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Book review

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The Riddle of Thinking

Thinking, Fast and Slow

by **Daniel Kahneman**

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I.

Based on the assumption of rational choice, economic science analyzes the direct and indirect consequences of market participants' decisions. Rational choice behavior is described as a decision maker's effort to choose an action that maximizes the decision maker's utility or profit in the given circumstances. Seen from another angle, this dominant economic theory has built its complex models on the assumption of market participants' unbounded rationality. Nonetheless, during the rapid rise of mainstream theoretical concepts, some analysts indicated the need to review and modify these underlying assumptions. In the 1950's, the great analyst of wide intellectual range and Nobel laureate in economics, Herbert A. Simon, questioned the stated assumption of unbounded rationality (Simon 1955), advocating the application of the concept of bounded rationality. Simply put, Simon's point of departure for decision makers was to find a satisfactory solution instead of searching for the optimal solution. It was followed by research in various fields ultimately indicating without any doubt it is necessary to be much more careful in using the assumption of perfect rationality. Later research in this area resulted in the creation of a new field, behavioral economics. Behavioral economics deals with the factors that influence the decisions of market participants, based on bounded - not perfect - rationality. One is not to start from the assumed behavior but to explore the actual human behavior. One classic study in the field (Peter Diamond and Hannu Vartiainen 2007), describes behavioral economics as an umbrella of approaches seeking to extend the standard economic framework to account for relevant features of human behavior absent in the standard economic framework.

Behavioral economics incorporates research results from other sciences into the science of economics, particularly including findings from cognitive and social psychology (Mathew Rabin 1998; Stefano DellaVigna 2009). In this context, one cannot fail to mention the psychologist Daniel Kahneman (described by some as the greatest living psychologist). In 2002, Kahneman won the Nobel Prize in Economics with U.S. economist Vernon L. Smith (one of the founders of experimental economics), for including the results of psychological research in economic science, according to the Nobel Committee's explanation, with special emphasis on the analysis of the decision making process of market participants under conditions of uncertainty. The award actually came as the crowning achievement of decades-long research by many. Kahneman has had a long and successful collaboration with a number of

prominent analysts, but Amos Tversky stands out in this circle, to whom this book was dedicated. Their joint work resulted in several papers that marked a turning point in understanding the decision making process.

In the mid-1970's, Kahneman and Tversky published "Judgment under Uncertainty: Heuristics and Biases" in the prestigious journal *Science* (the paper was printed in its entirety as an appendix to the book under review here). In this book, Kahneman's comments on this paper underline documented systematic errors in people's thinking, tracing these errors to the design of the machinery of cognition rather than to the corruption of thought by emotion. In one of their later works Kahneman and Tversky developed the now famous prospect theory, which examines the behavior of people in situations that involve risk and uncertainty (Kahneman and Tversky 1979). Kahneman and Tversky have shown that individuals do not maximize expected utility. This work is among the most cited papers in the field of social sciences. Referring to this paper, Kahneman remarks that prospect theory was accepted by many scholars not because it was "true" but because the concepts that it added to utility theory, notably the reference point and loss aversion, were worth the trouble. He also states that new predictions turned out to be true. This work is one of the foundations of behavioral economics. The Nobel Committee mentioned both articles in their explanation of Kahneman's contribution to the understanding of the decision making process.

II.

