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# **Decision making under uncertainty**

## **(Summary)**

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Key words: decision making, behavioral economics, cognitive biases, game of Go, leadership, CRT

# **1. Introduction**

## **1.1. Overview**

On average, an adult makes approximately 34,000 decisions each day (Bouffard, 2019). Even if many of these decisions are small, some have a big influence on our lives and the lives of those around us. This emphasizes the importance of decision making in both personal and professional contexts, especially in leadership roles, where successful decision making is critical. This thesis explores the decision making process and examines tools to enhance it, focusing on the ancient board game Go.

Decision making is often made more complicated by biases, information overload, and uncertainty. To address these issues, various strategies, including analytical models and psychological techniques, have been created. This thesis explores the possibility of using the game of Go with its strategic complexity to improve leadership decision making skills, including strategic planning and adaptability.

The challenges encountered while playing the game of Go, with its millennia-long history and profound strategic depth, can be seen as an analogy to the complex decisions faced by leaders (Miura, 1995). This thesis aims to demonstrate the potential of Go as a tool for leadership development, with the hope that it will eventually be adopted as a widespread method for enhancing decision-making skills.

## **Background of the Research**

Decision making is a multidisciplinary field enriched by contributions from fields like philosophy, psychology, economics, sociology, and political science. Philosophers like Plato and Aristotle explored rationality and ethics. Psychology examines cognitive processes involved in decision making. Economics uses mathematical models to understand decision making under various conditions, and sociology considers cultural and group dynamics. Political science explores governance and power dynamics in decision making, with strategic principles from classical texts like Sun Tzu's "Art of War" being still today.

Recent innovations in decision making methodologies include the use of games like chess and business simulations to replicate complex environments for strategic thinking and operational decisions (e.g., Graber (2009), Hunt & Cangemi (2014), Senthil & Ravindran (2023)). Virtual

reality training programs also offer safe spaces to practice decision making without real-world consequences. Such advancements indicate that both traditional and innovative methods can effectively complement each other.

As organizations and societies have been growing increasingly complex, leaders face more elaborate challenges. Modern leaders must be emotionally intelligent, adaptable, and capable of handling uncertainty and rapid changes (Finley, 2009). This evolving landscape requires a fresh look at traditional leadership development tools, making Go a particularly interesting subject of research due to its strategic complexity and the planning, patience, and adaptability it requires. Furthermore, taking into account that leadership programs can be very costly for companies, improving leadership skills through the game of Go could be a cost-effective alternative.

Go remains underexplored as a tool for enhancing leadership and decision making skills, despite its very big potential. While research indicates that there are cognitive benefits from playing complex games, there are very few studies that specifically look at the impact of Go and its cognitive benefits, and particularly its benefits on leadership development. Previous authors, such as Miura (1995) and Kerr (2011), have noted similarities between Go and leadership, emphasizing that playing Go enhances creativity, decision making, and leadership skills. This thesis aims to fill this gap by exploring whether Go players exhibit superior decision making skills and if playing Go could enhance leadership abilities. By examining Go's unique attributes through empirical research, the thesis contributes to academic literature and offers practical insights for organizations seeking innovative leadership development strategies. This thesis proposes that Go could provide a fun and enjoyable environment for improving decision making skills in a controlled, risk-free setting.

**Research problem:** This thesis aims to explore the potential of the centuries old game of Go to contribute to leadership and decision-making improvement for humans in general and then in particular for managers.

**Research question:** Is there a relationship between regular playing of the game of Go and improved decision-making and enhanced leadership skills among individuals? To answer this question, we will first investigate whether Go players demonstrate better decision-making skills compared to nonGo players.

**Hypothesis:** It is hypothesized that individuals who regularly play Go will demonstrate significantly better decision-making and leadership skills compared to those who do not play the game.

This thesis attempts to close the gap in the literature by looking into the potential benefits of Go as a tool for leadership training, providing empirical evidence that links playing the game of Go with improved decision making and leadership skills. Prior research has drawn analogies between Go and project management, noting that playing Go can enhance decision making skills and certain leadership traits, but this has often been based on observations rather than empirical research (e.g., Watson & Chatterjee, 2006; Henkel, 2011; Kerr, 2011; Jirasophon, 2019).

