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1 Introduction

In today's society, competition and social comparison have become an integral part of our daily lives, often present without us even realizing it. Researchers are actively exploring these phenomena and seeking to gain a deeper understanding of how we perceive and navigate competition with others. The primary objective of this paper is to examine the fundamental aspects of competitors and investigate whether they are linked to the well-known N-Effect.

Competition and social comparison are intertwined concepts that have significant psychological and social implications. In competitive scenarios, individuals or groups strive to surpass or excel beyond others in order to achieve a particular objective or desired outcome. This involves comparing one's performance, abilities, or resources with those of others to establish a sense of relative superiority or to attain rewards, success, or recognition. Competition can manifest in various domains such as academia, sports, business, and interpersonal relationships, shaping behavior and influencing outcomes in these contexts.

Competition encompasses various important elements that influence human behavior and social dynamics. Firstly, motivation plays a significant role as it serves as a powerful driving force, pushing individuals to excel and achieve greater heights. The desire to succeed and outperform others can fuel increased effort, persistence, and focused behavior.

Additionally, competitions often incorporate awards and incentives as external motivators. The promise of rewards, prizes, or recognition can further enhance individuals' motivation to participate and perform at their best. Such extrinsic factors create an added sense of purpose and drive individuals to give their utmost effort.

Evaluation of results is a crucial aspect of competitions. Scores, ranks, or accomplishments are assessed and compared, providing objective feedback for individuals to gauge their performance. These evaluations serve as unbiased metrics of achievement and enable participants to reflect on their work and progress.

Furthermore, social comparison is a psychological process that plays a significant role in shaping individuals' self-perception and understanding of their position in relation to others. By comparing themselves to others, individuals gain insights into their own abilities, strengths, and weaknesses. Social comparison also helps

individuals comprehend societal or group norms, expectations, and standards, allowing them to align their behavior and characteristics accordingly.

Emotional responses are an inherent part of social comparison. Individuals may experience envy, admiration, or feelings of superiority when comparing themselves to others. Positive comparisons can boost self-confidence, while unfavorable comparisons may trigger negative emotions. It's crucial to remember that social comparison and competitiveness may have both positive and negative impacts. While healthy competition can be motivating and lead to performance improvement, excessive or unfavorable competition can induce stress, anxiety, and negative social dynamics.

Understanding the psychological processes, motivations, and dynamics involved in competition and social comparison provides valuable insights into individual behavior and social interactions. It highlights the intricate interplay between motivation, evaluation, self-perception, and social norms, offering a comprehensive understanding of how these factors shape human experiences and outcomes.

Competition has been a subject of study for economists and psychologists for several decades, leading to ongoing discussions and the emergence of new questions that require thorough exploration and understanding. The relevance of this topic remains high, particularly as researchers aim to comprehend competition from a strategic management perspective, moving beyond the realm of psychology alone. Given the inherent connection between strategic management and psychology, it becomes essential to interpret human behavior throughout various stages of personal interactions.

Understanding the complexities of human behavior in competitive scenarios can be challenging, as the outcomes and results may not always be immediately apparent. However, delving deeper into the topic and exploring the specific connections that shape human behavior can provide valuable insights and facilitate appropriate performance and responses. Our behaviors are often reactions to external stimuli and interactions with others, and when individuals engage in competitive endeavors, their performance is influenced by a multitude of external and internal factors.

By examining the intricacies of human behavior in competitive contexts, we can comprehend the underlying dynamics and mechanisms at work more thoroughly. This understanding can guide decision-making, strategic planning, and the development of effective approaches to navigate and succeed in competitive environments.

Ultimately, the integration of psychological insights into strategic management allows for a more nuanced understanding of human behavior and enhances our ability to adapt and thrive in competitive settings.

