

Thinking, Fast and Slow

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I. System 1 and System 2

THE TWO INTERTWINED MECHANISMS OF FAST AND SLOW THINKING

Fast thinking/*System 1* performs the automatic mental activities of perception and associative memory, and also involves both variants of intuitive thought – the expert and the heuristic.

Intuitive judgements, most often under uncertainty, can be attributed to either expert skills or heuristics, that is, either to the effects of prolonged practice (e.g. information/model stored in memory => recognition) or to judgement heuristics.

When the spontaneous search for an intuitive solution fails (neither an expert solution nor a heuristic answer comes to mind), the brain switches to a slower, more deliberate and effortful form of thinking => slow thinking/*System 2*.

→ When facing a question, System 1 often provides an intuitive answer; then, the extent of deliberate checking and search is a characteristic of System 2.

System 1 is in charge of building a coherent operating model (jumping to conclusions so as to handle the multitude of decisions it is confronted to), while System 2 is in charge of doubting and unbelieving.

However, System 2 is lazy, and sometimes busy; people are more likely to be influenced by commercials, persuasion, when they are tired and depleted.

Ego depletion

Psychologist Roy Baumeister has shown that all variants of voluntary effort – cognitive, emotional or physical – draw on a shared pool of mental energy.

Ego depletion => an effort of will or self-control is tiring; if you have had to force yourself to do something, you are less willing or less able to engage in a cognitive task, exert self-control or perform a physical activity when the next challenge comes around.

Effortful mental energy appears to be especially consuming glucose. Baumeister's experiments have shown that the effects of ego depletion could be undone by ingesting glucose.

Keith Stanovich and Richard West further split System 2 into two, drawing a distinction between intelligence and rationality:

- the algorithmic mind deals with slow thinking and demanding computation.
- the reflective mind, concerned with rationality, deals with deliberate checking of intuitive answers, and memory search. It is the one guarding us from overconfidence and from making cognitive errors (also known as judgement biases when systematic).
Shane Frederick's Cognitive Reflection Test evaluates people's tendency to answer questions with the first idea coming to mind.

As mental effort is aversive, System 2 is lazy. Intelligent people might be quite capable of cognitive thinking, but avoid it as much as possible, instead preferring to give way to their intuition (System 1): intelligent but irrational.

➔ Fast thinking is the most preferred method the brain chooses when making choices and judgements.

ASSOCIATION AND PRIMING, FEATURES OF SYSTEM 1

System 1 is constantly building and operating on a model of the world that instantly evaluates events, and is the source of people's rapid and precise judgements.

The philosopher David Hume identified three main principles of association: resemblance, contiguity in time and space, and causality.

Associative memory works by linking ideas:

- o causes are linked to their effects (virus -> cold)
- o things to their properties (lime -> green)
- o things to the categories to which they belong (banana -> fruit)

Associative activation: ideas trigger cognitive, emotional and physical responses

Priming effects exploit associative activation: information is placed in associative memory, then activated, when the subject is looking for readily-available elements to pass a judgement (cognitive ease).

Research into priming effects has shown that our thoughts and behaviour are heavily influenced by the environment of the moment. Many people find these results upsetting, because they threaten the subjective sense of agency and autonomy.

Examples of priming effects:

- ❖ *The Florida effect*: words are used to prime thoughts of old age (related words, as the indirect method works better), which in turn prime a behaviour, walking slowly.

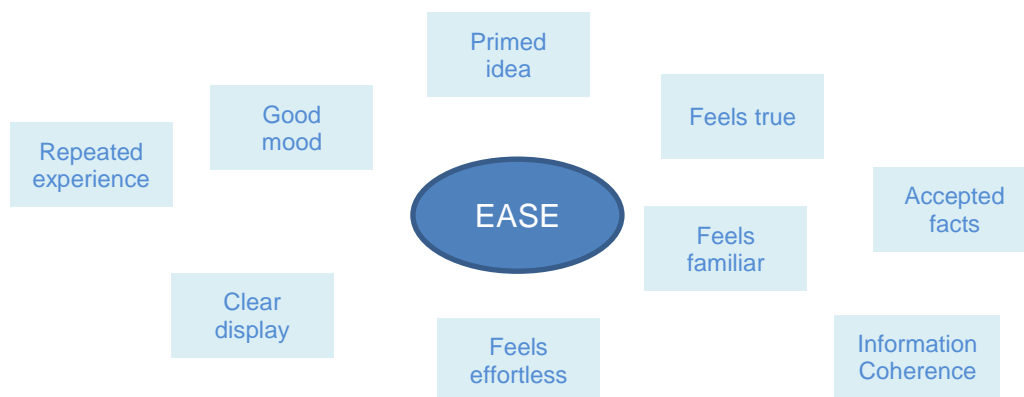
- ❖ *The Lady Macbeth effect*: feeling that one's soul is stained (by lying, etc.) triggers a desire to cleanse one's body.
- ❖ *Anchoring effects*: occur when people consider a particular value for an unknown quantity before estimating that quantity, with the estimate staying close to the considered number. This is irrespective of the conscious irrelevance of the considered number (can be a number knowingly random) => anchors do not have their effects because people believe they are informative.
Anchoring is first of all a priming effect (relying on associative activation), which also involves a process of adjustment from the anchor, done by System 2. People adjust less (stay closer to the anchor) when their mental resources are depleted.

