Decision Making, Fast or Slow?
The Tale of System X and System Y

Mats Danielson[1,2]

[1] Dept. of Computer and Systems Sciences, Stockholm University
PO Box 7003, SE-164 07 Kista, Sweden
mats.danielson@su.se
[2] International Institute for Applied Systems Analysis, IIASA
Schlossplatz 1, AT-2361 Laxenburg, Austria

Abstract: This article extends the classical dual-process theory of cognition, notably Kahneman's Systems 1 and 2, by proposing a corresponding duality in decision-making processes: System X and System Y. System X embodies intuitive, affect-driven decision-making, rooted in emotional evaluations and fast experiential knowledge that mirrors the evolutionary origins of instinctual behaviour. It reflects how humans and other animals have historically made survival-oriented choices based on precompiled emotional signals. In contrast, System Y represents rational, deliberative decision-making that utilises simple logic, reasoning, and structured analysis, operating through conscious effort and cognitive control. While System X aligns with immediate affective preferences, System Y applies systematic evaluation and basic logical structuring to complex or unfamiliar decision problems. The article argues that sound decision-making, especially in complex contexts, requires a deliberate integration of both systems. Reliance on either intuition alone or analytic calculation alone is insufficient for robust outcomes. To support this position, the article draws on cognitive psychology, behavioural economics, neuropsychology, and decision theory, framing the two systems as complementary and mutually necessary. Furthermore, the PILOT method is presented as an applied hybrid approach that incorporates an intuition criterion into a structured multi-criteria decision process, offering a practical example of System X and Y collaboration. The System X and Y model thus advances the understanding of decision competence by framing affective and rational processes as joint contributors rather than adversaries. This hybrid approach is argued to more faithfully reflect human cognitive capacities and to enhance decision quality across personal, professional, and policy domains. Embracing the integration of intuition and reason provides a more realistic and effective model for real-world decision-making.

Keywords: Decision Making Processes, Dual-Process Cognitive Theories, System X and System Y, Affective Decision Analysis, Rational Analysis and Intuitive Judgement, Hybrid Decision Models

1. Introduction

Human decision making appears to draw upon two fundamentally different modes of thought. Psychologists and behavioural economists have long distinguished between a fast, intuitive mode and a slow, deliberative mode of cognition. The dual-process cognitive model, popularised by Kahneman (2011), builds on insights by many researchers in psychology and other cognitive sciences. He labels these *System 1* (fast, automatic and intuitive thinking) and *System 2* (slow, effortful and logical thinking). System 1 encompasses quick judgments and gut reactions that rely on learned habits and emotional cues, whereas System 2 involves careful reasoning and analysis. Kahneman and others have shown that while intuitive System 1 thinking is efficient, it is prone to systematic biases if relied upon in isolation. Deliberative System 2 can correct these biases, but it is cognitively demanding and not always engaged unless needed.

Building on this dual-process foundation, this article develops the theory of two *decision* systems, *System X* and *System Y*, as an extension of the dual-process model, specifically modelling decision making processes. System X uses feelings and affective impressions as decision scores, instinctively favouring the option that *feels* best. It is an intuitive, affect-driven decision system rooted in the brain's evolutionarily older structures and accumulated life experience, closely paralleling System 1 in its fast, automatic nature. System Y, by contrast, uses logical

reasoning and structured analysis to evaluate options, whether through informal reflection (e.g. a pros-and-cons list) or structured decision-analytic techniques (e.g. multi-criteria analysis or cost-benefit calculations). This corresponds to the rational, reflective thinking of System 2, but with a particular emphasis on deliberate *decision* procedures rather than generic thinking and acting. System Y thus represents the exercise of rational decision making, applying basic logic and quantitative trade-offs to choose optimal actions, within the bounds of everyday cognition (i.e. basic propositional reasoning, as opposed to advanced formalisms like predicate, temporal or second-order logic, which play no role in ordinary decisions).

The central premise of the System X&Y model is that good decision making in more complex situations requires an integration of both systems. Complex or high-stakes decisions are most effective when they draw on the strengths of systematic analytical evaluations *and* intuitive feeling-based judgments. System X provides experiential wisdom: the subtle cues from emotion and gut instinct that often reflect deep-seated knowledge of what is important to us. System Y provides logical structure: the rigorous comparison of alternatives against objective criteria to guard against wishful thinking or bias. We argue that neither system alone is sufficient for consistently sound decision making. Purely intuitive choices may be fast but risk being distorted by cognitive bias or incomplete consideration of facts; purely analytic choices may be thorough but risk ignoring values, context, and the decision-maker's true preferences, potentially leading to choices that are rational but wrong for that person.

In the pages that follow, we develop the theory of Systems X and Y in detail and position it relative to Kahneman's dual-process model and related research in psychology, decision theory, and cognitive science. We begin by reviewing dual-process theories of thinking and their application to decision making, highlighting the role of affect and analysis in human judgments. We then define System X and System Y more formally: their psychological and neurobiological underpinnings, evolutionary origins, and modes of operation in decision contexts. The strengths and limitations of each system are examined in light of evidence from psychology and decision science. Subsequently, we present arguments for why a hybrid approach combining System X and Y is essential for sound decision analysis, especially in complex decisions with multiple criteria. In particular, we propose that structured decision methods should incorporate an intuition check, a consideration of how each alternative *feels* alongside traditional analytical criteria. As an illustrative example of this integration, we discuss the PILOT decision-making method, which explicitly includes an intuition criterion to capture gut feelings in a structured multi-criteria decision process. This hybrid X+Y method, we suggest, offers the best chance of correctly ranking alternatives and making choices that are both rationally justifiable and intuitively satisfying. Finally, we consider the broader implications of the System X&Y model for decision theory and practice, arguing that recognizing the duality of decision systems can enhance everything from personal decision-making strategies to organizational and policy decision processes.

2. Dual-Process Theories of Thinking

The idea that two different mental systems govern human thought has a long intellectual history. Modern dual-process theories emerged in cognitive psychology to explain inconsistencies in human reasoning, and they have converged on the notion of a Type 1 process (fast, automatic, intuitive) and a Type 2 process (slow, controlled, and analytical). Kahneman's System 1 and System 2 is the most widely cited formulation. System 1 handles quick, automatic cognitive

operations that run with little or no conscious effort, for example immediately recognizing patterns or making a snap judgment about a person's mood. System 2, in contrast, involves effortful activities such as concentrating on a complex problem, performing a calculation, or deliberately evaluating a situation. Where System 1 is intuitive, emotional, and uses heuristics (mental shortcuts), System 2 is logical, procedural, and follows rules of reasoning. Table 1 conceptually contrasts these modes in the context of decision making:

> **System 1** (Intuitive Thinking): Fast, automatic, and often unconscious. Draws on implicit knowledge and heuristics. Little mental effort; go-with-your-gut approach. Yields an immediate judgment or preference for decision options, often based on how one *feels* about them.
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> **System 2** (Analytical Thinking): Slow, deliberate, and conscious. Draws on explicit reasoning and evidence. High mental effort; think-it-through approach. Yields a considered evaluation of options based on logic and objective analysis.

Table 1. Kahneman's two thinking systems

Researchers have identified these dual modes in many contexts. For instance, people swiftly form impressions of risk or attractiveness using affective heuristics (System 1), but given time and data, they can also compute probabilities or weigh pros and cons (System 2). Stanovich and West (2000) have referred to Type 1 processes as contextualised and experiential and Type 2 as decontextualised and analytic, noting that the latter is closely tied to general intelligence and working memory. Seymour Epstein's cognitive-experiential self-theory likewise posits a rational system (analytical, logical, and slow) and an experiential system (intuitive, emotional, and fast) operating in parallel, each adapted for different functions. The experiential system (akin to System 1) encodes reality in images, metaphors, and feelings, and is grounded in past experience; the rational system (akin to System 2) encodes reality in abstract symbols, words, and logical rules. This alignment of dual-process concepts across independent theories gives credence to the idea that human cognition naturally bifurcates into two modes. These systems are of course not literal organs in the brain, but rather conceptual distinctions. Nonetheless, the dichotomy helps explain patterns in human decision behaviour, including why we sometimes make choices instinctively and other times only after careful deliberation.