The expected outcome of this research is a deeper understanding and confirmation of Go's potential to enhance cognitive and leadership skills. Such findings could lead the way for designing leadership programs and workshops that incorporate Go, offering a novel approach to developing these skills on a broad scale.

## **1.2. Importance and motivation**

The importance of this research emerges from the dual challenges that organizations face in cultivating and evaluating leaders who can make quick, strategic decisions and adapt to changing environments. The game of Go, especially played under time constraints (“byoyomi”), serves as a model for quick strategic thinking and adaptability, reflecting the decision making and strategic flexibility required from leaders. This thesis explores whether Go can be an innovative tool for developing and assessing leadership skills.

The thesis contributes to the academic literature linking strategic games with leadership skill development, a fairly well-documented relationship in chess, and extends it to Go with empirical evidence. This thesis demonstrates that Go players make more effective decisions in contexts related to leadership, suggesting the game's utility in enhancing leadership skills. A second study included in this thesis examines the cognitive reflection among Romanian university students, finding a weak correlation between cognitive reflection test (CRT) performance and baccalaureate exam scores, challenging traditional educational assessments. A third study explores biases in decision making, reflecting on the universality of these biases. My personal motivation comes from my long experience as a Go player and the similarities I have noticed between the challenges faced during a game and those encountered in a work environment by me and by others.

The originality of the research lies in its cross-disciplinary approach, linking fields like behavioral economics, leadership, and game studies, and proposing practical implications for corporate training programs using the centuries old game of Go. The research also wonders about the effectiveness of the Romanian baccalareate exam in assessing the cognitive reflection of the pupils taking the exam, suggesting the need for the reevaluation of the exam. Overall, the thesis presents Go as a valuable tool for leadership development and cognitive skill enhancement.

### **1.3. Methodology**

The present research uses quantitative methods for the primary and secondary studies, and qualitative methods for the third small study. Surveys are employed in the primary and secondary studies to examine the differences between various populations. The primary study compares Go players and nonGo players across different demographics, while the secondary study focuses on Romanian university students and their cognitive reflection. In the primary study, the surveys include the Cognitive Reflection Test as well as questions from the field of economics, questions about Go experience, and general demographics. Data analysis is done with statistical tests like T-tests and regression analyses using SPSS or PSPP software. The research aims to provide insights into Go's potential for leadership development and decision making skills but doesn't include before and after studies, as this is meant for further studies. Limitations include assumptions about participant engagement and survey accuracy for measuring the desired things, as well as the exclusion of certain topics like the influence of Go workshops and validation of translations, which come as recommendations for further studies.

### **1.4. Outline of the thesis and contributions**

The thesis is divided into six chapters that discuss introductory, theoretical, and empirical aspects. Each chapter contributes to the overall argument, but each one can be read independently as well. Chapter 1 is the introductory one and lays the foundation of the research, by summarizing the objectives, significance methodology and importance of the research behind looking at the impact of the game of Go on decision making and leadership skills. Chapter 2 looks at the rationality and economic theories, particularly behavioral economic theory, and explores some of the theories and tools for improving decision making. Chapter 3 introduces the Cognitive Reflection Test and presents a study at a Romanian university, examining differences between genders and correlations with academic performance. Chapter 4 introduces the game of Go, describing its history and rules, scientific relevance, and its implications for understanding the decision making process, while also proving that Go is not just a game. Chapter 5 consists of a study about what makes a good manager and it compares Go players with nonGo players and managers with nonManagers based on different

skills. The thesis ends with the conclusions that sum up the findings of the thesis, highlighting the potential of the game of Go to developing leadership skills and encouraging further research in this direction.

## **2. The decision making process and how to improve it**

### **2.1. Introduction**

The chapter introduces key concepts in decision making, like behavioral economics, game theory, nudge theory, and choice architecture, in order to explore how decisions are made and how they can be improved. It looks into anomalies that show that humans sometimes don't behave rationally, and discusses how behavioral economics challenges traditional economic assumptions, while taking into account some of the ethical implications of interventions in the decision making processes.

### **2.2. Literature Review**

#### **2.2.1. Anomalies. Considerations on some aspects that make us humans**

Sometimes, people don't make perfectly rational decisions because of things like mental shortcuts and other influences. These anomalies, with a few examples presented below, show that economic theories assuming people always make the best choices don't always describe the reality.