The book's central theme? One sees from the title it is about fast and slow thinking. Kahneman says his aim was to present a view of how the mind works, drawing on recent developments in cognitive and social psychology. In the first part of the book, entitled "Two Systems", Kahneman artificially divides the thought process into two systems: System 1, the "hero of the book", and System 2. How do these systems "work"? Kahneman points out that in this analysis, mental life is described by the metaphor of two agents that produce fast and slow thinking. System 1 is guided by impressions and feelings. It's fast, automatic and effortless, using stereotypes, associations and metaphors. The main function of System 1 is to maintain and update a model of your personal world, which represents what is normal in it. To a great extent we are guided in life by System 1 impressions, but in this we do not know what causes these impressions. One of them is the impression of causality. In everyday life, people have very limited information on many things, but on this basis they have to make conclusions and decisions. Here System 1 enters the stage. It creates a coherent causal story by linking fragments of knowledge at its disposal. System 1 is, among other things, the cause of numerous systematic errors in our intuition. Contrary to it, System 2 is based on slow inference. It is slow, hard, logical, analytical and lazy. Kahneman remarks that the division of labor between System 1 and System 2 is highly efficient as it minimizes effort and optimizes performance. In this context, attention is drawn to the important finding reached by extensive experimental research: attention is a limited resource and it must be carefully allocated. Some analysts believe that the theories of bounded rationality in most cases are actually theories of allocation of attention.

The second part of the book is entitled "Heuristics and Biases". Using the term "heuristics", the author implies a simple procedure that helps find adequate, though often imperfect, answers to difficult questions. Kahneman talks about substitution - when a difficult question is replaced by an easier one and an answer is given to it. This is again System 1 in action. In this chapter, Kahneman deals with the following riddle: why is it so difficult for us to think statistically? The key problem is that the statistics requires us to think about many things at once and System 1 is not designed for that. It is precisely the reliance on heuristics that is the cause of systematic errors in the process of prediction.

It is interesting to mention first the observation stated by Kahneman on the problem of estimating the probability of an event. Namely, Kahneman recalls that during his many years of experimental work none of the participants in the experiment asked the question what probability actually is. This means that people in their decisions assume that they know what it means. Experimental research shows that the truth is far from it. Estimating the probability of occurrence of an uncertain event is a very difficult task and in its implementation people commit a number of systematic errors. It is also important to note that such mistakes are made not only by laymen but also by trained statisticians.

We shall present here just a few observations. What has been observed is the effect of the law of small numbers. What does statistics teach us? It is a statistical rule that large samples are more accurate than small samples. In addition, it is important to note that there is a higher probability an extreme outcome is likely to be detected in a small sample than is the case in a large sample. The fallacy in inference manifests in the fact that the law of large numbers has been applied to a small sample.

At work is again the activity of System 1. It always tries to construct a coherent story. However, even a most coherent story is not necessarily the most likely one. The formation of a coherent story introduces a causal explanation of chance events, which is unacceptable. The aforementioned tendency to seek causal explanations is a manifestation of the tendency of people to favor security instead of doubt.

An "anchoring effect" describes that in a person's quantitative assessment of phenomena which they possess no accurate information, they are guided entirely by irrelevant numbers which their attention is drawn to. In other words, people's estimates are affected completely by uninformative numbers. The problem, says Kahneman, is that they're doing it unconsciously. Thus, System 1 is at work again as it tries its best to construct a world in which the anchor is the true number. It is important to bear in mind that this is not only an experimental finding but behavior that is often observed in the real world.

Kahneman also analyzes the phenomenon of availability. Availability means that the probability of an event is based on the ease and speed with which we remember its implementation in the past. Thus, to a frequent event we ascribe a high probability of occurrence, and to a rare event a low probability of occurrence. But some problems appear therein. For example, some event highlighted in the media remains in our mind and so we are inclined to overestimate the probability of its occurrence. In the same way, we underestimate the probability of occurrence of events

without high media attention and it is more difficult for us to remember them. The role of emotions is also evident. Events that are emotionally charged are easy for us to imagine and we remember them more easily than those that are emotionally neutral. Events we were not interested in elude our attention and therefore we underestimate the probability of their occurrence. In addition, we overestimate the probability of events that happened to us personally compared with those that have occurred to others. It has been also noted that we are biased in choosing the sources of information, that we choose to collect mainly affirmative information (that would substantiate what we believe in advance), and that we overlook the lack of relevant information.

III.