Critically, dual-process models have been applied to decision making by behavioural economists and decision theorists to explain deviations from classical rationality. Classical economic models assumed a single, rational decision-maker calculating expected utilities (analogous to pure System 2 reasoning). However, experiments by Kahneman and Tversky (1974) and others have revealed that people often rely on intuitive heuristics that diverge from optimal logic, leading to biases such as overestimating unlikely events or preferring immediate rewards. These findings suggested that a fast, heuristic-driven System 1 was often at work when people made decisions, sometimes at odds with the slower but more normatively rational System 2. Kahneman's Thinking, Fast and Slow (2011) synthesises decades of such research, cataloguing how intuitive thinking can produce systematic errors in judgment under uncertainty. For example, when confronted with a difficult decision or a complex probability problem, many people default to an answer that feels right (System 1's suggestion) rather than painstakingly computing a well-founded answer (System 2's approach). This can result in well-documented errors like the availability bias (overweighting information that comes easily to mind) or anchoring (being unduly influenced by an initial value). These errors are less likely if System 2 is fully engaged, since analytic thinking can check and correct the impulsive answer. However, engaging System 2 requires time and effort, and people are naturally *cognitive misers* who tend to

conserve mental effort. Thus, unless the stakes are high or the person is explicitly prompted, the intuitive System 1 often drives the decision by default.

It would be wrong, however, to cast System 1 as merely a source of error and System 2 as the infallible voice of reason. Research indicates that intuitive processes are often highly *adaptive*. Gigerenzer and Todd (1999), for instance, have demonstrated that simple heuristics can be remarkably accurate in many environments. People's gut judgments can exploit environmental regularities to make smart decisions with minimal information. Emotions and gut feelings also carry wisdom: they condense learning and experience into a visceral impression that can guide behaviour advantageously when time is short. Conversely, deliberate reasoning can be led astray by faulty premises or overconfidence; a person can rigorously analyse a problem but still arrive at a poor decision if they mis-specify the parameters. Thus, a consensus is emerging that both intuitive and analytical processes have roles to play and that understanding decision making requires examining their interplay. In light of this, dual-process theory has evolved from asking "Which system is better?" to asking *how to deploy the right system at the right time*. The concept of meta-decisions has been introduced to describe decisions about how to decide. In other words, a practically wise decision-maker must first decide whether a given situation calls for a quick intuitive choice or a thorough analysis (or some combination thereof). This meta-cognitive skill, knowing when to trust your gut and when to kick in your analytic reasoning, is important for effective decision making. As we will argue, an optimal decision process often involves a *sequence* or *blend* of both modes: intuition can be consulted to harness experience and feelings, and structured analysis can be performed to systematically compare options, with each mode providing a check on the other.

Having established the general dual-process perspective, we now focus on decision making specifically and introduce System X and System Y. These terms correspond rather closely to System 1 and 2, but they underscore particular features relevant to choosing among alternatives and thus when to invoke each. System X will denote the *affective/experiential* decision system (the gut-driven mode of choice), and System Y will denote the *rational/analytic* decision system (the brain-driven mode of choice). In the following sections, we delve into each of these in turn, first explaining the nature of System X and then System Y before exploring how they can be combined for better decision outcomes.

3. System X

System X is the decision making mode that relies on feelings, intuitions, and affective evaluations to guide choices. It is essentially the emotional, experience-based side of human judgment. When using System X, a person tends to ask themselves, *"Which option feels right or makes me feel the best?"* and to favour the alternative that evokes the most positive overall effect. This contrasts with explicitly calculating which option has the highest value. Instead, the decision is driven by a holistic emotional impression. System X corresponds to what psychologists call intuitive or experiential processing, and it aligns with Kahneman's System 1 in being fast, automatic, and often unconscious. However, System X highlights specifically the role of affect (likes, dislikes, comfort, anxiety, excitement, etc.) as a decision criterion. It is not mere whimsy; rather, System X draws on a vast store of precompiled experiential knowledge to evaluate situations quickly. Over a lifetime, people accumulate countless experiences of what is pleasant or unpleasant, safe or risky, rewarding or punishing. These experiences train emotional responses, somatic *markers* in Damasio's (1994) terms, that become attached to decision options and situations. Thus, when confronted with a choice situation, System X can instantly summon

an affective score for each option based on subtle cues and past learnings, effectively telling the decision-maker, "Hey, remember, this *feels* like the better choice."

3.1 Origins and Mechanisms of System X

From an evolutionary perspective, System X is deeply rooted in the primitive brain. Long before humans had the capacity for abstract reasoning, our ancestors relied on rapid emotional signals to make life-and-death decisions: fight or flee, approach or avoid, eat or reject. Emotions are evolution's way of encapsulating survival-relevant information in a quick impulse. The neural substrates of System X include the limbic system, particularly the amygdala and ventromedial prefrontal cortex (vmPFC), which tag experiences with emotional value and retrieve those feelings during decision making. The Somatic Marker Hypothesis, proposed by Damasio (1994), holds that emotional marker signals arising from these brain regions guide (or bias) decision making, especially under complexity and uncertainty. According to this hypothesis, when we face a complex choice, purely cognitive analysis (weighing innumerable factors) might overload our limited working memory; instead, the brain leverages emotional signals as shortcuts to indicate which options are advantageous. For example, a particular option might unconsciously trigger a gut feeling of dread because it reminds us of a past failure, whereas another option might evoke confidence because it aligns with past successes. These bodily-felt cues, faster than conscious thought, push us toward or away from the respective options.

In everyday terms, System X is what we experience as our "gut instinct" or intuition in decision making. It operates through what Slovic et al. (2002) have called the affect heuristic: a tendency to rely on the emotional appeal of options to judge their value or risk, often bypassing detailed analysis. If something *feels good*, we incline to see it as high-benefit and/or low-risk; if it *feels bad*, we instinctively treat it as low-benefit and/or high-risk. This heuristic can be observed, for instance, in consumer choices (people may choose a product that just feels right even if a competitor has objectively better properties) and in risk perceptions (individuals often gauge the danger of an activity by their immediate emotional reaction to it rather than by statistics). The affective system encodes a great deal of information in that immediate reaction, including personal values and past experiences, which is why it is often useful. Zajonc's (1980) classic proposition that preferences need no inferences encapsulates System X: we can sometimes know what we prefer without knowing exactly *why* because the preference is determined by a feeling that arises before (or in the absence of) explicit reasoning.

One key mechanism by which System X learns from experience is through reinforcement and feedback. Choices that lead to good outcomes become associated with positive feelings, while those leading to bad outcomes become associated with negative feelings. Over time, this forms a repertoire of intuitive predictions about what choices will yield satisfaction or regret. Notably, this learning can happen implicitly. We might not remember the details of every past decision, but our emotional brain has been keeping score. The Iowa Gambling Task experiments illustrate this clearly (Bechara et al., 1997). When people repeatedly choose from different card decks with varying reward/punishment profiles, they gradually develop an intuitive aversion to the disadvantageous decks *before* they can articulate why those decks are bad. Their skin conductance (an emotional arousal indicator) starts spiking at the thought of picking from a bad deck even while they still profess ignorance of the pattern, reflecting subconscious learning. Individuals with vmPFC damage, who cannot generate such emotional signals, notoriously fail at this task despite understanding it cognitively; they keep choosing risky decks, unable to use gut feelings to guide them. These findings underscore that emotions carry decision-relevant

information. In complex, uncertain situations, a gut feeling can tip us off to the better choice long before rational analysis would figure it out.

3.2 Characteristics of System X Decisions

Decisions made via System X have several characteristic attributes.

Speed and Effortlessness: System X operates quickly and automatically. A person might get a hunch or feeling about what to do within seconds of encountering a decision problem. This process feels effortless; one simply experiences a leaning toward a particular option without conscious calculation. As a result, System X is the default mode for many everyday decisions and snap judgments. It is active when time is limited or when a decision context is familiar enough that an immediate sense of the best choice emerges. For example, an experienced physician might have an intuitive sense of the right diagnosis after a brief patient interaction or a driver might instinctively brake when they *feel* something is not right on the road, even before fully identifying the hazard.

Holistic Evaluation: Rather than methodically comparing options attribute by attribute, System X tends to evaluate each option as a whole, based on the overall affective impression it generates. It is akin to asking "How do I *feel* about Option A versus Option B?" and trusting that feeling, which itself may be an aggregation of numerous factors (most of them subconscious). This holistic nature means System X can integrate many considerations implicitly, including social and moral values, personal experiences, and contextual cues, but without explicitly breaking them down. The result is often described as a Gestalt-like judgment or an overall sense of which choice is better.

