# 1 What You (Likely) Won't Learn in Business School

Remember the COVID-19 pandemic, the subsequent disruption of global supply chains, and the resulting product shortages? Before the pandemic, many institutions clung to the *illusion of certainty*—the belief that the world is more certain than it actually is. After decades of holding fast to the assumption that all risks can be foreseen, managed quantitatively, and controlled, an appreciation of the reality of uncertainty is reentering corporate and government offices. The distinction between risk and uncertainty lies at the heart of making effective decisions using smart heuristics.

Business schools teach plenty of skills, but they tend to leave out some of the most useful ones when it comes to making decisions. That omission is not accidental. Courses on management, leadership, and finance teach aspiring managers that rational decision making means choosing the alternative with the highest expected utility, which requires foreseeing all the possible consequences of each potential option. Good managers, so the story goes, search for all relevant options, carefully analyze all the possible consequences, weight utilities by probabilities, and calculate which option maximizes the expected utility. Around the world, business schools teach this procedure to legions of students. "More is better" has become an article of faith: more data, more information processing, and more analysis are all assumed to improve decision making.

Long ago, Benjamin Franklin advised a nephew who was considering marriage: If in doubt, list the pros and cons of all your options, weight them, and do the calculation; otherwise, you will never get married.[1] Yet few people actually choose their partners by doing a calculation—and rightly so. Finding a suitable partner involves a high degree of uncertainty, as divorce rates indicate. When it comes to marriage, one cannot foretell *all* the possible

consequences, not to mention their precise probabilities. The same holds true in business: it is impossible to foresee all possible consequences of entering a foreign market, acquiring a company, or hiring a new CEO.

In general, the expected utility maximization procedure that business schools teach and Benjamin Franklin advocated is useful in stable, well-defined situations where nothing unexpected ever happens. However, executives operate in an increasingly *volatile*, *uncertain*, *complex*, *and ambiguous* (VUCA) world. Here, the advice to collect all information, consider all options, and anticipate all the possible consequences and their associated probabilities is of little use. It creates an illusion of certainty.

Nonetheless, managers regularly decide whom to hire, when to terminate a project, and whether to acquire another company. To make these decisions, they rely on a set of tools called *heuristics*. Surprisingly, business schools rarely instruct their students in how to use these powerful tools to make intelligent decisions. Instead, if heuristics are mentioned at all, they are portrayed as something to avoid in favor of more complex decision strategies. Popular science books echo this negative view and tend to attribute (in hindsight) all kinds of disasters, from obesity to financial crises, to "heuristics and biases."[2] In this book, we share with you a more positive, realistic, and practical view and provide a systematic introduction to the science and art of heuristic decision making.

A *heuristic* is a simple rule that enables decisions to be made quickly, frugally, and accurately. Heuristics are necessary tools in situations of uncertainty (i.e., when the conditions required for maximizing utility do not exist). The distinction between situations of risk, where maximizing is possible, and situations of uncertainty, where it is not, goes back to the economist Frank Knight.[3] It has since been mentioned in virtually every economics textbook, only to be subsequently ignored. Here, we give uncertainty the attention that it deserves, and consequently, we take heuristics seriously.

We begin by introducing three Nobel Memorial Prize laureates in economics. What did they think about decision making? And how did they actually make their own decisions?

## Herbert Simon and Satisficing

In 1978, Herbert A. Simon was awarded the Nobel Memorial Prize in Economic Sciences "for his pioneering research into the decision-making process

within economic organizations."[4] The *process* of decision making can determine the rise or fall of an organization. Strikingly, however, this very process is rarely considered relevant in theories of organizations and economics. Instead, economic theory posits that managers behave as if they maximize their expected utility, no matter how they make decisions. Simon rejected the assumption made in classic theory that executives are omniscient profit or utility maximizers, and he highlighted the total lack of evidence that the theory describes how decisions are actually made. Responding to this type of criticism, Milton Friedman famously stated back in 1953 that it is immaterial whether expected utility maximization describes the process of decision making or not; it is simply a tool for predicting behavior, and all that counts is its predictive accuracy.