COGNITIVE EASE, AND ITS CRUCIAL ROLE IN DETERMINING THE USE OF SYSTEM 1 OR 2

System 1 determines whether extra effort is required from System 2 when performing the task at hand, which particularly involves an assessment of the cognitive ease (= fluency, the technical term).

➔ Cognitive ease mobilises System 1, while cognitive strain mobilises System 2.

Good mood, intuition, creativity, increased reliance on System 1 (gullibility, less vigilance and more prone to logical errors), etc. form a cluster.



When you are in a state of cognitive ease, you are probably in a good mood, like what you see, believe what you hear, trust your intuitions, and feel that the current situation is comfortably familiar. You are also likely to be relatively casual and superficial in your thinking. When you feel strained, you are more likely to be vigilant and suspicious, invest more effort in what you are doing, feel less comfortable, and make fewer errors, but you also are less intuitive and less creative than usual.

Cognitive ease is both a cause and a consequence of a pleasant feeling.
(However, making a quick intuitive decision relies on a snap, surprise good feeling which must not be expected/ perceived as caused by something else.)

System 1 has been shaped by evolution so that good mood and cognitive ease go in pair with assessments of safety and familiarity.

Repetition induces affection, and cognitive ease.

- ➔ “Mere exposure effect” (Robert Zajonc): exposure to things that proved safe confers a liking (explained by evolution). It is actually stronger when the stimuli never consciously come to the attention of the individual.
- ➔ Truth illusions: a reliable way to make people believe in falsehoods is frequent repetition, as familiarity is not easily distinguished from truth.

Although self-criticism, logical analysis is one of the functions of System 2, it is more of an apologist than a critic of the emotions of System 1. Its search and acceptance of information and arguments is mostly constrained to what is consistent with existing beliefs, not with an intention to examine them. A coherence-seeking System 1 suggests solutions to an undemanding System 2.

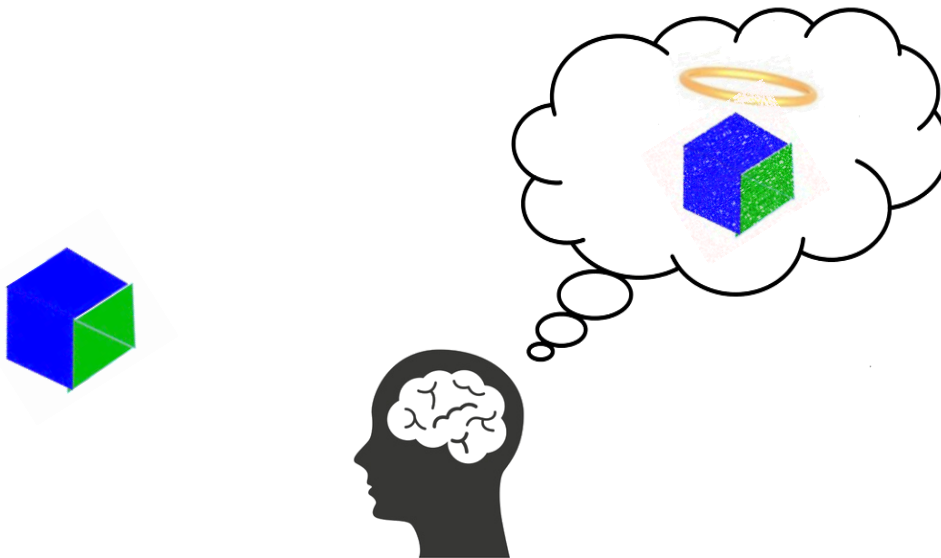
Using statistics versus individual cases

Showing one or two individual cases will influence System 1.

Surprising individual cases have a powerful impact and are a more effective tool for teaching psychology because the incongruity must be resolved and embedded in a causal story (as System 1 likes coherence).

THE HALO EFFECT – EXAGGERATED EMOTIONAL COHERENCE

- ⇒ The tendency to make an overall judgement – positive or negative – of a person/thing (ex: liking, or disliking, everything about it) based on one trait, without considering unobserved attributes. In other words, when first impressions influence later judgements.



The halo effect contributes to coherence, as it inclines us to match our view of all the qualities of a person to our judgement of one or a few significant attributes. It can be explained by the urge to suppress ambiguity (a source of mental effort), and by the fact that the associative process in the brain (used to build a model of the person/thing) works by only connecting activated/known information, without considering (important) variables whose values are unknown.

The sequence in which we observe characteristics of a person matters, because the halo effect increases the weight of first impressions – sometimes to the point that subsequent information is mostly wasted.

When applied to group judgement, a way to prevent adverse consequences of the halo effect is to de-correlate errors, by obtaining separate, independent judgements on the issue being considered. This will provide more information overall, as otherwise the first account (most often given by assertive people) would influence the following ones, which would have a tendency to just conform.