Heuristics and Simplified Cues: System X frequently relies on heuristics, which are mental shortcuts or rules of thumb that simplify decisions. These include the affect heuristic mentioned above, as well as others like familiarity (choose the option you know best), trust (go with the person you like more), or status-quo bias (stick with what feels normal or traditional). Such heuristics draw on one's feelings and intuitions about options, and they work well in many common situations, though they can misfire in others. Because of these shortcuts, System X does not guarantee a thorough consideration of all evidence, but it provides an answer that is *satisficing* (good enough) from the perspective of past experience and inherent preferences.

Personal Values and Needs: Importantly, System X reflects the decision-maker's deep-seated values, desires, and needs, often better than their momentary rational deliberations do. Emotive reactions are closely linked to what we care about. For instance, a career opportunity that excites someone likely aligns with their passions and aspirations, whereas one that leaves them cold may conflict with their intrinsic interests, even if it looks good on paper. In this sense, System X can be seen as the voice of one's authentic self or long-conditioned priorities, speaking through feelings. This is a strength in decisions that should rightly incorporate personal values (i.e. most decisions in life). Your intuition might protect you from pursuing a path that rational analysis might mistakenly favour due to surface metrics like salary or prestige, while ignoring deeper fulfilment.

Susceptibility to Biases and Errors: Despite its adaptive nature, System X is not infallible. Because it relies on associative memory and emotional charge, it can be led astray by irrelevant factors or biases in one's experience. For example, a person might feel intensely averse to investing in stocks because they vividly recall a relative losing money in a market crash (an availability bias: a salient memory drives a strong feeling of risk). Or someone may favour a familiar option over a objectively better unfamiliar one due to a mere familiarity comfort (a status quo

bias or mere exposure effect). Emotions themselves can be unrelated to the decision at hand. Fatigue, hunger, or mood can skew what feels right at a given moment. Moreover, System X has trouble with novel situations that fall outside its experience; in unprecedented scenarios, its analogies may be wrong and its feelings misleading. It is also why prejudices can become encoded in intuition: if one's experience (or societal conditioning) has linked certain cues to negative stereotypes, the gut feeling may reflect that bias rather than objective reality.

On balance, System X is powerful and indispensable. It allows humans to make decisions swiftly when time or information is limited, leveraging the wisdom of past experiences encoded in emotion. Many everyday decisions, such as what to eat, how to phrase a sentence, or whom to trust in a brief encounter, are handled well by System X and would be impractical to deliberate on fully. Even in complex decisions, System X provides a starting point or default stance that can be very useful. As we will later argue, explicitly taking into account how alternatives *feel* can improve decision making because it surfaces information that might not be captured in structured analysis. However, System X alone is not sufficient for consistently sound decision outcomes, especially in complex, high-stakes, or novel problems. To counterbalance and refine intuition, we turn to System Y, the logical-rational decision system.

4. System Y

System Y is the mode of decision making characterised by deliberative reasoning, logical analysis, and systematic evaluation of options. When engaging System Y, a decision-maker steps back from immediate intuitions and carefully works through the decision problem using reasoning processes: listing pros and cons, examining evidence, projecting outcomes, and comparing alternatives against each other on relevant criteria. This corresponds to what we colloquially call using one's *brain* (as opposed to one's heart, which would be System X). In Kahneman's terms, System Y partly aligns with System 2: it is slow, effortful, and conscious. Unlike System X's reliance on emotional scores, System Y tries to assign more objective scores or weights to options based on logic and data. It asks, "Which option makes the most sense or provides the greatest net benefit when I analyse it piece by piece?"

4.1 Reasoning Processes in System Y

The cognitive operations of System Y involve forms of logical inference and explicit comparison. In practical decision making, this often boils down to classical logical and arithmetic reasoning that most people can do, rather than advanced mathematics or esoteric logic. For example, System Y thinking will use basic propositional logic (if A then B; not B, therefore not A) or simple causal reasoning (Option 1 will lead to X, which is good, but also Y, which is bad). It may also employ naïve probabilistic thinking (weighing likelihoods) and optimisation (seeking to maximise a certain value like profit or satisfaction). Importantly, System Y in real-life decisions does *not* imply that humans set up equations or engage in formal logical reasoning. Instead, they approximate those principles in a common-sense way: they articulate reasons, consider hypothetical scenarios, and attempt to be internally consistent in how they value things. In essence, System Y tries to follow the prescriptive models of decision theory albeit in a very simplified, qualitative form. Common methods that exemplify System Y include:

Making a Pros and Cons List: One of the oldest and simplest decision aids, attributed to Benjamin Franklin, is to write down the advantages and disadvantages of each option. This exercise forces the decision-maker to explicitly identify factors that matter and to see how each option stacks up. It is an informal type of multi-criteria analysis. By scoring how many pros vs. cons each option has (and perhaps weighing their importance qualitatively), a person is engaging

System Y to reach a reasoned conclusion. Franklin described this as a method of "moral or prudential algebra," reflecting the underlying rational calculus being applied.

Scenario Analysis: System Y also encompasses constructing logical arguments and exploring hypothetical scenarios. A decision-maker might reason: "If I take job A, then I will gain X experience, which could lead to a promotion in three years. If I take job B, I will get a higher salary now, but possibly fewer growth opportunities later." This type of consequential reasoning, imagining outcomes for each option and their desirability, is a sign of analytic thinking. It relies on *naïve propositional logic* (Job A implies outcome X; outcome X is desirable; therefore Job A has a positive aspect) and sometimes on more complex chains of reasoning (If I choose B, then although I earn more now, in five years I might be less satisfied, which has Y implication…). Through such scenario analysis, System Y tries to predict and compare future states resulting from each choice, something System X does only implicitly.

Rules and Principles: Another aspect of System Y is its use of explicit principles or rules. This can range from simple decision rules (Never invest more than you can afford to lose or Always prioritise health over work) to applying rules (legal guidelines, ethical codes, financial ratios). By referencing external criteria or general principles, System Y moves beyond personal feeling to a more standardised assessment of the decision. For example, a medical doctor making a treatment decision might consciously recall clinical guidelines (System Y) rather than just relying on intuition from experience (System X), especially if the case is unusual.

Decision Analysis: In more complex decisions, System Y can be supported by structured techniques from decision analysis. It involves identifying the important criteria (attributes or objectives) for the decision, evaluating each alternative option on each criterion, and then weighting the criteria to calculate an overall score for each alternative. This structured approach is essentially an extension of the pros/cons concept, with numerical scores and weights. For instance, when buying a house, one might score each house on criteria like price, location, size, and feel (if one includes an intuition criterion), and then assign weights to these criteria based on their importance. The scores can be combined (e.g., via a weighted sum) to rank the houses. Such structured analysis is a textbook example of advanced System Y engagement: it externalises and quantifies the reasoning process. It is slow and laborious compared to just walking into a house and deciding you love it (System X), but it provides a detailed justification for why one option might objectively be better.

Under the hood, these processes recruit the brain's prefrontal cortex and executive functions, which handle planning, working memory, and inhibitory control. In neuroimaging studies, tasks that require analytic decision making and self-control (e.g., the Cognitive Reflection Test or complex reasoning problems) show increased activation in the lateral prefrontal cortex and parietal areas associated with computation, consistent with System Y's engagement. People differ in their propensity to engage System Y: traits like the need for cognition (enjoyment of thinking hard), cognitive reflection, and numeracy correlate with more frequent or effective System Y processing in decisions. Importantly, System Y can override System X when given sufficient motivation and ability. For example, a person might have an initial gut preference for one option, but after sitting down and analysing it rationally, they might deliberately choose another option if the analysis convinces them the gut was wrong.

4.2 Everyday Logic vs. Formal Logic

It is worth noting that System Y's logic in everyday decisions is usually basic and qualitatively reasoned, not the kind of logic studied at university. Humans do not naturally think in terms of a logical calculus when making daily choices about jobs, purchases, or personal relationships,

nor would it be practical to do so. Instead, System Y uses the fundamental cognitive toolkit of cause-and-effect reasoning, basic arithmetic, and naïve logical rules that are within our mental grasp. For instance, one might reason, "If I spend money on vacation now, I will not have enough to buy a new laptop later," which is a straightforward logical and arithmetic consideration. Thus, System Y represents rational decision making within the bounds of human cognitive limitations, what Simon (1957) called *bounded rationality*. We aim to be logical and thorough, but we also satisfice (settle for a good-enough solution) when we cannot analyse perfectly.