Within the realm of competition, there exists a concept known as in-group favoritism, which suggests that individuals tend to perceive competitors who possess non-ability attributes similar to their own as more competitive. This phenomenon is driven by the human tendency to seek validation and affirmation of their own abilities and identity. When individuals perceive others who share similar attributes as more competitive, it can serve to bolster their self-perception and enhance their confidence in a competitive setting.

The implications of in-group favoritism are significant for performance outcomes. When individuals perceive a close competitor who shares similar attributes, it can ignite a sense of motivation and engagement in competitive situations. The recognition of a rival who is seen as similar can fuel increased effort, persistence, and a heightened sense of rivalry. These factors, in turn, can have an impact on performance outcomes.

By understanding the dynamics of in-group favoritism in the context of competition, individuals and organizations can better comprehend the underlying motivations and behaviors that influence performance. Recognizing the significance of perceived similarity in competition can inform strategies and interventions aimed at enhancing motivation, fostering a positive competitive environment, and maximizing performance potential.

Garcia and Tor (2009) were one of plenty researchers, who studied N-Effect. They already proved that the presence of more competitors leads to the less competition, as the increasing number of competitors lowers the motivation to compete. The main objective of this thesis also covers N-Effect perspectives and is aimed to discover the N-Effect phenomenon but from another perspective. Not only the number of competitors would raise during the experiment but also the nature of competitors will change. By “nature of competitors” are meant two different types of competitors, precisely, strangers and friends. It is assumed that the nature of competitors would influence the strength of N-Effect. The research would show, which groups would behave differently and would show the possible aspects (time limit, number and nature of competitors) of their behavior.

Literature review showed that many studies, which were conducted to check the existence of N-Effect were proved and moreover, competition was connected to social comparison and self-evaluation (Tesser, 1988). This study additionally includes social comparison and assumes that it influences the strength of N-Effect.

This study introduces and explains different researchers and their studies in order to be better informed about the topic, which is going to be examined, together with hypotheses and current research.

Chapter 1 describes the main idea of the thesis and its structure. Chapter 2 represents literature review of related studies and shows some graphs for a better understanding of the literature. Chapter 3 introduces research design, talking about two main aspects: 1) research gap and experimental model; and 2) research questions and hypothesis. Chapter 4 presents methodology of the research, together with method selection, platform selection, study design and procedure. Chapter 5 is evaluation of results (Data Analysis and evaluation of results). Chapter 6 summarizes the thesis, talks about limitations of the study and gives advices for a possible future research.

2 Background

This chapter is aimed to present the background of the thesis and gives the main explanation of its objectives.

Section 2.1 (together with 2.1.1) explains the main studies, which are related to the thesis and shows the short overview of what was researched before. Section 2.2 includes the main definitions, which are often used in the paper.

2.1 Literature Review of Related Studies

Plenty of scientific papers were reviewed in order to determine the research gap and research question for the thesis. The main research papers, which are useful for this paper were concluded and explained below. With understanding of the reviewed papers, it is easier to conduct another valuable survey, similar to already given ones but at the same time with elements of improvement and extension, which weren't examined before.

Triplett's study stands as one of the pioneering investigations delving into the impact of competition on human performance. Through a series of experiments, Triplett explored how the perception of competition and the presence of others influence individual performance. His notable discovery revealed that individuals tend to exhibit enhanced performance when working on tasks alone or in a competitive setting with others. This finding suggests that the mere presence of other individuals can serve as a motivating factor, leading to improved performance. While specific details and intricacies of Triplett's study are not extensively documented, his research laid the foundation for understanding the relationship between competition and performance. Subsequent studies have further built upon Triplett's work, delving into the psychological mechanisms and contextual factors that underlie the effects of competition on human behavior in more comprehensive ways. These subsequent investigations have shed light on the intricacies of how competition influences motivation, effort, and performance outcomes. By exploring various psychological processes, such as social comparison, intrinsic and extrinsic motivation, and goal orientation, researchers have deepened our understanding of the complex interplay between competition and individual performance. Through continued research, scholars have expanded upon Triplett's initial insights, providing a more nuanced understanding of how competition impacts human behavior and performance in diverse domains. This growing body of knowledge enables us to comprehend the underlying mechanisms and conditions that shape the effects of

competition, paving the way for practical applications in areas such as education, sports, and organizational settings.