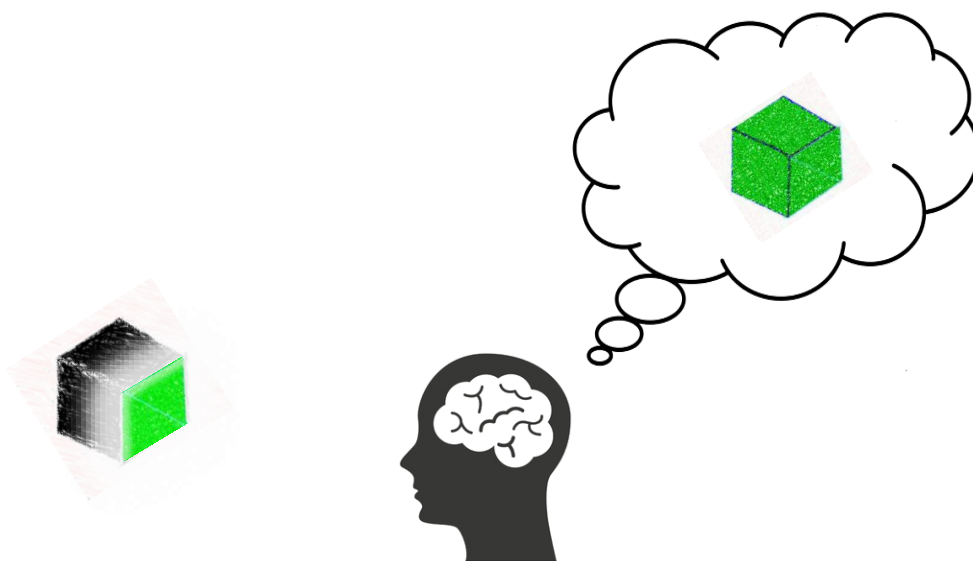
GOING WITH COHERENT BUT PARTIAL INFORMATION – "WHAT YOU SEE IS ALL THERE IS"

- ⇒ Jumping to conclusions in the context of limited evidence (focusing on existing evidence, while ignoring absent evidence).
- ⇒ A facet of intuitive thinking, in which information consistency/coherence matters, not completeness nor even quality/ reliability. In this respect, using relevant statistics does not come to mind.

The measure of success for System 1 is the coherence it manages to create; the amount and quality of the data on which the story is based are largely irrelevant.

A message, unless it is immediately rejected as a lie, will have the same effect on the associative system regardless of its reliability.

"They did not want more information, which might harm their confidence. WYSIATI!"



The law of small numbers is a manifestation of a general bias that favours certainty over doubt.

It is observed in some sampling effects, which generate particular artefacts (i.e. observations produced entirely by some aspect of the method of research): small samples yield extreme results more often than large samples. Choosing too small a sample is a common mistake, where false inferences are made.

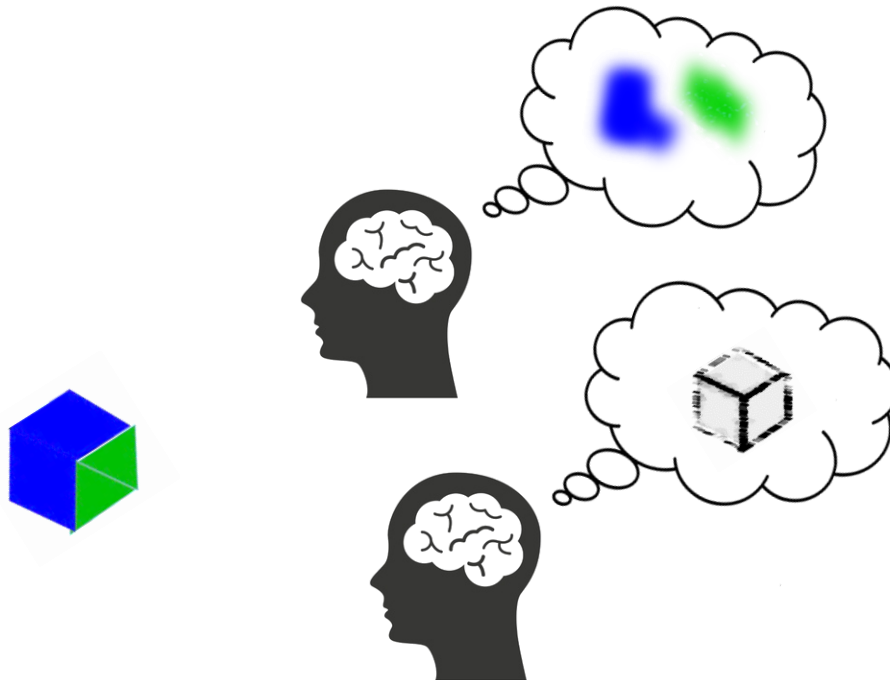
This is exacerbated by the fact that people are too quick to perceive order and causality in randomness.

WYSIATI: we are prone to exaggerate the consistency and coherence of what we see.

SUBSTITUTION

The reason why we have intuitions/opinions about many things that we know little about can be explained by the use of heuristics, simple procedures that help find handy, though often imperfect, answers to difficult questions.

Heuristics work by substituting a question – often difficult or ambiguous – with another question, often easier or simpler.



In terms of terminology, the original/target question is the assessment intended to be produced, and the simpler question answered instead is the heuristic question.

In less regular - low-validity - environments, the heuristics of judgement are invoked. System 1 is often able to produce quick answers to difficult questions by substitution, creating coherence where there is none - which may pass the lax and lenient review of System 2. A lazy System 2 often follows the path of least effort and endorses a heuristic answer without much scrutiny of whether it is truly appropriate.

Because substitution occurs automatically, you often do not know the origin of a judgement that you endorse and adopt.

But an unbiased appreciation of uncertainty is a cornerstone of rationality – although it is not what people and organisations expect, so that acting on pretended knowledge is often the preferred solution.

People judge competence by combining the two dimensions of strength and trustworthiness.

There are mechanisms in the brain that evaluate dominance, competence, etc. from the shape of the face. The faces that exude competence combine a strong chin with a slightly confident-appearing smile. Ratings of competence of politicians (participants were shown the faces of politicians unknown to them) were correlated with their electoral results.