A separate chapter, "Overconfidence", deals with people's excessive confidence in what they believe and in what they actually know or think they know. In other words, this chapter analyzes the inability of people to accept the unpredictability of the world and their tendency to underestimate the role of chance in events. In the decision making process and also in the estimates upon which decisions are made, individuals use intuition among other things. Even by professionals, many judgments are greatly influenced by a combination of intuition and technical analysis. The cause of systematic errors is precisely exaggerated self-confidence that appears in this process. It was also observed that individuals overestimate the accuracy of the information they have. DellaVigna notes that market participants' overconfidence in the accuracy of their own information can explain anomalies in financial markets (DellaVigna 2009). People generally overestimate their knowledge and skills as well as their intuition. Kahneman warns that overconfidence is in direct consequence a feature of System 1 and that it can be tamed but not vanquished. He observes that the main problem with subjective confidence is in its determination by the coherence of the story one has constructed and not by the quality and amount of the information that supports it. It is precisely the duty of System 2 to correct intuitive predictions. It is a task neither easy nor simple. It's always easier to notice someone else's errors in reasoning than our own. And if we are not able to notice a mistake we cannot eliminate it.

An important observation that the researchers have made is the illusion of understanding. When making projections, people are under the powerful influence of the past. The key cause of this illusion lies in the fact that people believe they better understand the past than they actually do. In particular, by looking backward and interpreting, they introduce a higher degree of determinism to the course of past events than likely. Things are later reconstructed so their course seems inevitable and the only one possible. From this we draw an erroneous feeling that the future will also be more predictable than is really the case. In any case, errors in prediction are inevitable because the world is complex and unpredictable. Many things our lives depend not only on our intentions and efforts, but also on luck. Many events and processes that mark our lives are the result of pure coincidence, which we cannot influence, and not the result of our skills, knowledge and the ability to predict. The illusion that things are under our control, that we can control chance events, leads to

many disappointments due to the failure of actions based on faulty estimates and projections. Planning fallacy is our tendency to overestimate the gains and underestimate the costs. This is the reason that we often choose high risk projects. This is evident not only in the behavior of individuals but also in actions by the governments or companies. Excessive optimism of planners appears at all levels.

Research has also shown the following tendency: our current choices are determined by the previous wrong decisions and sunk costs. No one likes or wants to admit that his decision was wrong and therefore he still holds to it even though it would be best to give it up right away. This is precisely the action of sunk costs in our decision making. Because of them we do not give up the job with which we are greatly dissatisfied, because of them we stay in a marriage that would be best to terminate immediately, because of them we insist on projects that are definitely unprofitable.

The chapter "Choices" presents the elements of prospect theory. In their research Kahneman and Tversky have questioned the dominance of the central position of decision theory whereby individuals who make decisions under the conditions of uncertainty, maximize expected utility. Expected utility theory is based on axioms of rationality. It is not conceived as a psychological model, its intention was to explain the logic of choice. Experimental research of choice under conditions of uncertainty has shown that the axioms underlying the rational behavior (normative assumptions) are systematically violated. It was found that people express preferences that are incompatible with expected utility theory. In their famous 1979 article - "Prospect Theory: An Analysis of Decision under Risk" - Kahneman and Tversky have already offered the aforementioned prospect theory. Prospect theory is a modification of expected utility theory. The huge impact of this article on economic science resulted also from the fact that it was published in the prestigious journal *Econometrica*.

What are the key findings of the research in this context? The outcomes of an action are measured relative to a reference point. When evaluating the options, decision makers start with some value as a reference point and consider the options as gains and losses relative to the reference point. If the outcomes are expressed in a sum of money, then an outcome greater than the reference value is seen as a gain, while an outcome less than the reference value is treated as a loss. We assign an affirmative value to gain and a negative value to loss. Kahneman and Tversky noted the fact that individuals do not evaluate in the same way gains and losses of the same sum of money. Losing it seems larger than gaining the same amount. This is described in the literature as loss aversion.