The contrast between everyday logic and formal logic can be seen in the fact that people often struggle with abstract logical puzzles, yet they can make sound decisions in context-rich environments. For example, many individuals find the Wason selection task (a logic puzzle) difficult in its abstract form, even though the same logical structure is easily solved when framed as a familiar social rule (catching cheaters). This indicates that System Y reasoning is most effective when it can use content and context, not pure symbols. It operates with what Johnson-Laird (1983) calls mental models rather than formal logic. In practice, this means System Y decisions are often aided by external tools (writing things down, using calculators or spreadsheets, etc.) to extend our logical capacity. Indeed, part of System Y's task in real-world decision making is knowing how to use such tools or structured methods to overcome our mental limitations. The rise of structured decision making as a discipline is essentially about providing methodologies to support and enhance System Y reasoning so that it approaches normative rationality as closely as possible.

4.3 Strengths and Limitations of System Y

System Y's approach to decisions, rational, explicit, and systematic, offers some key strengths:

Thoroughness and Transparency: By breaking a decision into parts, System Y ensures that many aspects of the problem are considered. This structured analysis can prevent oversight of important factors that an intuitive approach might miss. It also makes the reasoning process transparent: one can explain why a certain choice was made (e.g., Option A was chosen because it scored highest on the weighted criteria, particularly due to its low cost and high reliability). This is valuable in collaborative or organizational settings where decisions need to be justified or audited. It also allows for self-reflection and revision. If a flaw is found in the analysis, it can be corrected and the decision reconsidered.

Consistency with Objectives: System Y helps align decisions with one's stated objectives and values in a consistent manner. In intuitive decision making, people might be swayed by momentary emotions and end up making choices inconsistent with their long-term goals or their prior preferences (a classic example is succumbing to temptation that one later regrets, like impulse spending). Through deliberate reasoning, one can remind oneself of overarching goals (I am saving to buy a house, so I should not spend on a luxury car now) and apply principles of consistency (this is related to the concept of intra-personal consistency and rational choice theory's assumption of transitive preferences). Thus, System Y can yield more *internally coherent* decisions that better satisfy the decision-maker's true objectives when viewed in total.

Handle Complexity and Novelty: While System X shines with familiar patterns, System Y is better equipped for novel, complex problems that defy intuition. In scenarios with many variables or ones that are unfamiliar, our gut feelings may be unreliable or simply absent. Analytical decision making allows us to construct a model of the problem from scratch. For example, deciding on a retirement investment portfolio might involve balancing risk, return, diversification, and tax implications, most of which an average person has no strong intuition for. By

systematically researching and calculating, one can arrive at a rational investment plan. Structured methods can tackle complexity beyond human intuition, and while a layperson might not do those unaided, even a simplified analytical approach (like using a retirement calculator) is a System Y strategy to cope with complexity. Novel problems (like responding to a new global pandemic, for policymakers) similarly require analytical models (e.g., epidemiological models, cost-benefit analyses of interventions) precisely because intuitive judgment has little prior experience to draw on.

Reduction of Cognitive Biases: One of the motivations for System Y approaches in both personal decision making and organizational processes is to mitigate biases and errors that stem from intuition. By forcing a decision-maker to articulate reasons, consider alternatives systematically, and check consistency, System Y acts as a safeguard against many heuristic-driven biases. For instance, consider the bias of confirmation bias (focusing only on information that confirms our initial leaning). A structured analysis that requires listing pros and cons for all options pushes one to also acknowledge the downsides of a favoured option and the upsides of a disfavoured one, thus countering confirmation bias. Similarly, anchoring bias (being unduly influenced by an initial number or impression) can be reduced by System Y when we consciously reset our evaluation criteria or derive values from data rather than anchors. In complex decisions, structured techniques like decision matrices or weighted scoring are partly designed to counteract the narrow focus and emotional distortions of intuitive judgement by ensuring all factors are systematically accounted for. In short, System Y provides a check-and-balance to System X's impulsive tendencies, often debiasing the decision process and leading to more rational outcomes.

Despite these advantages, System Y also has important limitations:

Slowness and Cognitive Demand: The deliberate nature of System Y means it is time-consuming and mentally effortful. For trivial decisions, engaging in full-blown analysis is inefficient (one would not make a weighted matrix to decide what to eat for breakfast). Even for significant decisions, analysis can reach diminishing returns: more time and detail might only marginally improve the decision quality. Humans also have limited cognitive resources since attention and willpower for intense thinking are finite. Prolonged analysis can lead to mental fatigue and decision paralysis (sometimes dubbed analysis paralysis). It is been observed that people can get overwhelmed by too many options or too much information, a phenomenon related to decision fatigue. Thus, System Y is not always feasible or desirable to use, especially under time pressure or when information is scarce.

Overfitting and False Precision: Analytical decision making can give a false sense of certainty through numbers and models that are actually based on uncertain or subjective inputs. If one assigns precise scores and weights in a multi-criteria analysis, the resulting rankings might appear authoritative, but they are only as good as the assumptions made. There's a risk of *overfitting* a decision model to one's current understanding and not accounting for unknown factors or future changes. For example, a business might quantitatively score project alternatives and choose one that scores 8.7/10 over another that scores 8.5/10, implying a spurious precision. In reality, there may be modelled risks or intangibles that could flip the outcome, which a narrow analysis might miss. An intuitive approach might sometimes better sense those intangibles. This limitation means that System Y must be used with humility, recognising that models are simplified reflections of reality, not reality itself. This is where sensitivity analyses come in.

Dependence on Quality of Data: System Y is only as effective as the quality of reasoning and information that goes into it. Flawed premises will lead to flawed conclusions (the classic GIGO

Garbage In, Garbage Out problem). Someone can diligently analyse a decision, but if they use incorrect data, omit an important criterion, or apply a faulty logical step, the analysis may suggest a disastrously wrong choice with great confidence. Cognitive biases can also infect System Y in subtle ways. For example, one might unconsciously weigh a criterion higher because it favours the option they secretly prefer (thus smuggling intuition in without admitting it). Or one might choose a complex model that impresses on paper but is too complex to truly understand, leading to misinterpretation. In group decisions, analytical processes can be derailed by politics or miscommunication (for instance, group members might game the weighting process to get their preferred outcome). Therefore, System Y requires *skill and honesty* to use properly: skills in analysis, probability, logic, and an honest effort to be objective. Not everyone has training in structured decision analysis, which can limit the usefulness of System Y methods for some decision-makers.

Ignore Emotion and Human Factors: Finally, a purely System Y approach can be too cold and rigid, failing to account for the human elements that should matter in many decisions. Obsessive focus on quantifiable criteria might marginalise qualitative but important factors (like personal fulfilment or a gut feeling that are hard to quantify). Trying to decide moral issues purely by logic can be unsatisfying because it ignores empathy and values that people feel deeply. In personal decisions, someone might pick the option that scores highest on paper only to find themselves unhappy because it did not feel right, an indication that the analysis missed some key value the person holds. Thus, System Y by itself might lead to choices that are rational in a narrow sense but not truly *wise* or fulfilling. We will later argue that incorporating System X's input (emotion, intuition) into the analysis can mitigate this issue, creating a more balanced decision model.

In summary, System Y represents our capacity for rational decision making. It is deliberate, rule-guided, and oriented towards the objective optimisation of outcomes. It excels at handling complexity and enforcing consistency, but it can be slow, demanding, and prone to its own kind of errors if misused. Such misuse is far from uncommon. More concerning, however, is the phenomenon where outcomes primarily driven by System X are subsequently rationalised and presented as if they were products of System Y. For example, in domains such as moral decision making, reasoning often follows intuition in order to justify choices already made at an intuitive level. Such post-hoc rationalisation can mimic the appearance of deliberate reasoning, thereby masking its true origin. It is essential to distinguish genuine System Y reasoning from such retrospective constructs, as confusing them runs the risk of misunderstanding the source of the decision outcome and undermining the belief in true rational evaluation.

Of course, neither System X nor System Y is infallible or universally superior. Each has its domains where it shines. This sets the stage for understanding why the integration of the two is often the best strategy. Good decision-makers are not those who only rely on analysis, nor those who only follow their gut, but those who know how to balance and blend intuition with analysis. We explore this integration next.