INTUITION

Herbert Simon's definition of intuition:

The situation has provided a cue; this cue has given the expert access to information stored in memory, and the information provides the answer. Intuition is nothing more and nothing less than recognition.

Two conditions enable to evaluate an intuitive judgement as highly probable:

- an environment that is sufficiently regular to be predictable
- an opportunity to learn these regularities through prolonged practice and feedback.

Outside of these conditions, intuition might be mere substitution.

Confidence is a belief of two related impressions: cognitive ease and coherence.

It follows that the confidence that people have in their intuitions is not a reliable guide to their validity.

II. Heuristics and biases

A heuristic technique/method – often simply called a heuristic – is a particular approach to problem solving that employs a practical method, not guaranteed to be optimal, perfect, or rational, but instead sufficient for reaching an immediate goal. Where finding an optimal solution is impossible or impractical, heuristic methods can be used to speed up the process of finding a satisfactory solution. Heuristics can be mental shortcuts that ease the cognitive load of making a decision. Examples that employ heuristics include using a rule of thumb, an educated guess, an intuitive judgment, a guesstimate, profiling, or common sense.

When a question seems too difficult in order to make a choice, there is a temptation to substitute it for a simpler one, and answer that one instead so as to determine the choice – which is the essence of heuristics – even though people would not usually notice the substitution they made in their mind (and would *then* tend to rationalise their decision).

For example, the affect heuristic relies on a substitution in which the answer to an easy question (*How do I feel about it, good or bad?*) serves as an answer to a much harder question (*What do I think about it?*).

Although judgement heuristics are quite useful, leading to accurate intuitions, they also produce the **focusing illusion**, whereby the aspect to which attention is directed will loom large in the global evaluation, at the detriment of the other determinants which are either ignored or neglected.

Overreliance on heuristics may produce **biases** in judgement.

Biases (= systematic errors) in the thinking of normal people can either be attributed to the design of the machinery of cognition, or to the corruption of thought by emotion (fear, affection, hatred, etc.).

The potential for personal control of biases is low, but the opportunity for successful debiasing exists, when the circumstances of passing judgements are identified.

A FEW HEURISTICS

Heuristic	Description	Examples
Availability	<p>Defined as the process of assessing importance, size or frequency by the ease with which instances are retrieved from memory.</p> <p>This might be ignoring relevant probabilities (“probability neglect”).</p> <p>The <i>number</i> of instances recollected might be in fact going in the opposite direction of the size/frequency/importance estimated, if it becomes more difficult than expected to recollect from memory. In a study, participants who had been asked to list 12 cases (a high number) in which they had not behaved assertively ended up thinking of themselves as quite assertive! If you cannot easily come up with instances of meek behaviour, you are likely to conclude that you are not meek at all. In this scenario, the availability heuristic that the subjects apply can be better described as an "unexplained unavailability" heuristic, insofar as they have much more trouble <u>than expected</u> coming up with instances; the drop in fluency of recollection is steeper than anticipated. (this would not apply if the subject is quite affected by the matter, though) Conversely, if the recollection performance is given an explanation (even unknowingly spurious) by the experimenter, the heuristic wouldn't be applied.</p>	<p>Personal experiences / pictures / vivid examples are more available than incidents that happened to others / mere words / statistics.</p> <p>The salient issues in people's minds are often the ones with a great extent of coverage in the media.</p>
Affect	<p>When judgements and decisions are guided by feelings of liking and disliking.</p> <p>Emotional attitude, such as liking and disliking, determines people's beliefs about things, which affects related attributes of those things, such as benefits, risks, etc.</p> <p>When people are in favour of something, they tend to amplify the benefits and neglect the risks.</p> <p>People's emotional evaluations of outcomes play a central role in guiding decision making.</p> <p>The weight of the emotional reactions are linked to the ease with which ideas come to mind --> linked to the availability heuristic.</p>	<p>Investing in a company's stock because the investor likes the company's products.</p> <p>Letting one's political preference determine the arguments that one finds compelling.</p> <p>If you are a hawk (respectively, dove) in your attitude towards other nations, you probably think they are weak (respectively, strong) and will be (resp. not be) easily coerced.</p>
Mood	<p>When a particular question that alters a person's mood is in actual effect used as a substitution of another, more general question.</p>	<p>Asking a student about the number of dates they had last month, or about their relationship with their parents, or about the state of their finances, would influence the answer to a later question about their happiness.</p>
Representativeness / Resemblance	<p>When stereotypes govern judgements – i.e. when a prediction is done by comparing the subject to a target group's stereotype.</p> <p>The heuristic would mislead in particular if it causes people to neglect base-rate information</p>	<p>Baseball scouts traditionally forecast the success of possible players in part by their build and look.</p>