However, a review of fifty years of research on utility functions—including the utility of income functions, the utility of wealth functions, and the value function in prospect theory—concluded that the power of utility functions "to predict out-of-sample is in the poor-to-nonexistent range."[5] This finding supports Simon's criticism that expected utility theory not only fails to describe how decisions are made but also is too indeterminate and flexible to predict well.

*Out-of-sample* means that predictions are made beyond the data used to create a model in the first place. In contrast, utility and other complex models are often tested by simply fitting their parameters to already-known choice data. It is sometimes misleadingly said that these models "predict" decisions when in actuality, they optimize the fit to past data. *Optimizing* is a mathematical concept that means determining the maximum or minimum of a curve, such as a utility curve. The distinction between fitting and predicting is crucial. A more complex model with more free parameters can obviously fit past data better. However, often the resulting model overfits and is less able to predict—for instance, when the future is not like the past.[6] Thus, even if one were to accept Friedman's questionable argument that theories need only predict outcomes, not describe the process of behavior, expected utility would still fare poorly: it neither describes nor predicts well, at least not in the uncertain world of business.

Simon proposed instead that decision makers *satisfice* in situations where optimization is impossible. The term *satisficing*, which originated in Northumbria (a region in England on the Scottish border), means "to satisfy." Simon learned about satisficing from direct experience: In the mid-1930s, fresh from

a class on economic theory at the University of Chicago, he tried to apply utility maximization to budget decisions in his native Milwaukee's recreation department. To his surprise, he learned that managers did not compare the marginal utility of a proposed expenditure to its marginal costs. Instead, they simply added incremental changes to last year's budget, engaged in habits and bargaining, or voted on the basis of their identification with organizations. Simon concluded that in the real world of business, the framework of utility maximization "was hopeless."[7] This experience led him to a new question: How do human beings reason when the conditions for rationality postulated by the model of neoclassical economics (such as having complete information and operating under risk rather than uncertainty) are not met? He found the answer in heuristic processes, including recognition, satisficing, heuristic search, and aspiration levels. The study of heuristics enables us to both describe the process and predict the outcome of decisions.

Simon lived what he taught about satisficing. He made decisions easily and rapidly, considering only a few options and their key consequences. According to his daughter, Kathleen Simon Frank, he was always willing to live with the outcomes of his decisions rather than constantly mulling over things.[8] He was very down-to-earth, with a frugal lifestyle, wearing the same type of clothes every day. He had just three shirts: one that he wore, one in the wash, and one in his closet. Simon lived a satisficing life, using the time that he saved that way to indulge his love of reading widely in the sciences, listening to his students, and debating ideas.

### Harry Markowitz and the 1/*N* Rule

Twelve years after Simon, in 1990, Harry Markowitz received the Nobel Memorial Prize in Economic Sciences for his theory of portfolio choice. Unlike Simon's satisficing, which described how people *actually* make decisions, Markowitz's theory was normative; that is, it prescribed how investors *should* allocate wealth in assets that differ in return (mean) and risk (variance). Markowitz was honored for developing a mathematical formula, the mean–variance portfolio, that aims at maximizing profit. Business schools all around the world continue to teach his formula and its many variants. The method requires an exhaustive analysis of financial data to predict future returns, variances, and covariances. For a large number of assets, this may require estimating thousands or even millions of numbers.

When Markowitz made his own investments for the time after his retirement, one might assume that he followed his own Nobel Prize–winning formula. In fact, he relied on a heuristic known as the *1/*N *rule*: invest your money equally across *N* options. If $N = 2$, this means a 50:50 allocation, and so on. In behavioral finance, relying on $1/N$ is dubbed *naive diversification bias* and is attributed to people's cognitive limitations and irrationality. But that clearly does not apply to an economist with the stature of Markowitz. He later explained that his decision to invest equally in stocks and bonds aimed at avoiding future regrets: "You know, if the stock market goes way up and I'm not in it, I'll feel stupid. And if it goes way down and I'm in it, I'll feel stupid. So I went 50-50."[9]