Research has also shown the effect of an endowment effect. When people come into possession of some good they appreciate it more than they appreciated it before. The consequence is that they ask more for it than the amount they were willing to pay to get it (this effect is skillfully used by companies that allow customers to return the product if it they were not satisfied - returning the product will only happen if its characteristics are far below expectations). This effect is explained by the already mentioned loss aversion which often leads to problems in the negotiation process and the difficulty in reaching an agreement. The parties to the negotiations see their concessions as losses and value them more than identical concessions by the other party.

These findings have far-reaching implications and they are applicable in different contexts. Namely, it has been established that there is a different intensity of motivation to avoid loss and motivation to achieve gains. A stronger motive is to avoid loss. This is an important point to understand the resistance caused by any institutional change or social reform. Any change creates potential winners and losers. But the losers are more active, their influence is greater and they will try to prevent change leading to the conclusion that loss aversion is a powerful conservative force that favors minimal changes from the status quo in the lives of both institutions and individuals.

The research has also established so-called bias toward probabilities, that is upward bias towards small probabilities and downward bias towards high probabilities. We overestimate the probabilities of rare events (we tend to overestimate very small probabilities of acquiring a favorable outcome). It has also been noted that we prefer to eliminate risk entirely rather than just to reduce it. This effort is referred to as the effect of security. We also underestimate or overestimate to a high degree the probability of complex events.

An interesting observation is that when we explain the poor outcomes of actions we undertook ourselves, we identify the effects of the factors over which we had no control. All of this is also the result of the selectivity of our memory. Since we remember successes more often than failures, we overestimate the likelihood of future successes. We tend to establish of non-existent cause and effect relationships. One cannot resist the inclination to observe a series of events in a causal relationship even when one is aware that the relationship between them is accidental. In this way, a false causality is created which leads to the fact that the predictions of probability of realizing an uncertain event are given more easily and with more confidence than there is a basis for that in reality.

At the end of the book Kahneman presents a short but very stimulating analysis of far-reaching consequences of these "technical issues". Specifically, he compares the views of the Chicago school and the views of the behavioral economics. The first is based on the rational participants, and the second takes into account the empirical observations this book deals with. What is the relationship of these two theoretical approaches to individual freedom of choice? Kahneman notes that for the former, the freedom of choice is untouchable as long as their individual actions do not harm others while for the latter freedom has a cost, which is borne by individuals who made bad choices and by a society that feels obligated to help them. This implies that the decision of whether or not to protect individual agents from their mistakes presents a dilemma for behavioral economists while the economists of Chicago school do not face that problem because in their view rational agents do not make mistakes and their freedom is free of charge. Kahneman then recalls that in the literature, a new concept has been introduced - the libertarian paternalism. It refers to the fact that the state or other institutions can "nudge" people to make decisions that serve their own long-term interests.

IV.

The book by Kahneman consists of short chapters grouped around a few central themes, each of which is devoted to one specific research topic and therein it is fully presented. Thus the reader can read each chapter as a separate whole. Of course, the reader will easily discover the connecting thread between all chapters. Although it is an extremely complex area of research, the book is written with admirably simple style. Such books can be written only by top experts on subjects of analysis who are also very good stylists. Kahneman showed that he meets both requirements. In this book the reader will encounter a number of subtle observations which will make him reconsider his previous positions. Therefore, the book should be read slowly and with patience. Without a doubt it is a work that is bound to cause a great deal of attention not only of the narrow circle of professional psychologists and economists, but also of all those who are interested in how people actually make decisions (based on the number of copies sold it has already happened). When the reader closes the pages of this brilliantly written and very stimulating book he cannot help but feel that the model of a perfectly rational economic man, upon which the dominant economic theory and analysis is based, is only a "brave assumption". Therefore, the findings presented in the book by Kahneman must be seriously taken into consideration by economists in their analysis.

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