	<p>(statistics/proportions of instances in given categories).</p> <p>Cognitive ease increases the use of this heuristic, whereas enhanced activation of System 2 favours reliance on statistics.</p> <p>The second sin of this heuristic is insensitivity to the quality of evidence. The available description of the subject might not characterise accurately.</p> <p>Bayesian reasoning/statistics provide the solution to combine prior beliefs (e.g. base rates) with evidence about the particular instance.</p>	<p>Ex. of Bayesian statistics: if it is believed that 3% of graduate students enrol in computer science, and that the description of a particular individual makes him 4 times more likely to enrol in CS than in any other field, then the probability of him enrolling in CS is 11%. If the base rate had been 80%, the new degree of belief would be 94.1%.</p>
<p>Hindsight bias aka I-knew-it-all-along effect</p>	<p>Inability to reconstruct past beliefs, causing people to underestimate the extent to which they were surprised by past events.</p> <p>A general limitation of the human mind is its imperfect ability to reconstruct past states of knowledge, or beliefs that have changed. Once you adopt a new view of the world, you immediately lose much of your ability to recall what you used to believe before your mind changed.</p>	<p>Actions that seemed prudent in foresight can look irresponsibly negligent in hindsight.</p>
<p>Outcome bias</p>	<p>When assessing the quality of a decision not by whether the process was sound but by whether its outcome was good or bad - which ignores the determinative power of luck.</p>	<p>Blaming decision-makers for good decisions that worked out badly, or vice versa.</p> <p>Concluding that a company is mismanaged from its falling share price >>> outcome bias, part hindsight and part halo effect.</p>

Cass Sunstein and Timur Kuran named the mechanism through which biases flow into policy “the availability cascade”. The importance of an idea is often judged by the fluency and emotional charge (availability and affect heuristics) with which that idea comes to mind in the eyes of the public, irrespective of the attached probability, which down the line distorts priorities in the allocation of public resources – even though the alternative, i.e. non-elected and unaccountable experts making decisions, is not viable neither). So, a non-event might be amplified by the media and active participants, and lead to excessive legislation.

FALLACIES

Conjunction fallacy

Violates the logic of probabilities, or economic values, being sum-like variables (i.e. subtracted or summed up when considering multiple events or items) – which can be represented by Venn diagrams. This fallacy fails to subtract probabilities when events are combined, and averages out instead of summing values together.

Ex: They added a cheap gift to the expensive product, and made the whole deal less attractive. Less is more in that case.

Subjective confidence

(Subjective) confidence in a judgement is a feeling which reflects the coherence of the quality of the information and the cognitive ease of processing it.

It is not a reasoned evaluation of the probability that the judgement is correct.

Declarations of high confidence merely tell you that an individual has constructed a coherent story in his mind, not necessarily that the story is true.

The illusion of skill/validity

Experts try to be clever, think outside the box, and consider complex combinations of features in making their predictions, which may only work in the odd case. Those with the more knowledge are often less reliable, as they develop an enhanced illusion of their skills and become unrealistically overconfident.

Experts know they are skilled, but they don't necessarily know the boundaries of their skill.

The planning fallacy

A manifestation of the pervasive optimistic bias.

Characterises plans and forecasts that:

- are unrealistically close to best-case scenarios

This is partly due to anchoring effects. The successful completion of an undertaking requires a series of events to occur; even when each of these events has a high probability (the anchor), the overall probability of success can be quite low if the number of events is large. The general tendency to overestimate the probability of conjunctive events leads to unwarranted optimism.

- could be improved by consulting the statistics of similar cases.

*The remedy is **reference class forecasting**, a.k.a. taking an outside view: using distribution information from other ventures similar to that being forecasted, to get statistical information on performance and the likely overruns of cost and time; and from the baseline prediction, adjusting according to specific factors.*

Sunk-cost fallacy

Can be considered from two angles.

When an organisation has spent a great deal of effort, it is hard to change directions, or stop the project and write off the initial investment; rather than admitting failure, an additional investment is made. But sunk costs should not matter more than the rationality of making a further investment.

Someone loses the tickets to a show (sunk costs); should new tickets be bought? Rather than accounting for the extra cost of the tickets, the person should re-frame the situation in terms of money lost (decreasing the total wealth), and evaluate whether another purchase is warranted.

In both cases, history should be left aside, and evaluate from scratch.

III. Choices

(EXPECTED) UTILITY THEORY

Draws on functions that relate psychological intensity to the physical magnitude of the stimulus, which are typically logarithmic. In this respect, utility is a logarithmic function of wealth. Ex: the same psychological distance separate \$100,000 from \$1 million, and \$10 million from \$100 million.

Daniel Bernoulli suggested that people do not evaluate prospects by the expectation of their absolute outcomes, but rather by the subjective value – utility – of these outcomes. He observed that people's choices are not based on the strict dollar values but on the psychological values of outcomes, i.e. their utilities.

Utility theory explains why risk aversion decreases with increasing wealth.

PROSPECT THEORY

Yet, people do not normally think of relatively small outcomes in terms of states of wealth but rather in terms of gains, losses and neutral outcomes. Prospect theory, involved in the treatment of risky choice, is therefore based on the central assumption that the psychological analysis of outcomes should be applied to gains and losses rather than to total assets.

Gains and losses are said to be the *carriers of value* in prospect theory (whereas states of wealth are the carriers of value in utility theory) – which introduces the concepts of reference point (from which to consider the direction of a change) and loss aversion.

Loss aversion has an evolutionary history; organisms that treat threat as more urgent than opportunities have a better chance to survive and reproduce – negativity and escape dominate positivity and approach. Prospect theory considers that wealthy people can still be loss averse for small amounts which would make no meaningful difference to their state of wealth.

The loss aversion coefficient is around 2:1, and applies across various domains.

Loss aversion is a powerful conservative force that favours minimal changes from the status quo in the lives of both institutions and individuals, because the arguments for potential losses are made more strongly. Negotiations are easier if the shared pie is expanding, in which case losses are perceived as reduced gains.

Given equal utilities of outcomes between someone who can only win from a gamble and someone who can only lose, the loser would take more risk to try and lose the least.

People become risk-seeking when all their options are bad, because of diminishing sensitivity to losses.