Those who think of $1/N$ as naive overlook an important fact. Markowitz's portfolio choice theory is optimal only in a world where one can foresee all future returns, variances, and covariances of all assets. In an uncertain world, however, estimating thousands or millions of parameters from past data leads to overfitting. The $1/N$ rule, by contrast, has no free parameters, so it cannot overfit. What appears to be a limitation—no free parameters—can turn out to be an advantage in prediction. Accordingly, subsequent studies showed that in stock investments, $1/N$ often outperforms the mean–variance portfolio because it is more robust and does not overfit.[10] Less can be more.

### Reinhard Selten: Game Theory and Real-World Problems

Four years after Markowitz, in 1994, Reinhard Selten won the Nobel Memorial Prize in Economic Sciences for his work on game theory. Yet he had two scientific passions: alongside game theory, the psychological study of heuristics and bounded rationality. As a trained mathematician, he made a clear distinction between the two. He regarded his work on game theory as a mathematical exercise in a well-defined world, *not* as how people do or should behave in the real and uncertain world.

Consider Selten's famous chain store paradox:[11] A chain store called Paradise has branches in twenty cities. A competitor, Nirvana, plans to open a similar chain of stores and to decide one by one whether to enter the market in each of these cities. Whenever a local challenger enters the market, Paradise can respond either with aggressive, predatory pricing, which causes both sides to lose money, or with cooperative pricing, which will result in sharing

profits fifty-fifty with the challenger. How should Paradise react when the first Nirvana store enters the market—with aggression or cooperation?

Selten proved that the best answer is cooperation. His proof is based on the principle of *backward induction*, in which one logically argues backward from the end to the beginning. When the last of the twenty challengers enters the market, there is no reason for aggression because there is no future competitor to deter, and thus one should cooperate and not sacrifice money. Now consider what to do with the next-to-last challenger. Given that Paradise will be cooperative toward the twentieth challenger, there is no reason to be aggressive toward the nineteenth either because everyone knows that the chain store will cooperate with the final challenger. Thus, Paradise should cooperate with this challenger too. The same argument applies to the eighteenth challenger, and so on, all the way back to the very first. Selten's proof by backward induction implies that in every city, the chain store should respond cooperatively from the first challenger to the last.

After deducing the result, Selten found his proof intuitively unconvincing and indicated that in the real world, he would instead follow his gut feeling to be aggressive to deter others from entering the market:

> I would be very surprised if [aggression] failed to work. From my discussion with friends and colleagues, I get the impression that most people share this inclination. In fact, up to now I met nobody who said that he would behave according to [backward] induction theory. My experience suggests that mathematically trained persons recognize the logical validity of the induction argument, but they refuse to accept it as a guide to practical behavior.[12]

Selten's disclosure might lead some to suspect that he was a person whose impulses overwhelmed his thinking. But the real explanation of his dismissal of the logical conclusion lies in his discerning between well-defined situations with complete information, such as in the chain store problem, and the ill-defined reality of business competition, where backward induction is no longer a safe guide. The clash between Selten's logic and his intuition is a consequence of this important conceptual distinction.

Up to the present day, however, most business schools continue to teach that logical arguments are the benchmark for effective business decisions and relying on heuristics and expert intuition will lead to failure. Consider a panel discussion held at the prestigious biannual OWL Science-Meets-Entrepreneurs Day at the Faculty of Business Administration and Economics at Bielefeld University, where Selten and one of us (Gigerenzer) spoke with

two successful local entrepreneurs. The assembled audience expected to witness a heated debate between scientists and entrepreneurs, but when Selten and Gigerenzer spoke about the benefits of heuristics and the importance of intuition for innovation, the two entrepreneurs wholeheartedly agreed. Exploiting simple rules and gut feelings was the way that they built up their companies and made their fortunes, although they had learned little about either in business school. In the end, Selten and Gigerenzer appealed to the professors in the audience to take uncertainty and heuristics seriously and to start teaching their students how people make profitable decisions in the real world. At first, the audience was speechless in shock, and then they nearly hit the ceiling. But the two entrepreneurs rose to the defense, insisting that little of what they had learned in business school was of practical use for their business careers. Visibly amused by the debate was the president of the university, a computer scientist by training, who knew that heuristics are the bread and butter of programming.