- **Independence and Conformity:** Asch's (1956) experiments demonstrated how people tend to conform to group pressure, even if they disagree. Even when the task was straightforward, participants often agreed to the incorrect answers provided by others, revealing a tendency to value fitting in over forming their own opinions.
- **Behavioral Study of Obedience:** Milgram's (1963) experiments revealed the extent to which individuals obey authority figures, even when it involves harming others. Surprisingly, many participants chose to administer potentially deadly electric shocks, revealing the conflict between personal morals and obedience to authority.
- **Group Inhibition of Bystander Intervention:** Latane and Darley's (1968) study showed that the presence of others can inhibit individuals from taking action in emergencies. The diffusion of responsibility among groups leads to reduced likelihood of intervention, demonstrating the influence of social context on behavior.
- **Interpersonal Dynamics:** The Stanford prison experiment demonstrated how assigned roles can significantly influence individuals' behaviors. Participants fully embraced their roles, leading to authoritarian behavior by guards and passivity among prisoners (Haney et al., 1973).

- Sustained Inattentional Blindness: Simons and Chabris (1999) highlighted how individuals often fail to notice unexpected events due to selective attention. Inattentional blindness leads to the illusion of awareness, despite missing crucial details.
- Flashbulb Memories: Our memories of significant events, known as flashbulb memories, can be distorted over time. Despite the fact that we seem to remember them clearly, these memories are susceptible to inaccuracies, leading to false recollections of past events (Chabris & Simons, 2010).

These anomalies demonstrate the complexity of human decision making and our limitations as humans. Recognizing and understanding these deviations is crucial for creating more accurate economic models and developing strategies to alleviate cognitive biases. Strategic games like Go can offer a way for addressing these shortcomings by engaging with them in safe environment.

### **2.2.2. Individuals and their rationality - Types of individuals**

The human perception of oneself is filtered through various lenses, leading to a disparity between self-image and the actual self, which in turn can influence decision making. Achieving alignment between self-perception and reality enhances understanding of human behavior and facilitates better decision making. Introspection and research in fields such as psychology, sociology, and decision making theory help with bridging this gap. Standard economic theory sees individuals as rational actors with clear preferences and beliefs, operating within certain constraints and making choices to maximize their expected utility (Croson & Gächter, 2010). However, empirical evidence suggests deviations from this model, challenging the assumption of this perfect rationality (Halpern, 2015, p. 12).

### **2.2.3. Economic theories of human behavior**

While standard economic theory portrays individuals as rational actors maximizing expected utility (Varian, 2010, pp. 54–56), empirical evidence from behavioral economics challenges this notion (Kahneman, 2003). Behavioral economics explores how psychological, social, and cognitive factors shape decision making, revealing deviations from rational behavior. Humans often exhibit biases, inconsistencies, and emotional influences in their choices, contrary to the rational actor assumption. This recognition of the multidimensional nature of decision making underscores the importance of incorporating insights from psychology and sociology into economic models. Policies and systems based solely on the assumption of perfect rationality may lead to inefficiencies when confronted with actual human behavior. Therefore, understanding the spectrum of human decision making,



from rational to irrational behaviors, is crucial for designing effective policies and interventions that account for human biases and limitations (Plott & Smith, 2008).

#### **2.2.4. Game theory – a tool for studying decision making**

Game theory emerged alongside monumental advances in medicine and the advent of nuclear weapons, providing a framework for understanding conflicts and cooperation. It offers insights into strategic interactions across various domains, from business competition to international relations (Bătrâncea, 2009, p. 39). The core assumption of game theory is that players are rational actors seeking to maximize utility, although behavioral game theory acknowledges deviations from this assumption observed in real-world behavior (Myerson, 1997, p. 1). Key concepts in game theory include players, actions, preferences, strategies, payoffs, outcomes, and equilibrium, forming the basis for analyzing decision making in diverse scenarios (Rasmusen, 1990, pp. 21–27). Combinatorial game theory explores different types of games: two-person-games, games with perfect information, null-sum-game and games with an end (Waldmann, 2001). Behavioral game theory, a subset of game theory, examines actual human behavior in strategic interactions, incorporating elements such as emotions, errors, and learning. Overall, game theory provides a valuable framework for understanding and predicting decision making in complex social contexts (Camerer, 2003).

