MIND GAMES: EXPLORING THE PARADOXES OF RATIONAL DECISION MAKING

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Every day, we encounter a multitude of decisions, some more conscious than others. Our minds effortlessly sift through various options, weighing the potential outcomes and consequences of each. These decisions, whether significant or insignificant, are fundamental to our very existence, as they shape the course of our lives. As humans, we are all too familiar with the struggle of indecisiveness. However, the act of making a decision is a perpetual and essential part of our being. With each piece of information, we receive, a new possibility arises, offering a unique outcome that could alter our path. It is estimated that on any given day, an average person makes a staggering 35,000 decisions. Some of these may be simple and rational, while others may be complex and irrational, but all decisions have one thing in common: consequences. The influence of decisions is inescapable, permeating every aspect of our lives. We may feel bound by them or empowered by them. Yet, what if there was a way to consistently make optimal choices?

For a vast range of human activities, game theory can offer valuable insights into the decision-making process. This field of study presents a systematic approach to decision-making, which can help us to better understand how to navigate complex situations. Before delving into the intricacies of game theory, it is essential to establish a clear definition of what constitutes a game. A game is a formal representation of a strategic situation, in which the decisions of one or more players have an impact on the outcomes of the game. Put simply, any situation that requires a decision can be viewed as a game. According to the London School of Economics, game theory is a formal study of decision-making, in which multiple players must make choices that have the potential to influence the interests of other players. As a tool for decision-making, game theory can provide valuable insights into the potential outcomes of various decision-making scenarios. In the current global pandemic, which has brought about significant economic challenges and widespread confusion, game theory can be a powerful tool to help us make informed decisions across a broad range of domains. From financial decisions to existential and even spiritual choices, game theory offers a framework for analyzing complex situations and identifying optimal decision-making strategies. The potential of game theory to

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shed light on the decision-making process is immense, and its applications are far-reaching. By adopting a game-theoretic approach to decision-making, we can gain a deeper understanding of the complex interactions that shape our lives and make more informed decisions as a result.

John Von Neumann's work on game theory was aimed at addressing critical problems in economics. Von Neumann, widely considered the foremost mathematician of his era, was known for his ability to blend pure and applied sciences in his work. Together with Oskar Morgenstern, he authored the influential book "The Theory of Games in Economic Behaviour," which established the foundations of game theory. According to Von Neumann's theory, any situation can be viewed as the outcome of a game played by two or more players. There are three key components to any game: players, strategies, and pay-offs. The decision-maker in a game is known as a player, and the plan of action they choose is referred to as a strategy. In more complex games, strategies can include complete plans for every decision point that a player may encounter. The desirability of an outcome to a player is captured by the concept of pay-off, which is a numerical value. Game theory provides a framework for analyzing the strategic interactions between rational adversaries who share common knowledge of the game's rules, use available strategies, and gain possible pay-offs. However, in practice, players often lack perfect information about the events taking place in the game. In game theory, absolute information refers to the situation where a single player makes a move and has knowledge of all actions taken up until that point. The concept of strategic interdependence lies at the heart of the game theory. This refers to the mathematical modeling of strategic interactions between rational adversaries, where each player's action depends on what the other side will do. Strategic interdependence is ubiquitous in daily life, where individuals often find themselves in situations where their actions are dependent on the actions of others. Game theory provides a valuable framework for understanding these complex interactions and identifying optimal decision-making strategies in a wide range of scenarios.

Von Neumann's formulation of game theory, while a groundbreaking achievement, has been found wanting in some respects by modern game theorists. Its focus on optimal strategies in zero-sum games, where the sum of pay-offs to all players is always zero, is a limitation. In such games, the interests of the players are diametrically opposed, and one player's gain necessarily comes at the expense of another player's loss. However, in the real world, players can rapidly increase or decrease their resources, and forming coalitions can lead to exponentially greater

pay-offs for multiple players. Thus, game theory has had to adapt and evolve to accommodate a wider range of scenarios beyond the simplicity of zero-sum games.

John Forbes Nash Jr., an American mathematician, has made significant contributions to game theory, which has shed light on the factors that govern chance and decision-making in complex systems present in everyday life. Nash's work has created the foundations for strategic equilibrium, which is also known as Nash equilibrium. It is a set of strategies, one for each player, that has the property of no player being able to unilaterally change their plan of action to achieve a better payoff. Nash's approach provides optimal strategies for any finite game. A New Yorker article describes Nash equilibrium as a particular solution to games where one selects the best outcome based on the strategies employed by all other players.

A strategic equilibrium is an optimal outcome in a game, where each player's strategy is the best response to the other players' strategies. John Nash, a renowned mathematician, made significant contributions to game theory by formulating the concept of strategic equilibrium, which is also known as Nash equilibrium. His work provided insight into decision-making processes in complex systems, and he was awarded the Nobel Memorial Prize in Economic Sciences in 1994 for his contributions. However, despite his brilliant achievements, Nash suffered from schizophrenia, which began to manifest in 1959. Although he managed to improve his condition, he tragically died in a car crash in 2015, along with his wife, while traveling in a taxi on the New Jersey Turnpike. Despite its significance, Nash Equilibrium was dismissed by Jon Von Neumann as mathematically trivial, suggesting that it was a straightforward concept to understand.

The Prisoner's Dilemma is a classic example in game theory that sheds light on the practical applications of this mathematical field. Consider two accomplices, George and Charlie, who have collaborated on a bank heist. Although the authorities lack concrete evidence, they are confident of the duo's guilt. George and Charlie are being interrogated separately, with the outcomes of their decisions relayed to them. The criminals face two choices - confess or keep quiet - with potential pay-offs of five, ten, or twenty years in prison. If both confess, they will each serve ten years. If one confesses and the other stays silent, the confessor will go free, while the other will get a twenty-year sentence. If both remain silent, they will receive a five-year prison term. Neither can leave the room until they have made a decision. This dilemma presents an intriguing and complex challenge to the players, and the strategy they choose will significantly impact their fate.

The classic example in a game theory known as the Prisoner's dilemma provides valuable insights into the applications of game theory. The answer to the dilemma lies in a fundamental finance concept, which can be represented by a single matrix. The key is to identify the dominant strategy, which is a strategy that weakly dominates another and offers the best payoff, no matter what the other player chooses. In the case of George and Charlie, the best option for George is to confess, as it offers the highest potential reward, and the same goes for Charlie. Therefore, their only dominant strategy is to turn on each other and confess. However, this situation illustrates the limitations of rationality in certain scenarios, as the assumption that agents or players always seek to maximize their utilities or payoffs is not always accurate. In reality, players do not always behave rationally. For instance, if both George and Charlie were to choose not to confess, they would receive a lesser sentence than if they both confessed. But this only works if they can trust each other not to turn on one another, which is uncertain in this case. Thus, the Prisoner's dilemma highlights the importance of considering different perspectives and not relying solely on rational analysis, as it may not always conform to reality.

As exemplified by the Prisoner's Dilemma, the most rational course of action may not always yield the optimal outcome. This paradox underscores the shortcomings of Von Neumann's game theory, which fails to provide adequate solutions in non-zero-sum games. Hence, it is critical to acknowledge that rationality alone may not always be the most effective approach and to account for other factors like emotions and social dynamics when making decisions. In some cases, irrational actions may even prove more fruitful than rational ones. Recognizing the limitations of rationality can pave the way for more nuanced and effective decision-making strategies.

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