## Uncertainty Is Not Risk

These three Nobel Memorial Prize laureates represent three approaches to decision making. Simon proposed theories of heuristic decision making and used them to make his own decisions. Markowitz proposed theories of optimal portfolio allocation but relied on a heuristic for his own retirement investing. Selten developed both theories of optimal behavior in well-defined games and theories of heuristics in an uncertain world and relied on heuristics and gut feelings for his own decisions. While all three laureates relied on heuristics for their personal decisions, the key difference among their theories is whether these also dealt with heuristic decisions or just with optimizing alone. Optimizing is possible only in a well-defined, stable world with known probabilities—what Knight called "risk." It is meaningless in situations of uncertainty.

Simon, like Knight, distinguished between situations of risk and uncertainty and, with his empirically oriented mind, he was curious about how people make good decisions under uncertainty. As mentioned previously, he learned about the limits of optimization approaches when working on budget decisions, but also when conducting research on artificial intelligence (AI), of which he was one of the founders. To date, he is the only recipient of both the Nobel Memorial Prize in Economic Sciences and the Turing Award,

which has been dubbed "the Nobel Prize in Computing." Most interesting problems in computer science are intractable (i.e., no optimal solution can be found), as is the case in the games of chess and Go. Early on, Simon realized that logical solutions, such as backward induction or expected utility maximization, do not work when a problem is intractable. By nevertheless insisting on the mathematics of maximization, as most theorizing in economics does, one is forced to exclude all intractable problems, along with all situations of uncertainty. In this way, game theory ends up excluding virtually all challenging games that people like to play, and expected utility theory becomes inapplicable to real-world business decisions. When performing an exhaustive search is impossible, instead of letting the optimizing framework dictate which problems to study and which not, Simon's approach was heuristic: to study complex games such as chess and investigate how successful players decide upon their next move.

Markowitz's theory assumes such a stable world of risk. The idea is to harness huge amounts of data and estimate future returns, including their variances and covariances. Modern finance originated from his and Robert C. Merton's similar approaches to portfolio allocation. It treats finance as if it were a lottery, not a situation of uncertainty. Merton, another recipient of the Nobel Memorial Prize in Economic Sciences, applied this framework while on the senior management team of the hedge fund Long-Term Capital Management. It did not go well. The fund lost billions in the aftermath of the unexpected Russian financial crisis and had to be bailed out by the Federal Reserve.[13] Optimized portfolios are fragile in an uncertain world: the analysis of past correlations provides a guide to future asset returns only so long as the future is like the past.

Finally, the beauty of Selten's approach is that he studied both situations of risk, as in game theory, and situations of uncertainty and intractability. As the chain store paradox illustrates, he rejected the idea that logical arguments can prescribe how we should act in the real world of business, where neither side has complete information or is obliged to follow the rules of the chain store game. Selten loved game theory because it was mathematically challenging (he was a mathematician, after all), but he did not confuse it with a theory about how we behave, or even how we should behave outside closed worlds. He considered it a mistake to think of expected utility theory as the only rational theory. In fact, the motto of his book *Bounded Rationality* (written with Gigerenzer) was "to study how people make decisions without

probabilities and utilities."[14] While many economic theorists are uneasy with the exaggerated assumptions of rational choice theory, they continue to apply them because they do not see a clear alternative. But both Selten and Simon showed that there is an alternative: the study of heuristic decision making.

## The Science and Art of Heuristic Decision Making

In this book, we demonstrate how business executives can make good decisions in a VUCA world with the help of smart heuristics. We do so by drawing on the research on *fast-and-frugal* heuristics inspired by the work of Simon and Selten, as well as on observations of how professionals such as Markowitz actually make decisions. We provide real-world examples and offer practical advice for how leaders and organizations can develop their own *adaptive toolbox*, or repertoire, of heuristics to make effective decisions.