5. Integrating System X and System Y

Decades of research and practical experience indicate that the best decisions often emerge from a combination of intuitive and analytical approaches. System X and System Y each compensate for the other's weaknesses and enhance the other's strengths when used together. In this section, we articulate why a dual-system perspective, consciously employing both feeling-based and

reasoning-based evaluations, leads to superior decision outcomes, especially for complex decisions. We then discuss strategies for effectively integrating the two systems in decision analysis and how recognising their interplay can improve decision-making skills.

5.1 Complementary Strengths and Compensating Weaknesses

System X and System Y can be thought of as two advisors with different viewpoints: one advisor (X) quickly offers a recommendation based on *experience and instinct*, and the other (Y) offers a recommendation based on *logic and evidence*. If these advisors agree on the best option, it is a strong indication that the decision is sound since it satisfies both the heart and the brain. If they disagree, it is a signal that more reflection is needed; either the gut is detecting something the analysis has not accounted for, or the analysis is seeing something that the gut overlooked. Using both systems provides a form of redundancy and cross-check that can catch errors either would make alone.

Consider an example: a manager is hiring a new team member. Her System X intuition after interviews strongly favours Candidate A, who just *felt* like a great fit culturally, over Candidate B, who seemed competent but did not spark excitement. However, her System Y analysis of the candidates' resumes, test results, and references gives a slight edge to Candidate B (who has slightly better qualifications on paper). If she were to go purely with System X, she might hire A immediately; purely with System Y, she might hire B. By engaging both, she recognises the conflict and can investigate it: Why does A feel like a better choice? Are there qualities in A (charisma, shared values, etc.) that are not captured in the formal criteria? Are those qualities legitimately important to job performance or team cohesion? Conversely, is her intuition possibly overlooking a red flag about A that a more thorough background check might reveal? By reflecting in this way, she might conclude, for instance, that A's superior soft skills (which her gut sensed) are indeed important for the role, and thus decide on A, but only after verifying that A's technical skills are sufficient despite being a bit weaker on paper. In doing so, she uses System Y to scrutinise her System X-based preference and ensure it holds up to reasoning, essentially vetting intuition with analysis. This generally leads to a more confident and robust decision.

On a higher level, System X can inject creativity, personal meaning, and contextual awareness into the decision process, while System Y imposes structure, rigor, and objectivity. Complex life decisions, such as choosing a career, a place to live, or a life partner, clearly engage emotions and intuitions about what will make us happy; ignoring those (i.e. using pure logic) could lead to an ill-fitting choice. But they also benefit from analysis (weighing practical pros and cons, ensuring financial viability, etc.); ignoring that could lead to a choice that feels good momentarily but fails in practice. Only by combining the two can we aim for decisions that are both subjectively fulfilling and objectively sound.

Empirical studies support the value of such integration. For instance, research on expert decision-makers (like firefighting commanders, nurses, or military strategists) finds that they often rely on a blend of intuition and analysis. Klein's studies of firefighters led to the recognition-primed decision (RPD) model, which describes how experts make rapid decisions by recognising a plausible option via intuition (based on patterns from experience) and then mentally simulating it to verify it will work (1998). That simulation step is a form of System Y reasoning being applied after System X suggests an initial course of action. If the simulation (analysis) finds a flaw, the expert may modify the plan or consider the next intuition. This is a seamless blend: System X provides the quick options while System Y checks them. Notably, RPD was found to be more effective in real-time decisions under pressure than forcing a purely analytic

comparison of multiple options, the latter was too slow in firefighting scenarios. Yet the analytic element was still present in the form of checking the intuitively chosen option. This exemplifies how experienced decision-makers intertwine intuition with analysis to get the best of both: speed with some rigor. Similarly, in medical diagnostics, doctors often have a gut feeling about what is wrong with a patient (rapid pattern recognition), but they confirm through tests and differential diagnosis (analytic verification). The best clinicians trust neither gut alone nor tests alone blindly but use each to inform the other.

Psychological research on decision satisfaction also indicates that people are more satisfied with their choices in the long run if they feel they have *honoured their true feelings* while also *doing due diligence*. A purely intuitive choice might later lead one to second-guess, "Did I really think it through?" especially if outcomes turn poorly. A purely analytic choice might lead to regret, such as "I went against my gut and I'm unhappy even though it seemed rational." Integrating the two can create more commitment to the decision and less regret because one knows that both the emotional and rational aspects were considered. Indeed, Janis and Mann's work (1977) on a conflict theory of decision making emphasised the importance of vigilance (careful analysis) but also warned against hyper-states such as panic or overanalysis. The ideal is a balanced process that addresses all concerns. When both System X and Y align on a decision, one can be more confident it is the right one.

5.2 Knowing When to Use Which

An effective decision-maker not only uses both systems but also knows when and how much to engage each. This discernment is a critical meta-cognitive skill. Some situations strongly favour intuition: for instance, in emergencies or split-second decisions, there is no time for analysis (one must trust System X, hopefully well-trained). In domains where a person has extensive expertise and feedback (e.g. a chess master or experienced stock trader), their intuitions can be extremely reliable, sometimes outperforming slow analysis because they can subconsciously recognise subtle patterns. In contrast, situations that are novel, high-stakes, or complex typically demand a heavier System Y involvement: for example, deciding national policy, making a large investment, or choosing a medical treatment plan often requires data gathering, consultation, and systematic evaluation. Gut feeling alone would be dangerous or insufficient.

Decision-makers must watch for signs that their initial intuitive judgment might be on somewhat shaky ground, prompting a shift to more analysis. Some warning signals include:

- The decision is highly complex or multifaceted, beyond what one can grasp at once. If you feel a bit confused or overwhelmed, it is a sign that System Y is needed to break it down.
- The problem is unfamiliar, or there is no prior experience to draw on. No gut feeling can be very trustworthy in a scenario you've never encountered; analysis and research must fill the gap.
- The stakes are very high, including a lot of cost, risk, or irreversible consequences. Even if intuition gives an answer, it is prudent to double-check analytically when potential regret is huge.
- There is conflict or disagreement among stakeholders or within oneself. If different people's intuitions diverge, analysis can provide common ground. If you feel torn, writing things out might clarify.
- One notices possible biases or emotions that could be clouding judgment. Feeling extremely emotional, such as excited, angry, or scared, might skew intuition. Conscious analysis can introduce a more balanced perspective.

Conversely, signals that more intuition should be heeded could be that the analysis is extremely close between options, essentially a tie on paper. In such cases, gut feeling might rightly tip the balance based on subtler factors, or the analysis yields a choice that one feels very uncomfortable with, suggesting something important to the decision-maker is not captured in the numbers.

Goleman (1995), in discussing emotional intelligence, noted that self-awareness and self-regulation allow one to pause an initial impulse and bring in reasoning (that's engaging System Y when needed), while also allowing one's reasoning to be informed by empathy and gut sense (engaging System X's input). Educational programs in decision making now often teach about cognitive biases (to warn when intuition might err) and about decision analysis techniques (to support rational evaluation), essentially training people in managing both systems. There is also increasing interest in decision support systems that incorporate both evaluation algorithms (such as Danielson, 2019) and human intuition. These tools can, for instance, provide an analytic recommendation but also an interface for decision-makers to input subjective judgments.

5.3 Emotional Intelligence in Decision Making

One can draw a parallel between our System X&Y model and the concept of emotional intelligence. Emotional intelligence includes the ability to understand and use one's own emotions effectively. In decision making, this translates to being aware of one's gut feelings (System X signals) and neither ignoring them nor being blindly led by them. A person with high decision-related emotional intelligence will notice their visceral reactions and treat them as data to be integrated, not as oracles to be obeyed or as nuisances to be ignored. For example, if you are making a career decision and you feel anxious about one option, you would not just suppress the anxiety or let it dictate your choice unexamined; instead, you would ask, "Why am I feeling anxious? What concern might that reflect?" Perhaps it is fear of failure in a highly demanding role, or perhaps it is just fear of the unknown which could be overcome with time. Emotional insight can thus guide the analytical process to focus on the right issues (in this case, analysing the support and training available in that demanding role to mitigate failure risk).

At the same time, rational thought can refine and educate our emotions. If your gut is biased due to a phobia or a misleading anecdote, consciously recognizing that can help recalibrate the emotional response. Over time, engaging in such reflection can even train System X. Our intuitions can be updated by learning, especially when we force them to confront reality through analysis and feedback. Thus, using System Y is not just about one-off decisions, but about cultivating better intuitions for the future. In a sense, every time we correct our gut with logic, we are doing a small course correction in our experiential knowledge, potentially attenuating a bias. Likewise, when we discover through experience that our gut was right and the analysis missed something, we learn to incorporate that something into the next analyses.

