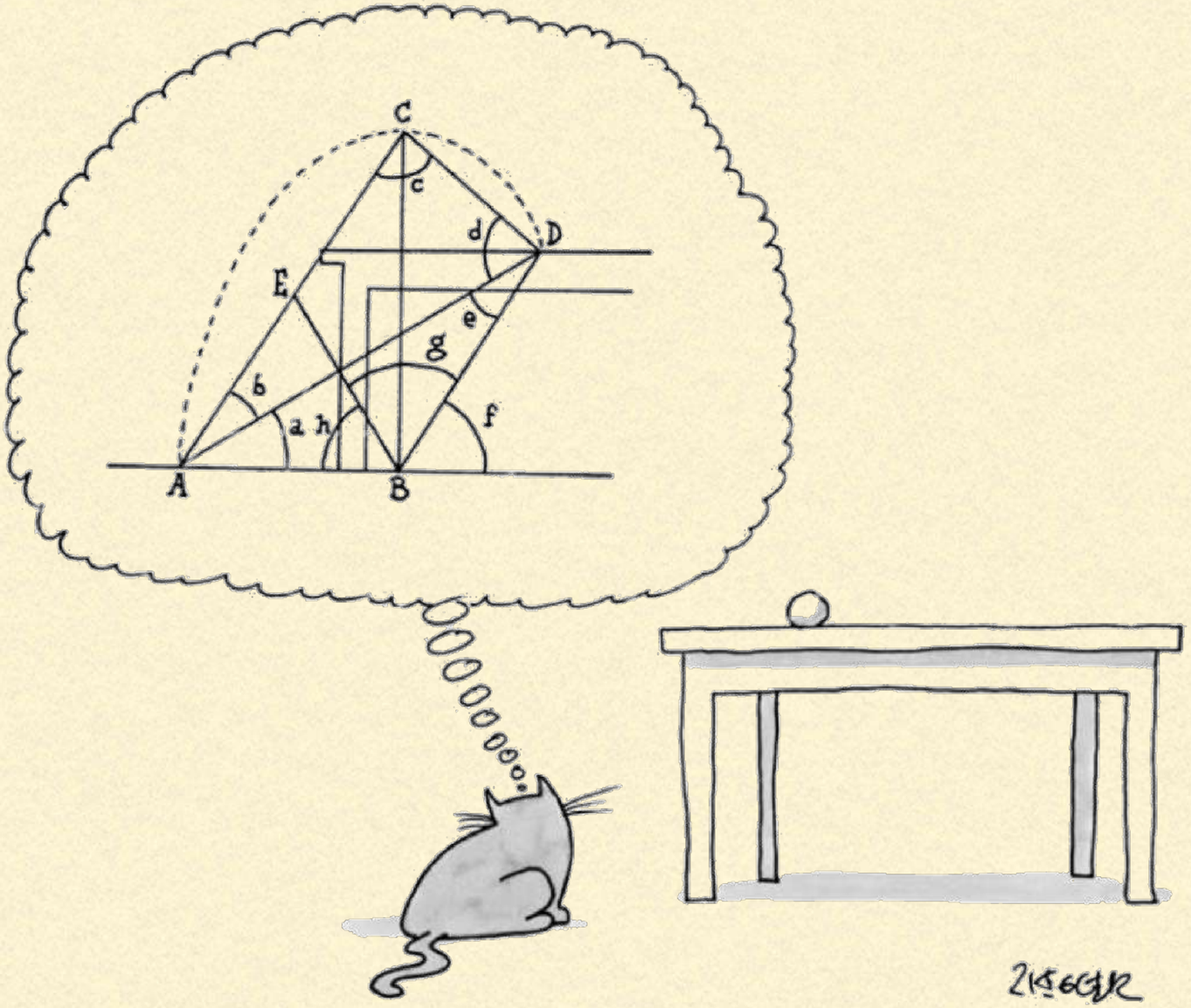


System 1

Fast, intuitive, emotional
Machine to jump to conclusions
Biased and error prone

Akin to ChatGPT
Associative and probabilistic solutions
Fast, convincing, can be wrong


Autonomy
Senior managers
Managers
Senior developers
Developers
Soft skills
Business Knowledge
Tech skills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