#### **2.2.5. Decision making and types of decisions**

The discussion explores human decision making, emphasizing its importance in daily life and the need to understand the decision making process. Decision theory and game theory offer different approaches to analyzing decisions, with decision theory focusing on individual decisions under uncertainty, in contexts in which the individual doesn't need to engage in strategic interactions with other individual decision-makers, and game theory examining decisions in strategic interactions (Rasmusen, 2010, pp. 10–11). Decision making is categorized based on the number of actors involved and the level of uncertainty, including decision making under certainty, risk, ignorance, and uncertainty, each with unique characteristics and implications for outcomes (Peterson, 2017, pp. 5–8).

### **2.3. Methods for helping individuals make better decisions**

Individuals have an inherent tendency to make predictable errors in judgment due to things like cognitive biases (Tversky & Kahneman, 1974), impatience, and mood influences. One option to help individuals take better decisions as a policymaker is to design interventions to help people

make better decisions without infringing upon their freedom of choice. Some examples include rearranging cafeteria layouts to promote healthier eating habits (Thaler, 2008, pp. 1-5) and strategies for influencing behavior, such as restrictions, monetary incentives, persuasion, and nudging (Soman, n.d., section 1). Another option is nudging, which is when choice architects subtly influence individuals' decisions by designing choice environments (Thaler & Sunstein, 2008). Nudges aim to steer individuals towards desired actions while preserving their freedom to opt out. Various real-life examples of nudges are described, including commitment contracts, visual cues, and prompts for behavior change (Thaler & Sunstein, 2008). Next to nudges there are also “thinks”, which aim to promote deliberative democracy and encourage citizen participation in decision making processes (John et al., 2011, pp. 11–12).

## **2.4. Conclusion**

In summary, this chapter discusses the significant progress made in understanding human behavior over the past 70 years, particularly through the integration of psychological insights in economics. The emergence of choice architecture, popularized by R. Thaler and C. Sunstein's book “Nudge” in 2008, has drawn attention to the potential of psychological principles in shaping decision making. Governments in several countries have successfully implemented nudges, which have brought promising results (Thaler & Sunstein, 2008, pp. 22–23). Overall, the chapter lays the groundwork for future discussions by presenting theoretical frameworks and methodologies for improving decision making processes.

## **3. A study in Romania about cognitive reflection**

### **3.1. Introduction**

In this chapter, the focus is on understanding reflective thinking and its importance in decision making and problem-solving. Reflective thinking, characterized by questioning initial responses and considering more complex alternatives, is crucial across various fields including education, business, and psychology. The chapter introduces a method for measuring reflective thinking, the Cognitive Reflection Test (CRT) developed by Frederick (2005), and presents an original study applying the CRT to a new sample (Avram, 2019). The study aims to provide fresh insights into how different groups exhibit reflective thinking, with surprising findings regarding the relationship between reflective thinking and academic performance.

### **3.2. Literature review**

The Cognitive Reflection Test (CRT) aims to look at individuals based on their cognitive ability by measuring their tendency to engage, or not, in reflective and deliberative reasoning (Frederick,

2005). This test, which consists of three simple questions, has emerged as a quick and effective tool for measuring cognitive abilities, showing a high correlation with IQ scores. The current study seeks to explore among other things, gender differences in CRT performance in a representative adult sample and examine its correlation with Romanian final high school exam results. Understanding such differences in cognitive abilities can inform various fields, including education and policy-making, by facilitating the creation of targeted interventions and policies. Recent research on the CRT has delved into directions like expanding the test (Toplak et al., 2014) and explaining gender differences (Primi et al., 2018).

### **3.3. Study at a Romanian university. Methodology and results**

The study conducted at a prominent Romanian university sought to examine gender differences and cognitive abilities using the CRT. This test, along with additional questions, was administered to 195 participants, comprising undergraduate and graduate students across different study years. The sampling method employed was stratified random sampling based on the participants' study year. Participants were not compensated for their participation, and the questionnaire took approximately 10 minutes to complete (Avram, 2019).

In terms of results, the study found that the mean CRT score for the Romanian sample was less than 1, indicating that, on average, participants answered fewer than one-third of the questions correctly. This score was comparable to that of students from Michigan State University but lower than the overall mean of all samples mentioned in the original study. Surprisingly, no significant correlation was found between CRT scores and responses to Kahneman's Linda question, differing from typical findings in the literature (Tversky & Kahneman, 1983; Frederick, 2005; Avram, 2019).