➔ BEHAVIOURAL ECONOMICS (contrasting with standard economic theory) have corrected the mistake of ignoring history when considering the perceived utility for a state of affairs.

The endowment effect

When someone owning something is only willing to sell it for a much higher price than his/her maximum buy price – can be explained by loss aversion and by the existence of a reference point (owning the item or not), as per prospect theory.

The endowment effect generally applies to goods that are held for use, rather than for exchange. Selling goods that one would normally use activates regions of the brain that are associated with disgust and pain; buying at a price perceived as too high also activates those areas. And on the contrary, buying at especially low prices is a pleasurable event, as brain imaging has shown.

Salespeople use the endowment effect when they first present the most expensive product of the range, with the most qualities and features – so that the customer will have a hard time going down the range.

The topical organisation of mental accounting leads people to evaluate gains and losses in relative rather than in absolute terms: consumers hardly exert more effort to save \$15 on a \$150 purchase than to save \$5 on a \$50 purchase.

When assessing an uncertain prospect, people assign **decision weights** to the possible outcomes, which are correlated to the probabilities of these outcomes, yet not identical (departing near the extremes) in prospect theory.

This can explain for example the gap between a ticket's low win probability and its perceived value.

Example of decision weights versus actual probabilities in a study of gambling:

Probability (%)	0	1	2	5	10	20	50	80	90	95	98	99	100
Decision weight (%)	0	5.5	8.1	13.2	18.6	26.1	42.1	60.1	71.2	79.3	87.1	91.2	100

An increase from 0% to 5% appears to have a larger effect than an increase from 30% to 35%, which also appears smaller than an increase from 95% to 100%, which suggests a category-bound effect: a change from impossibility to possibility or from possibility to certainty has a bigger impact than a comparable change in the middle of the scale.

Overweighting of the unlikely outcomes is rooted in System 1: emotion and vividness influence fluency, availability and judgements of probability.

People greatly undervalue a reduction in the probability of *<a negative outcome, such as a hazard>* in comparison to the complete elimination of it. Hence, insurance should appear more attractive when it is framed as the elimination of risk than when it is described as a reduction of risk.

Ex: a vaccine that reduces the probability of contracting a disease from 20% to 10% is less attractive if it is described as effective in half of the cases than if it is presented as fully effective against one of two virus strains.

All domains are affected; the more detailed/vivid the outcome (e.g. avoiding statistics when framing it), the more discrepancy between probabilities and decision weights.

One of the core achievements of prospect theory is the fourfold pattern of preferences (based on the combined ideas that people attach values to gains and losses and that their decision weights are different from probabilities), in which choices between gambles and sure things are resolved differently, depending on the odds and on whether the outcomes are good or bad:

	HIGH GAINS	HIGH LOSSES
HIGH PROBABILITY Certainty effect	95% chance to win \$10,000 Fear of disappointment RISK AVERSE: Accept unfavourable settlement to lock in a sure gain	95% chance to lose \$10,000 Hope to avoid loss, diminished sensitivity RISK SEEKING: Reject favourable settlement / desperate gambling / not cutting losses
LOW PROBABILITY Possibility effect	5% chance to win \$10,000 Hope of large gain RISK SEEKING: Reject favourable settlement / frivolous litigation / lottery	5% chance to lose \$10,000 Fear of large loss RISK AVERSE: Accept unfavourable settlement for peace of mind / insurance

NARROW VS. BROAD FRAMING

Narrow framing consists in considering a decision in isolation, instead of considering it as part of a bundle of similar decisions. When you see cases in isolation, you are likely to be guided by an emotional reaction of System 1.

The combination of loss aversion and narrow framing is a costly curse. The typical short-term reaction to bad news is increased loss aversion, which inhibits risk-taking – although risk-taking is positive, owing to statistical aggregation. The superior attitude is to control the emotional response when losing, and using broad framing: “think like a trader”, “you win a few, you lose a few”, “you do this all the time”, “treat it as one of many <monetary> decisions”.

A **risk policy** – routinely applied whenever a relevant problem arises – that aggregates decisions is analogous to the *outside view* applied to planning projects. The outside view shifts the focus from the specifics of the current situation to the statistics of outcomes in similar situations. The outside view and the risk policy are remedies against two distinct biases that affect many decisions: the exaggerated optimism of the planning fallacy and the exaggerated caution induced by loss aversion.

FRAMING EFFECTS

Designate the unjustified influences of formulation on beliefs and preferences. People’s preferences can be more or less *frame-bound*, rather than *reality-bound*.

Example of a statement framed in two different ways, linked to a possible treatment:

The one-month survival rate is 90%.

The one-month mortality rate is 10%.

Another problem framed in two different ways:

Would you accept a gamble that offers a 10% chance to win \$95 and a 10% chance to lose \$5?

Would you pay \$5 to participate in a lottery that offers a 10% chance to win \$100 and a 90% chance to win nothing?

The second version attract many positive answers: (uncompensated) losses evoke stronger negative feelings that costs. Framing negative outcomes as costs rather than losses improves the state of mind.

In the same optic, people will more readily forego a discount than pay a surcharge.

Neuroeconomics – the study of what a person’s brain does while he makes decisions – yielded three main findings relative to framing effects:

- The amygdala, a region associated with emotional arousal, is most likely to be active when the subjects’ choices conformed to the frame. It is likely to be associated with System 1.
- The anterior cingulate, associated with conflict and self-control, is more active when the subjects did not do what comes naturally. Resisting the inclination of System 1 apparently involves conflict.
- The most rational subjects, those who were the least susceptible to framing effects showed enhanced activity in a frontal area of the brain that is implicated in combining emotion and reasoning to guide decisions. These participants were reality-bound, with little conflict.