The interplay of Systems X and Y is also seen in group decision making. In groups, some members might lean intuitive, others analytic. Effective teams leverage both: they encourage members to voice hunches and feelings about options (instead of forcing everything into a spreadsheet), but they also use structured methods (like scoring, voting or scenario planning) to evaluate options systematically. For instance, a product development team might have a visionary who intuitively feels a feature will delight users, and an engineer who demands evidence or a prototype to test that assumption. Tension can arise if each sticks to their mode, but if they collaborate, the intuitive vision can be prototyped and tested (analysis) and often the combination yields a better product design than either pure vision without testing or pure data without vision.

5.4 Resolving Discrepancies

What should one do when System X and System Y yield conflicting conclusions? As alluded to, this situation, while uncomfortable, is highly informative. Rather than choosing one system's answer arbitrarily, the decision-maker can delve deeper to understand the source of the conflict. Often, it means that the decision model is incomplete. A conflict could indicate that important criteria are missing from the structured analysis: the gut may be factoring in a consideration that was not formally recognised. In decision analysis terms, this suggests expanding the objectives or criteria set. For example, an entrepreneur's gut might strongly favour one business strategy even though the revenue projections favour another; upon introspection, the entrepreneur might realise the first strategy aligns with her passion for innovation (a criterion not accounted for in revenue projections alone) and that passion is critical for long-term success and personal motivation. By adding alignment with passion as a criterion, the analysis might then tilt towards what intuition wanted, resolving the conflict in favour of a more holistic optimal choice. Alternatively, a conflict might mean that System X is biased by something irrelevant. In that case, it is System X that might need adjusting. For instance, someone might feel great about a house that is objectively suboptimal (too expensive, long commute) just because it has a beautiful garden that reminds them of their childhood home. Once they recognise this emotional pull, they might consciously discount it: "Yes, that garden gives me warm feelings, but I can landscape any house I buy. I should not overpay by $50k just for that." Here, logical analysis helps override an intuitive attachment that is not truly worth its cost.

The process of reconciling differences can be iterative. Decision analysts sometimes employ a technique of sensitivity analysis, testing how results change if assumptions or weights are varied. If the intuition strongly favours an option that the model ranks second, one can tweak the model to see what would need to be true for that option to come out first. Often, this surfaces the implicit weight one's intuition is giving to something. For example, maybe by increasing the weight of gut feeling or some proxy criterion, the option becomes top-ranked, suggesting that one's heart is effectively giving that criterion a weight that one's head initially did not. This does not automatically justify following the gut, but it quantifies the difference and prompts a conscious value judgment: do I *want* to give that criterion such importance? In personal decisions, the answer might be yes because ultimately, the decision-maker's values rule. In organizational decisions, it might lead to discussions about whether the emotional preference is in line with the organization's goals or just a leader's bias.

Importantly, good decision processes allow a final override by holistic judgment, recognising that not everything can be captured in an analysis. As the literature on decision-aiding notes, analytic tools are decision *support*, not decision replacement. The human decision-maker remains in charge of integrating any intangibles. Many decision analysts endorse what's sometimes called the Bishop's finger approach (named after an anecdote of a bishop who, after all deliberations, would point to a candidate by inspiration): after completing an analysis, one should still ask "Does the recommended solution feel right?" If not, it warrants a review. Ideally, one either finds a rational justification for changing the decision (missed info or criteria) or accepts that there is an unquantifiable reason to go another way and consciously does so. Because at the end of the day, *decisions are enacted by people*, not equations, and if a person cannot get comfortable with a choice, they may not implement it effectively or happily. It is better to acknowledge the role of System X at the end than to pretend one is a purely rational agent.

5.5 Hybrid Decision Strategies

When both Systems are employed skilfully, the result is often a hybrid strategy that maximises decision quality. One such strategy is to use System Y to structure the problem and System X to evaluate the remaining tough trade-offs. For example, one might use analysis to narrow down options to a short list that meets all objective requirements, and then trust one's feelings to pick the final option among those contenders that are all good enough. This approach prevents blatantly bad options (that fail factual criteria) from being chosen by whim, but acknowledges that among several satisfactory options, the best choice may come down to personal preference or intuition. Such a method was suggested by academics for decisions like selecting among top job candidates or university admissions: first filter by qualifications (analytic), then have final interviews or gut impressions decide between the finalists who are all capable.

Another hybrid approach is the premortem technique to complement intuitive decisions. If your gut strongly says Option X, do a premortem analysis assuming Option X failed spectacularly and ask why that might happen. This engages System Y's imagination of worst-case scenarios to test the intuitive choice. If you come up with serious, plausible failure reasons that you had not considered, you might either adjust the plan for Option X or reconsider the choice. If you struggle to find reasons, that bolsters confidence in the intuitive pick.

6. The PILOT Method

To concretise the benefits of combining System X and Y, we now examine an example of a structured decision process that explicitly integrates both. The PILOT method provides a step-by-step method for making complex choices, and notably, it includes what is called an intuition criterion alongside traditional analytical criteria. This offers a practical illustration of how a structured multi-criteria decision analysis can incorporate gut feelings (System X) as a deliberate part of the process, creating a hybrid approach that leverages both decision systems.

6.1 Overview of the PILOT Method

PILOT is a five-step decision-making procedure designed to help individuals or organisations reach well-founded decisions while using time efficiently. The steps are:

1. *Problem Identification*: Clearly define the decision problem and generate a set of alternatives to choose from. (In System Y terms, this sets up the decision space; creativity and intuition might be used here to brainstorm alternatives as well.)
2. *Criteria Identification* (Argument Matrix): Determine the criteria that matter for the decision, typically around four main criteria in the basic PILOT method, and gather information on how each alternative performs on each criterion. This often involves listing the pros and cons for each alternative under each criterion (forming an argument matrix of qualitative assessments). By the end of this step, you have a structured profile of each option's strengths and weaknesses.
3. *Ranking within Criteria*: For each individual criterion, rank the alternatives from best to worst on that criterion. This yields a sense of which option leads in which aspect. Often, no single option is best on all criteria (if one were, the decision would be trivial). This step is straightforwardly analytic.
4. *Weighting of Criteria*: This is the pivotal step where PILOT brings in System X. Before weighting the criteria, the method suggests capturing any subconscious or intuitive information that might not have been fully expressed in the criteria-based analysis. Specifically,

the decision-maker is asked to make a total ranking of the alternatives based on gut feeling, essentially predicting or intuitively guessing which alternative will come out best once all factors are considered. This gut-based ranking is termed the intuition criterion. It is an *optional* step (those uncomfortable can skip it), but it is recommended to ensure that any potential information in the subconscious is utilised. In practice, one reflects on the alternatives after having immersed in the details (from steps 1–3) and then writes down an instinctive overall ordering of preference. After noting this, one proceeds to assign weights to the explicit criteria, reflecting their relative importance. The trick is that the intuition ranking can inform the weighting: if one's gut ranking of alternatives differs from the initial analytic result, one might adjust the criteria weights to better reflect aspects one feels are undervalued. Essentially, the intuition criterion is treated as an additional perspective that the criteria should ideally align with. By the end of step 4, each criterion (including possibly the intuition criterion as a pseudo-criterion) has a weight, and the alternatives can be scored to produce an overall ranking.

5. *Overall Decision and Trade-off*: Finally, the method distinguishes between pure multi-criteria decisions (choosing based on functional criteria alone) and those involving a cost or price factor. If costs are involved and were not part of the initial criteria, a fifth step explicitly weighs the preferred alternative's functional benefit against its cost. Essentially, if one alternative is functionally best but another is much cheaper with slightly less functionality, this step handles that classic trade-off between quality and cost. In many cases, if cost is one of the criteria from the start, this step is implicitly handled. The result of step 5 is a final decision recommendation: the alternative that best balances all criteria and costs.

The outcome of the PILOT analysis is both a ranked list of alternatives and a thorough documentation of the reasoning. The method emphasises two benefits: (1) *quality of the result*, a clear and as fair-as-possible ranking of options, providing a strong indication of which decision to make, and (2) *quality of the process*, a structured procedure that improves understanding and can be stopped early if a winner is obvious, saving effort. However, PILOT also reminds us that a decision analysis is a basis for a decision, while *the real decision is always made by a human decision-maker*. In other words, even after the analysis, human judgment (which includes System X) has the final say.