In a VUCA world, complex analytic methods quickly reach their limits or become entirely inapplicable. *Less is often more*, and complexity is better tackled with simple strategies. In such environments, simple rules that search for and use little information often lead to better decisions by being not only faster, but also more accurate, transparent, and easier to communicate, teach, and learn. Although practitioners use heuristics on a daily basis and practitioner books in business extol the virtues of intuition and rules of thumb, they do not always understand why and under what conditions heuristics work. This book aims to change that by providing a theory-informed and research-based, yet practical discussion of how business leaders can use heuristics to make good decisions under uncertainty.

For Simon, intelligence was the product of both the inner cognitive system and the outer environment. To succeed, the inner system must be "smart" (i.e., able to exploit features of the environment with its limited capacities); heuristics are embodiments of this general adaptive strategy. This positive view of heuristics, however, diminished substantially after the 1970s, when heuristics became associated with systematic biases in judgments and decisions and were deemed inferior to expected utility models. Although this assumption is generally true in situations of risk, where all probabilities and consequences are known with certainty, it does not hold in situations of uncertainty and complexity, where optimization loses its meaning and where being robust and adaptive is of great importance. Launched in the

1990s, the fast-and-frugal heuristics research program, which we discuss in more depth in the following chapters, has revived and extended Simon's view on heuristics. A multitude of studies have shown that simple heuristics are often superior to complex models.[15]

### A Very Short Preview

Building on the fast-and-frugal heuristics program, this book demonstrates the efficacy of heuristic decision making in a twofold approach. First, it describes the *adaptive toolbox*, which leaders, managers, and professionals can use to make decisions. Second, and more important, it introduces the concept of *ecological rationality*, which prescribes the environmental conditions under which specific heuristics work well. Like any strategy, a heuristic cannot work well in all situations, which makes it important to understand, in a principled way, when it will be effective and when not.

*In this book, we use the term* smart heuristics *as shorthand to refer to heuristics applied in situations where they are ecologically rational. Applied in the wrong context, heuristics can be "not smart," leading to ineffective decisions. Intelligent decision making requires choosing appropriate heuristics for the task at hand.*

Part I of the book provides an introduction to ecological rationality and the adaptive toolbox. Part II describes the adaptive toolbox in areas such as leadership, business strategy, negotiations, and teamwork. Part III covers several cross-cutting themes such as AI and heuristics, the role of intuition, and organizational decision-making cultures.

### Using Heuristics—and Feeling Good about Doing So

Executives routinely use heuristics, and yet the misplaced association of heuristics with errors makes them mostly hesitant to admit to it. This hesitancy is generally weaker in family and entrepreneurial businesses, where intuition is more acceptable, and stronger in large corporations and public administrations, where the ideology of optimization dominates. As a result, instead of standing up to their heuristic decisions, executives routinely attempt to hide the actual heuristic decision-making process by creating the appearance that the decision was reached following an exhaustive, quantitative analysis.

Consider a typical case: An executive makes a decision based on a gut feeling, as no clear favorite emerges after considerable deliberation. Afraid to take

responsibility for the intuitive decision, the executive instead hires an expensive consulting firm for the purpose of justifying a decision that has already been made with the help of an impressive array of numbers and analytics.

How frequently does that happen in large corporations? When one of us (Gigerenzer) asked the principal of one of the largest consulting firms worldwide how many of the firm's projects involved justifying decisions that had already been made, the response (given on condition of anonymity) was that it was over 50 percent.

Consider how much wasted money, time, and effort could be avoided if organizations took heuristics seriously and studied how and when they work. As a result, they would not have to hide the fact that they regularly used heuristics. Instead, they could feel good about doing so—about making competent decisions in a world of uncertainty. We believe that the time is ripe to revise the image of heuristics in management and business from being biased to being smart.

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# Smart Management

## How Simple Heuristics Help Leaders Make Good Decisions in an Uncertain World

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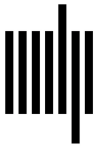

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