REGRET

Regret is felt when the negative outcome results from departing from the default behaviour, i.e. doing something unexpected, or not doing something expected.

The asymmetry in the risk of regret favours conventional and risk-averse choices.

One of the most useful precautions against potential regret is to anticipate it prior to making the decision. If when things go badly you can remember that you considered the possibility of regret carefully before deciding, you are likely to experience less of it. Also, regret and hindsight bias often come together.

People also generally anticipate more regret than they will actually experience, because they underestimate the efficacy of the psychological defences that can be deployed – the “psychological immune system”. So it is best not to worry too much about potential regret; even if you have some after the fact, it will hurt less than you think.

The Disposition effect

Relates to the tendency of investors to realize gains more quickly than losses (= sell assets that have increased in value while keeping assets that have dropped in value). Can be explained by loss aversion (prospect theory), regret avoidance and mental accounting (= keeping track of outcomes resulting from discrete decisions, from a narrow framing perspective).

IV. MISC

REGRESSION TO THE MEAN

The quality of performance being subject to random fluctuations, a particularly good performance would likely be followed by a bad one, and vice versa.

Regression effects are ubiquitous (luck playing an important role, and being fickle), and so are misguided causal theories to explain them. For example, rewards given in the case of a good performance will have a perceived detrimental effect (as the next performance will regress to the mean), whereas punishments will be perceived as efficient. Because we tend to be nice to other people when they please us and nasty when they do not, we are statistically punished for being nice, and rewarded for being nasty. (In fact, studies have shown that rewards for improved performance work better than punishment of mistakes over time.)

Experiments have shown that the regression to the mean is directly proportional to the deviation from it; in other words, the more extreme the score, the more regression we expect.

The events order does not matter, thus removing the possibility of causal explanations – it's just statistics. ***Our mind is strongly biased towards causal explanations and does not deal with "mere statistics".***

Correlation and regression are different perspectives on the same concept; whenever the correlation between two variables is less than perfect (when it is <1), there will be regression to the mean, i.e. statistically when one goes high, the other one goes low.

Failure to address the (considerable) uncertainty over the future leads to nonregressive predictions, therefore potentially completely off the mark. So, BEWARE of nonregressive intuitions!

Intuitive predictions must be corrected by regressing to the mean; this is done by first taking the mean, and applying a delta, which equals the difference between mean and intuitive prediction x correlation %. The correlation between two measures is equal to the proportion of shared factors among their determinants.

Reading age = shared factors + factors specific to reading age = 100%

GPA = shared factors + factors specific to GPA = 100%

The correlation can be estimated at 30% (or 0.30); if so, the GPA of an early reader will be closer to the mean than to the prediction, from the formula.

EXPERIENCED UTILITY VERSUS DECISION UTILITY

Experienced utility has to do with the pleasure and/or pain that comes from living an experience, and decision utility concerns the expectation of utility and the associated choices made.

The assumption of coincidence is implicit in the general idea that economic agents are rational (rational-agent model).

But in practice, the way that experienced utility is evaluated by people is the way it is remembered (then potentially leading to a subsequent choice, in which case decision utility comes into play – and then taste, habit, etc.), and the memory evaluation follows a particular pattern (the episode being short or long, like a piece of opera, a vacation, a life, etc.):

- Peak-end rule: the retrospective global rating of the episode depends on the average of the level of pleasure/pain at the best/worst moment and at the end.
- Duration neglect: the duration of the episode has no effect on the rating.

An experiment had shown that after trying both situations, participants were willing to keep their hands longer in cold water (14 degC) if water was slightly warmer in the last moments (+1 degC). Similarly, patients prefer undergoing a medical procedure which is longer but less painful towards the end (gradual relief).

The sum (or integral, as in, the area under the curve on the graph) of pleasure/pain over time is not factored by memory; only the peak intensity, and the end. But a memory that neglects duration will not serve our preference for long pleasures and short pains, thereby contradicting the rational model.

The life of the *experiencing self* can be described as a series of moments, each with a value. The value of an episode is simply the sum of the values of its moments. But this is not how the mind represents episodes; the *remembering self* tells stories, where time is not represented properly. In story-telling mode, an episode is represented by a few critical moments, especially, the beginning, the peak and the end.

The tyranny of the remembering self: confusing experience with the memory of it is a compelling cognitive illusion. It is this substitution that makes us believe a past experience could be ruined, for instance (e.g. a vinyl with a screeching sound at the end), whereas it is only the memory of it which is affected. That is why also some people devote their entire vacation to the construction of memories, instead of taking the time to improve their experience.

And then people would choose *by memory* when they decide whether or not to repeat an experience. As a result from past experiences, we are inclined to maximise the qualities of our future memories, not necessarily of our future experience.

So, the *experiencing self* does the living, but it's the *memory self* which keeps scores and makes the choices.

Happiness can be considered from the perspectives of both experienced well-being (felt by the *experiencing self*) and life satisfaction (evaluated by the *memory self*, therefore prone to yield distorted reflections of the actual experience due to its exaggerated emphasis on peaks and ends and its neglect of duration; also sensitive to the fulfilment of one's goals).