6.2 The Intuition Criterion

The most novel aspect of PILOT, from a System X&Y perspective, is the inclusion of the intuition criterion in step 4. This represents a concrete method for integrating System X into System Y's model. After doing a substantial amount of System Y work (listing pros/cons, criteria evaluations), the decision-makers pause and explicitly harness System X: they attempt to capture any lingering sense that something is missing or any overall feeling about which alternative is the best. As the PILOT guide explains, sometimes even after careful description of options by criteria, one has a feeling that is not fully explained by those criteria. This could be because the criteria set is incomplete or because the interaction of factors produces a holistic impression that criteria-by-criteria analysis has not captured. By articulating a gut ranking at that point, the method surfaces this information. In the example provided in the PILOT method description (Danielson, 2021), two decision-makers (Lilly and Larry) are choosing among six apartments. After compiling all the pros and cons (functional analysis) in steps 1–2, but before ranking them, they take a coffee break and speculate which apartment will likely come out on top in the end. They feel that two of the apartments will probably end up best (they even rank those two equally as top in their guess), and they guess the ordering of the rest. This guess is their gut-

feeling ranking, i.e., their intuition criterion. Importantly, they are instructed that this should consider only the functional qualities (not cost yet), which parallels how the criteria are all functional at this stage. In essence, they are predicting their own analysis outcome using intuition.

Once the intuition criterion is recorded, PILOT weaves it into the structured analysis. One way to do this is to treat it as an additional criterion (an overall gut-preference criterion) against which alternatives can be scored. In the example, the alternative(s) they intuited as top would get the highest score on this intuition criterion, etc. It then becomes one of the factors to weigh. In the PILOT description, they talk about the ranking of criteria with the intuition criterion, suggesting that the intuition-based ranking is used when weighting the criteria against each other. This could mean the decision-makers ensure that the weights they assign to the other criteria are such that the resulting overall ranking does not wildly contradict their gut ranking unless there is a justified reason. In effect, the intuition criterion might initially be given a weight (explicitly or implicitly) to see what overall ranking it would produce, and then the actual criteria weights are tuned. The document notes that after step 4, one will have a total score for each alternative. If the analysis is done honestly, one of three things will happen: (a) the ranking matches the intuition ranking, thus reinforcing confidence, (b) it differs, causing the decision-makers to re-examine their weights or the criteria until they either adjust the model or accept the difference by identifying a reason, or (c) they realise their gut was considering an aspect that should be explicitly added as a criterion.

This procedure of including an intuition criterion addresses a known challenge in decision analysis: the limits of quantifying all utilities. By giving intuition a voice in a structured way, PILOT acknowledges that some knowledge might remain tacit or hard to verbalise in criteria, yet is real. It prevents the common issue where a structured analysis yields a "surprising" result that the decision-maker feels uneasy about; instead, that unease is integrated early and transparently. One might worry that including an intuition criterion could simply reintroduce bias in a structured disguise. However, the key is that by making it explicit, it can be scrutinised and discussed. Rather than a person secretly tweaking their analysis to fit their gut (which often happens unconsciously), PILOT externalises the gut feeling as one more piece of data. This opens it to the question: "Why exactly did we rank these two apartments top by intuition? Let's discuss […] are we perhaps swayed by a great first impression or something emotional? If so, is that a valid factor or a bias?" Thus, the intuition criterion invites reflection on intuition itself. If the intuitions are deemed trustworthy, they get absorbed into the criteria weights legitimately; if not, the very act of articulating them can help decision-makers set them aside or adjust for them. This is arguably an elegant way to marry Systems X and Y: use System Y (structured step-by-step process) to control and calibrate the influence of System X (by giving it a formal role and evaluating it).

6.3 Advantages of a Hybrid Approach

The PILOT method exemplifies how including both analytic and intuitive components can yield a more robust decision. By the end of the process, the decision-makers have both a quantitative basis (scores, rankings) and a qualitative assurance (it aligns with or knowingly diverges from their feelings). This affords several advantages:

Improved Accuracy: The method claims to give a good pointer to which decision you should take, and by leveraging both objective and subjective inputs, it arguably increases the likelihood that the top-ranked alternative is truly the best choice for the decision-maker's goals and pref-

erences. If only formal criteria were used, there's a risk that something important to the decision-maker is not counted; if only intuition were used, some factual trade-off might be misjudged. Together, each alternative is evaluated from both angles. As a result, the chosen alternative has survived both the analytic scrutiny and the intuitive appeal test which is a strong indication of correctness.

User Confidence: A decision process that includes intuition tends to leave the decision-maker more confident and comfortable with the result. In PILOT, even though the method is structured, the decision remains personal and one's own intuitive rankings are part of it. This can increase acceptance of the outcome. It also can reduce lingering doubts, because the individual knows they did not ignore their gut. The PILOT text emphasises that after analysis, one should remember the actual decision is made by the human, implying that if something still feels off, one can adjust. This flexibility means the final decision is not just logically sound but also sits right emotionally, which is important for implementation.

Balanced Effort: The PILOT method is designed with efficiency in mind. One can stop after fewer steps if a clear answer emerges early. By using intuition at step 4, one might even shorten the process: if intuition and analysis already align strongly, one might not need extensive sensitivity checks or step 5 deliberations. Conversely, if there's a mismatch, one knows to invest effort into resolving it. Thus, effort is allocated where it is most needed. In many cases, intuitive insight can point out the likely winner early (as Lilly and Larry guessed which apartments would do best), and analysis can confirm it, meaning you do not waste time over-analysing a foregone conclusion but still validate your choice. In other cases, analysis might correct an intuition and prevent a mistake, which is then effort well spent.

Learning and Calibration: Using a hybrid method like this helps decision-makers learn about their own preferences and judgment patterns. By seeing when intuition was right or wrong relative to analysis, one gets feedback. Over multiple decisions, this can calibrate one's gut feelings (System X) to be more in line with objective criteria, and/or calibrate one's criteria selection (System Y) to better include what matters personally. In essence, the person becomes a better decision-maker. PILOT as a teaching tool not only helps with the immediate choice but builds skills in both analytical thinking and introspective intuition.

In practice, many experienced decision analysts informally do what PILOT structures: they will run an analysis, then ask the client, "Are you comfortable with this result? Does it feel right?" The PILOT method's contribution is making that a systematic step with a documented intuition criterion. This ensures it is not skipped or given lip service. Rather, it becomes an acknowledged part of rational decision making rather than something outside of it.

6.4 When Not to Trust the Gut

While praising the inclusion of intuition, it is also clear that not all gut feelings should be heeded. PILOT's option to skip the intuition step for those who find it uncomfortable or strange acknowledges that some people might distrust their intuition or fear it could contaminate the objectivity. If a decision-maker knows they have a particular bias or emotional issue with the decision (say, they are overly attached to one alternative for personal reasons unrelated to its merits), they might consciously decide to downweight the intuition criterion. The method can accommodate that by, in the weighting phase, giving the intuition criterion a low weight or zero if one chooses. The point is that System Y still has the final arithmetic, so one can temper System X's influence as needed. In a group decision, similarly, one would aggregate multiple people's intuition criteria. If they wildly disagree, it might cancel out or indicate lack of a clear gut consensus, suggesting heavier reliance on factual criteria.

Thus, the PILOT method does not blindly elevate intuition; it simply puts it on the table. The actual influence it has on the decision is up to the rational judgment of the decision-makers. In the example, if Lilly and Larry's intuition had ranked an apartment top that ended up performing poorly on all criteria, they would likely question that intuition (maybe it was a charming place but with many practical flaws). They might conclude that their intuition was misled by one impressive feature and deliberately override it with the analysis. Alternatively, they might realise one criterion was underappreciated (the charming feature might relate to a criterion like home atmosphere that they had not listed) and adjust for it. Either way, the process forces a reconciliation.

In summary, the PILOT method demonstrates a concrete way to achieve a System X+Y synergy. It shows that incorporating how alternatives *feel* (the intuition criterion) within a structured multi-criteria analysis yields a decision procedure that is arguably more aligned with human cognitive reality and ultimately more effective at identifying the truly best option. It exemplifies our broader argument: that analysis and intuition are not adversaries, but partners in decision making. The intuition criterion acts as a bridge between the intuitive System X evaluation of options and the analytic System Y evaluation, ensuring that the final decision honours both the decision's factual requirements and the decision-maker's experiential instincts.