Consistent with previous research, men outperformed women on the CRT in the Romanian sample, e.g., (Benbow & Stanley, 1980; Halpern, 2004; Hedges & Nowell, 1995; Hyde et al., 1990). Additionally, while a weak positive relationship was found between CRT scores and overall Romanian baccalaureate exam (BAC) results, no significant correlation was observed with BAC results in mathematics (Avram, 2019).

### **3.4. Conclusion**

This chapter looks at the CRT as a tool for assessing cognitive reflection, highlighting its importance as a tool of the decision making processes. By applying the CRT to a Romanian demographic group and examining its correlation with the Romanian high school final exam, the study contributes with new insights to the field, particularly in the context of Romania. The findings

of gender differences in cognitive reflection aligns with existing literature, while the correlation between CRT scores and Romanian bacculaureate results offers fresh perspectives on educational assessment methodologies. The study's originality lies in its pioneering application of the CRT to a Romanian sample and the exploration of the correlation with Romanian bacculaureate scores.

#### **4. Decision making in a particular system: the game of Go**

##### **4.1. Introduction**

Exploring the importance of games in both science and human life, demonstrates their varied roles, which go beyond simple entertainment. Games serve as valuable tools for understanding cognition and complex phenomena, with Go being an example of a game that has been used and continues to be used as a useful instrument in various fields, including AI development, decision making processes, and cultural studies.

##### **4.2. Literature review**

Games encompass systems with clear rules, offering quantifiable outcomes, engaging players in artificial conflicts. Games' captivating nature lies in their ability to offer enjoyment, intensity, and educational value, fostering creativity, problem-solving, and socialization. Particularly in education, games play a crucial role, enhancing active learning, critical thinking, and soft skills development, while also promoting social interaction and preparing students for real-world scenarios (Scurati et al., 2023).

The game of Go, originating in ancient China and later gaining popularity in Japan, holds a significant cultural and intellectual role in Eastern Asia (Papineau, 2001). Go has been deeply rooted in Eastern cultures, evolving into a martial art and holding prestigious positions in aristocratic and military circles (Moskowitz, 2014, pp. 3; 106). Despite its ancient roots, Go remains relevant in contemporary society, symbolizing a clash between tradition and modernity and finding representation in literature (e.g., Nobel prize winner Yasunari Kawabata's book "The Master of Go") and film (e.g., "A beautiful mind" (2001), "The Surrounding Game" (2017) and „AlphaGo" (2017)). In Romania, Go is recognized as a sport, and it has a dedicated player base and it hosts national and international championships (Web Page Ministerul Sportului a Stabilit Propunerile Pentru Cuantumul de Finanțare a Federațiilor Sportive Naționale Pe Anul 2023, n.d.).

The game of Go, renowned for its strategic depth and cultural significance, has transcended its traditional role as a board game to become a valuable research instrument across diverse fields, including economics, business, and project management. In the field of economics, scholars have

drawn parallels between Go and complex real-world problems, leveraging its strategic complexity to devise insights into market-entry strategies and international business practices. For instance, studies have compared traditional Western approaches, characterized by confrontation and immediate results, with Eastern strategies inspired by Go, emphasizing long-term strategic goals and gradual expansion (Miura, 1995; Nielsen, 2005). In the realm of project management, Go's decision making processes have been likened to those in complex projects, offering new approaches to tackle challenges such as uncertainty and conflict (Kerr, 2011). Moreover, research has demonstrated the cognitive benefits of playing Go, with players exhibiting superior visuospatial abilities and pattern recognition skills (Wojtasinski & Francuz, 2019). In education, Go has been explored as a tool for teaching mathematics (Tachibana et al., 2012) and enhancing cognitive functions among children, suggesting its potential to revolutionize traditional pedagogical methods (Fenech & Cabassut, 2022). In computer science and artificial intelligence, Go has been a subject of intense study, with attempts to develop AI systems capable of competing at human levels (Silver et al., 2016). Mathematical analyses of Go endgame positions have provided insights into game strategies (Berlekamp & Kim, 1996), while medical studies have explored the potential therapeutic benefits of playing Go, particularly in improving attention and cognitive functions among individuals with ADHD (Kim et al., 2014). Overall, the multifaceted applications of Go underscore its versatility as a research tool and its potential to address complex challenges across various disciplines.