Miswanting: when the decision utility falsely predicts experience utility (e.g. when we exaggerate the long-term benefits of a fancy car), we make errors of **affective forecasting**. The *focusing illusion* creates a bias in favour of goods and experiences that are initially exciting, even if they will eventually lose their appeal. By contrast, attention-demanding activities such as learning the piano have the benefits of novelty and excitement at the start, and of retaining their attention value in the long term.

V. Annexes

HOW TO WRITE A PERSUASIVE MESSAGE

Naturally, the message would be true, but that is not necessarily enough for people to believe that it is true. It is entirely legitimate for you to enlist cognitive ease to work in your favour, and studies of truth illusions provide specific suggestions that may help you achieve this goal.

The general principle is that anything you can do to reduce cognitive strain will help, so you should first maximize legibility. Compare these two statements:

Adolf Hitler was born in 1892.

Adolf Hitler was born in 1887.

Both are false (Hitler was born in 1889), but experiments have shown that the first is more likely to be believed. More advice: if your message is to be printed, use high-quality paper to maximize the contrast between characters and their background. If you use color, you are more likely to be believed if your text is printed in bright blue or red than in middling shades of green, yellow, or pale blue.

If you care about being thought credible and intelligent, do not use complex language where simpler language will do. My Princeton colleague Danny Oppenheimer refuted a myth prevalent among undergraduates about the vocabulary that professors find most impressive. In an article titled “Consequences of Erudite Vernacular Utilized Irrespective of Necessity: Problems with Using Long Words Needlessly,” he showed that couching familiar ideas in pretentious language is taken as a sign of poor intelligence and low credibility.

In addition to making your message simple, try to make it memorable. Put your ideas in verse if you can; they will be more likely to be taken as truth. Participants in a much cited experiment read dozens of unfamiliar aphorisms, such as:

Woes unite foes.

Little strokes will tumble great oaks.

A fault confessed is half redressed.

Other students read some of the same proverbs transformed into non-rhyming versions:

Woes unite enemies.

Little strokes will tumble great trees.

A fault admitted is half redressed.

The aphorisms were judged more insightful when they rhymed than when they did not.

Finally, if you quote a source, choose one with a name that is easy to pronounce. Participants in an experiment were asked to evaluate the prospects of fictitious Turkish companies on the basis of reports from two brokerage firms. For each stock, one of the reports came from an easily pronounced name (e.g. “Artan”) and the other report came from a firm with an unfortunate name (e.g. “Taahhut”). The reports sometimes disagreed. The best procedure for the observers would have been to average the two reports, but this is not what they did. They gave much more weight to the report from Artan than to the report from Taahhut. Remember that System 2 is lazy and that mental effort is aversive. If possible, the recipients of your message want to stay away from anything that reminds them of effort, including a source with a complicated name.

All this is very good advice, but we should not get carried away. High-quality paper, bright colours, and rhyming or simple language will not be much help if your message is obviously nonsensical, or if it contradicts facts that your audience knows to be true. The psychologists who do these experiments do not believe that people are stupid or infinitely gullible. What psychologists do believe is that all of us live much of our life guided by the impressions of System 1—and we often do not know the source of these impressions.

How do you know that a statement is true? If it is strongly linked by logic or association to other beliefs or preferences you hold, or comes from a source you trust and like, you will feel a sense of cognitive ease. The trouble is that there may be other causes for your feeling of ease — including the quality of the font and the appealing rhythm of the prose — and you have no simple way of tracing your feelings to their source. The sense of ease or strain has multiple causes, and it is difficult to tease them apart. Difficult, but not impossible. People can overcome some of the superficial factors that produce illusions of truth when strongly motivated to do so. On most occasions, however, the lazy System 2 will adopt the suggestions of System 1 and march on.

THE VIRTUES OF CHECKLISTS AND SIMPLE RULES

Formulas counter subjective confidence, as well as the illusion of skill/validity.

Simple equally weighted formulas based on existing statistics or common sense are often very good predictors of significant outcomes – good enough to compete with optimally weighted formulas (where the different predictors are assigned weights by using multiple regression – which is actually prone to accidents of sampling), and certainly good enough to outdo expert judgement, especially in low-validity environments (which entail a significant degree of uncertainty and unpredictability).

Experts do well with short-term predictions though.

Even when experts have an understanding of the factors used in the formula, they would not be able to maintain its consistency.

But rather than dismissing it entirely, it is best to incorporate intuitive judgement as an extra factor in the formula, and evaluate it once the other factors have been considered.

And naturally, circumstances exist under which it is better to substitute judgement for a formula:

⇒ the "broken-leg" rule, coined by Paul Meehl – rare, but decisive.

This logic can be applied in many domains, ranging from the selection of stocks to the choices of medical treatments.

In a memorable example, Robyn Dawes showed that marital stability is well predicted by a formula:

frequency of lovemaking minus frequency of quarrels

You don't want your result to be negative.

DECISION-MAKING IN GROUPS

The proper way to elicit information from a group is not by starting with a public discussion but by confidentially collecting each person's judgement.

As a team converges on a decision, and especially when the leader tips their hand, public doubts about the wisdom of the planned move are gradually suppressed and eventually come to be treated as evidence of flawed loyalty to the team and its leaders - the suppression of doubt contributing to overconfidence.

Possible remedy: before committing to a decision, arranging a **premortem session**, where the participants have to come up with the reasons why the decision failed further down the line, hypothetically. The premise of the session can be the following:

"Imagine that we are a year into the future. We implemented the plan as it now exists, and the outcome was a disaster. Please take 10 minutes to write about the cause(s) and history of that disaster."