7. Implications and Conclusion

The theory of System X and System Y decision making extends the Kahneman dual-system model by emphasizing an important point: thinking fast or slow is not just about solving puzzles or answering questions differently, but about *making choices*. And choices benefit from both our feelings and our reasoning. This integrated perspective has several implications for research and practice:

Decision Theory: Traditional economic theories often idealised a purely rational actor (homo economicus) using something akin to System Y exclusively (calculating utilities, etc.). Behavioural economics then highlighted the deviations due to System X influences (biases, heuristics, and prospect theory's value function capturing emotional reference points). The System X&Y model suggests that a *prescriptive* theory of decisions must incorporate *both* systems working in tandem. It is not enough to catalogue biases (failures of System X) as descriptive theory does. We must also understand the natural mechanisms of bias resistance that people use, i.e., how they bring System Y into play or how they leverage intuition wisely. It points toward a more nuanced model of rationality, called prescriptive decision theory, where intuitive heuristics are seen as adaptive to environments and analytical reasoning as adaptive to complexity, and the mind can select the appropriate tool. The model aligns with the idea of bounded rationality. The best prescriptive theory can do is often a combination of heuristics and analyses. Thus, real prescriptive decision aids (like decision support systems) should be designed to support this combination, not to force people into one mode or the other exclusively.

Cognitive Science: The System X&Y theory underscores the role of affect in cognition. It resonates with research in neuropsychology (like Damasio's work) that shows emotions are not antagonistic to reason but often a necessary underpinning of good decision making. It encourages further study of how emotional and rational processes interact in the brain during decision tasks, such as how the brain reconciles conflict between the amygdala (emotional alarm) and the prefrontal cortex (logical planning). Understanding this could inform training to improve that interaction (for instance, mindfulness training has been shown to help regulate emotional impulses without eliminating them, which could foster better X+Y integration). It also relates

to the concept of practical wisdom (phronesis) in psychology: the wisdom of knowing when to rely on intuition and when to deliberate. This is an area for developing assessments or training programs, for example teaching young adults how to approach big decisions by using both reflection and feeling, perhaps via cases or simulations that highlight the pitfalls of only one system.

Decision Support: In practice, how can individuals and organisations incorporate System X and Y? One takeaway is that any structured decision process (like strategic planning, project evaluation, or personal career planning) should make space for intuition. This could be as simple as including a step in decision meetings where participants privately write down their gut ranking before seeing the analytic rankings, and then discussing any discrepancies. Tools could be developed that have an intuition input slider or criterion, as PILOT does, rather than hiding subjective judgments. Decision coaches and consultants might explicitly ask clients about their feelings at various points and ensure those are addressed, not brushed aside. Conversely, for intuitive decision-makers, the lesson is to *slow down* and apply a bit of analysis for important choices. Even a one-page pros and cons list or a quick consultation with someone more analytically minded can inject enough System Y to catch major issues. Essentially, debiasing interventions (commonly taught to mitigate biases) can be reframed as promoting System Y engagement at the right moments, and insight interventions (helping people get in touch with their values and feelings) can be seen as promoting healthy System X input.

Complex Decisions: Our argument especially underscores that in complex decisions, which are increasingly common in modern life and policy (think of climate change policy, medical decisions with multiple treatment options, career moves in an uncertain economy), neither pure big-data analytics nor pure intuition will suffice. Climate policy, for instance, requires hard analysis (climate models, cost calculations) but also gut-level moral decisions about responsibility to future generations; a strictly analytic approach might undervalue far-future outcomes that people *feel* are important. Multi-criteria approaches, like cost-benefit augmented with ethical or intuitive criteria, could be beneficial. In medicine, there is a movement toward shared decision making, where doctors provide facts and patients provide preferences (essentially, the doctor's System Y plus the patient's System X of values and feelings combined). The System X&Y model provides a conceptual rationale for these trends: it acknowledges that rational decisions must incorporate the patient's subjective value trade-offs (System X) as well as clinical evidence (System Y).

In conclusion, System X and System Y together form a dual-system theory of decisions that mirrors the dual-process theory of cognition but places equal weight on *affect* and *analysis* as decision drivers. We have argued that both systems are fundamentally sound and necessary. System X is not a flawed shortcut to be eliminated; it is an evolved, intelligent subsystem that encodes experiential knowledge and personal values. System Y is not a cumbersome rationalisation; it is our means of extending reasoning to new or complex problems and ensuring consistency with facts and principles. By viewing them as partners, we can design decision processes that amplify human practical intelligence. The highest level of decision making, whether in everyday life or expert domains, appears to use common-sense intuition as a first guide but is willing to step back and think more systematically when the situation requires it, and likewise, uses structured analysis while never losing sight of the intuitive *feel* of what is right.

The practical message is clear. To make the best decisions, neither ignore your intuition nor trust it uncritically, and neither blindly follow analysis nor dismiss it as just numbers. Instead, do both. Listen to your System X, articulate what it is telling you, and then use your System Y

to examine and support those insights and vice versa. When you do so, you are effectively employing the full breadth of your cognitive abilities. Far from being opposites, they are complementary facets of human judgment. The System X&Y model thus bridges the false divide between gut decisions and rational decisions, showing that the best decisions are in fact *both* intuitive and rational. Armed with both systems, we stand a far better chance of making decisions that are not only logically sound and empirically informed but also authentically aligned with our well-being and values. Those are decisions that we will consider wise when looking back on them in retrospect.

References

Bechara, A., Damasio, H., Tranel, D., & Damasio, A. R. (1997). *Deciding Advantageously Before Knowing the Advantageous Strategy: The Role of the Human Prefrontal Cortex*. Science, 275(5304), 1293-1295.

Charlton, B. G. (2009). *Clever sillies: Why high IQ people tend to be deficient in common sense*. Medical Hypotheses, 73(6), 867–870.

Damasio, A. R. (1994). *Descartes' Error: Emotion, Reason, and the Human Brain*. New York: Putnam.

Danielson, M. (2021). *The PILOT method*. Research report, Stockholm University.

Danielson, M., Ekenberg, L., & Larsson, A. (2019). DecideIT 3.0: Software for second-order based decision evaluations. In F. Coolen, G. de Cooman, T. Fetz, M. Oberguggenberger, & J. Troffaes (Eds.), *Proceedings of the Eleventh International Symposium on Imprecise Probabilities: Theories and Applications (ISIPTA 2019)* (pp. 121–124). PMLR.

Gigerenzer, G., & Todd, P. M. (1999). *Simple Heuristics That Make Us Smart*. New York: Oxford University Press.

Goleman, D. (1995). *Emotional intelligence: Why it can matter more than IQ*. Bantam Books.

Janis, I. L., & Mann, L. (1977). *Decision making: A psychological analysis of conflict, choice, and commitment*. Free Press.

Johnson-Laird, P. N. (1983). *Mental models: Towards a cognitive science of language, inference, and consciousness*. Harvard University Press.

Kahneman, D. (2011). *Thinking, Fast and Slow*. New York: Farrar, Straus and Giroux.

Keeney, R. L., & Raiffa, H. (1976). *Decisions with Multiple Objectives: Preferences and Value Tradeoffs*. New York: Wiley.

Klein, G. (1998). *Sources of Power: How People Make Decisions*. Cambridge, MA: MIT Press.

Simon, H. A. (1957). *Models of man: Social and rational*. New York: Wiley.

Slovic, P., Finucane, M., Peters, E., & MacGregor, D. G. (2002). *The affect heuristic*. In T. Gilovich et al. (Eds.), Heuristics and Biases: The Psychology of Intuitive Judgment (pp. 397–420). Cambridge: Cambridge University Press.

Stanovich, K. E. (2009). *What Intelligence Tests Miss: The Psychology of Rational Thought*. New Haven: Yale University Press.

Stanovich, K. E., & West, R. F. (2000). Individual differences in reasoning: Implications for the rationality debate? *Behavioral and Brain Sciences, 23*(5), 645–665.

Sternberg, R. J. (1997). *Successful Intelligence*. New York: Plume.

Tversky, A., & Kahneman, D. (1974). *Judgment under Uncertainty: Heuristics and Biases*. Science, 185(4157), 1124-1131.

Zajonc, R. B. (1980). Feeling and thinking: Preferences need no inferences. *American Psychologist, 35*(2), 151–175.