#### **4.3. Some cognitive biases during Go-playing. Go and economics**

Understanding cognitive biases in Go can significantly enhance players' decision making abilities. When playing Go, emotions and intuition often affect optimal play, whereas detachment and logic tend to lead to better results. Anchoring bias, for example, leads players to overvalue opponents' moves, while availability bias influences decisions based on past experiences. Similarly, the endowment effect causes players to overvalue their own stones, impacting their strategic choices during gameplay (Avram, 2018).

The proverb “You are two stones stronger when watching a game” succinctly illustrates how emotional involvement can weaken players, highlighting the importance of detachment for enhancing performance. Moreover, players frequently rely on System 1 (intuitive) thinking, which can lead to errors. Conversely, System 2 (analytical) thinking is crucial for accurate assessment and strategic decision making in Go (Avram, 2018).

By recognizing and leveraging these parallels, individuals can enhance their decision making skills and adaptability not only in Go but also in various other domains of life and business.

#### **4.4. Conclusion**

The conclusion highlights the significance of games like Go in scientific research, offering insights into complex problems and the human mind. This is relevant for various fields, including AI development, learning, pattern recognition, and strategic thinking. The chapter also emphasizes the originality of reviewing Go's application across diverse research areas and proposes that the game could be useful in addressing biases and improving decision making skills.

### **5. A study about what makes a good strategic manager**

#### **5.1. Introduction**

In today's fast-paced business world, managers face an increasing number of decisions with very high impact that demand very fast action, as well as taking the right decisions. This chapter builds upon previous literature and explores the intersection of decision making processes, cognitive biases, and the strategic management skills required in leadership roles, ending with a multinational study examining whether Go players exhibit superior decision making abilities compared to non-players, which has implications for the leadership development.

#### **5.2. Literature review**

This study highlights three important categories of traits that are crucial for effective management: general intelligence, speed of cognitive processes, and patience; learning ability and abstract thinking; and economic and financial literacy. The game of Go is introduced in a previous chapter as a pertinent context for understanding these skills. The game offers practical insights into economic and financial principles, as shown by studies like the one of Chen et al. (2003), which highlight its relevance in gaining skills that are vital for effective leadership, such as resource allocation and risk management. Moreover, studies like the one of Baghestanian & Frey (2016) underscore the exceptional cognitive reasoning skills exhibited by strong Go players. Furthermore, research, such as the one by Rieger & Wang (2021), suggests a significant correlation between proficiency at Go and cognitive reflection.

#### **5.3. Multinational study on managers. Methodology and results**

The primary research question of this study is whether consistently playing Go leads to enhanced decision making skills and improved leadership skills. To address this question, the initial focus is

on examining whether Go players demonstrate superior decision making abilities compared to nonGo players.

### **5.3.1. Proposed Survey for Evaluation**

The survey used in this study aims to assess three key traits essential for effective management:

**a) General Intelligence, Cognitive Speed, and Patience:** The Cognitive Reflection Test is used to measure general intelligence and cognitive speed. For this study, a modified version consisting seven open-ended questions is utilized.

**b) Learning Ability and Abstract Thinking:** Given the absence of suitable tests in existing literature, a unique test is created for this study. Developed collaboratively with a fellow Go player, the test leverages the intricate dynamics of Go to evaluate abstract thinking and learning abilities in a person who is just learning the rules of the game. This test requires further validation.

**c) Economic and Financial Literacy:** After looking into the established literature, seven questions from Walstad et al. (2013) were selected to evaluate economic and financial literacy. These questions cover a spectrum of economic concepts.

### **5.3.2. Subject Pool Description**

The survey, conducted both online and offline, garnered responses from 206 participants across 26 countries, with the majority from Romania (93), followed by Finland (44) and Germany (15). Most participants were aged 35-44, with a similar number in the 25-34 age group, and the majority did not have managerial roles. Participants were volunteers from diverse demographics, found at Go clubs, tournaments, social media platforms, professional networks, etc. Despite the seemingly small sample size, it was sufficient to observe significant effects, surpassing previous studies with 46-61 subjects (Baghestanian & Frey, 2016).

### **5.3.3. Results**

As part of the study, various tests have been conducted, including t-tests and regression analyses, to explore differences in performance between Go players and nonGo participants, managers and nonManagers, as well as within subgroups based on factors like managerial status, gender, economics background, nationality, prior exposure to the Cognitive Reflection Test (CRT), and performance on Go-related questions. Some of the results are presented below:

**a) Differences between Go and nonGo Participants at the CRT:**

- A significant difference was found in CRT7 performance between Go players and nonGo participants, with Go players scoring notably higher.
- Results were supported by regression analysis, indicating that being a Go player was associated with higher CRT scores even when controlling for other variables.
- Additionally, within the Go player subgroup, stronger players tended to perform better on the CRT, confirming previous findings (Rieger & Wang, 2021).

**b) Differences between Managers and non-Managers at the CRT:**

- Managers generally outperformed non-managers on the CRT, with Go-playing managers showing the highest scores.
- A significant difference was found between Go-playing managers and nonGo-playing managers, indicating that being a Go player had an additional positive effect on CRT performance among managers.

**c) Gender Differences at the CRT:**

- Consistent with previous studies (e.g., Avram (2019)), men tended to outperform women on the CRT, both overall and within the Go player subgroup.
- However, no significant gender difference was observed within the nonGo participant subgroup, possibly due to the small sample size.

**d) Economics Background and CRT Performance:**

- Economics studies did not significantly impact CRT performance overall or within Go player or nonGo participant subgroups.
- However, there was a significant difference in performance on economic questions, with those who studied economics scoring higher.

**e) Nationality Differences:**

- Significant differences in CRT performance were found between participants from Romania and Finland, with Finns generally performing better.
- The reasons behind these differences were not explored but could be related to factors such as language proficiency, familiarity with test formats, or educational systems.

**f) Prior CRT Exposure:**



- Previous exposure to CRT questions was associated with higher scores.

#### **g) Go Performance (for nonGo participants) and CRT:**

- While Go players generally performed better on the CRT, no significant difference was observed in CRT performance between nonGo participants who performed well or poorly on Go related questions, which they answered to after watching a video that presented the rules of the game.

The current study has several limitations and it suggests ideas for future research. The thesis does not research the underlying reasons for the potential advantage of Go players in cognitive reflection and economic knowledge. It is mentioned that individuals with certain attributes may be drawn to Go, and that the game further enhances these attributes. However, this hypothesis was not explored due to time and resource constraints. Additionally, no investigation was conducted on the Go-related questions for nonGo participants to confirm their accuracy in assessing abstract thinking. A larger sample size and methodological enhancements, are suggested for future studies to analyze in a comprehensive manner the underlying mechanisms influencing decision making and leadership abilities.

Ideas for future research in this field include integrating Go into school education, particularly in countries like Romania. Introducing Go classes to school pupils could yield benefits, as observed in China, where Go is deeply integrated into the national culture and identity. Workshops for managers focusing on teaching the game of Go could be a cost-effective method to improve leadership skills. Additionally, exploring how Go can teach calculated decision making and risk aversion could be beneficial, as the game provides a safe environment to practice these skills. These offer promising directions for further research in understanding the cognitive and decision making benefits of playing Go.

#### **5.4. Conclusion**

The present study aims to investigate whether regular Go players of different ranks exhibit superior decision making skills and enhanced leadership abilities compared to nonGo players. The findings reveal that Go players demonstrated statistically significant advantages in skills essential for leadership, such as general intelligence, cognitive speed, patience, and economic literacy. These results are consistent with the reputation that the game of Go, which is that playing Go requires individuals to be able to think strategically and adapt easily to new situations. Overall, the study

suggests that playing Go regularly may contribute to improved decision making and leadership skills, though it acknowledges certain limitations and the need for further research.

## **6. General Conclusions**

This thesis focuses on the topic of decision making and on how playing Go could help enhance leadership abilities. The research questions focus on whether Go players excel in decision making and if playing Go enhances leadership skills. The results of the main study suggest that there is a relationship between playing Go regularly and better decision making and leadership skills. The suggestions made for further research include exploring how understanding behavioral economics can help with becoming better at playing strategic games, understanding biases in games like Go, and integrating Go into educational settings to enhance cognitive skills.

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