Triplett's groundbreaking study on dynamogenic factors in pace making and competition, conducted in 1898, presented insightful information that advances our knowledge of how competition affects human performance. His research emphasized the importance of having a competitor's presence in order to achieve higher results. According to Triplett, the presence of a competitor stimulates individuals to tap into their latent energy and compete more vigorously than they would when performing tasks alone. Triplett's study delved into the intricate dynamics of competition, highlighting the role of psychological factors in enhancing performance. He argued that individuals should engage their minds in a state of "worry" about the outcome of the competition, as this heightened mental engagement can be better achieved when competing against others. This aligns with the findings of this paper, which explores how a competitive environment can influence an individual's behavior and performance through a series of experiments. Triplett's research demonstrated that individuals who had competitors in their tasks exhibited faster completion times, indicating greater effort and engagement. The presence of competition seemed to unlock their hidden potential, leading to improved performance. Furthermore, Triplett's study examined the impact of competition on time aspects and found that participants competing together against a competitor required less time to complete tasks. While Triplett primarily focused on social psychology and sports psychology, his work holds relevance for strategic management thinking as well. The connection between competition, human behavior, and performance extends to various domains, prompting numerous researchers to conduct additional surveys and studies to further elucidate these relationships. By building upon Triplett's foundational research, subsequent studies have explored the multifaceted nature of competition, investigating its effects on motivation, effort, and performance outcomes. These endeavors aim to provide a clearer understanding of the interplay between competition and strategic management, shedding light on how individuals can optimize their performance in competitive environments across various contexts (Triplett, 1898).

Following Triplett's pioneering work, Gordon Allport, a prominent psychologist, conducted research that further explored the relationship between competition and performance. Allport aimed to learn on Triplett's results and research more about how various circumstances impact performance. Allport's experiment involved participants performing tasks either individually or in a co-working group, without direct competition. The results revealed interesting patterns. Individuals working alone took more time to complete the tasks but

produced higher-quality work. On the other hand, participants working in teams completed the tasks more quickly but exhibited lower-quality work. Allport attributed these contrasting outcomes to two factors. Firstly, when working in a group, there is a significant influence of self-evaluation and distraction. The presence of others may lead to self-comparison and a shift in focus, potentially affecting individual performance. Secondly, when working alone, individuals recognize the need to exert greater effort to achieve the desired outcome, resulting in heightened performance but with the trade-off of increased time requirements. This phenomenon can be understood as the facilitation effect, where the presence of others influences an individual's performance. The findings from Allport's study contribute to our understanding of how competition and social context impact performance outcomes. It highlights the interplay between individual effort, group dynamics, and the quality of work produced in different settings. By considering the effects of competition and collaboration, researchers can better comprehend the complexities of performance and create approaches to maximize both individual and group accomplishments across different environments. (Allport, 1920).

The next researcher, who continued to examine earlier performance studies was Dashiell (1930). He aimed to demonstrate that diverse audiences and fellow participants could also influence performance (Could this also apply to groups of strangers and friends? This study will provide answers to these questions.) In his investigation on social facilitation, he discovered that contrary to previous research, the quality of the task remained unaffected, but the presence of direct competition within a group motivated participants to work at a faster pace and complete the task sooner compared to when working alone.

The "Social Facilitation Theory" was developed by Robert Zajonc in 1965 as a result of his research on how social interaction affects a person's behavior. His research revealed the social facilitation effect, where an audience can improve performance on straightforward activities while degrading it on more difficult ones. Zajonc proposed that having other people around raises arousal, amplifying the dominant response. This leads to improved performance in simple tasks but can create interference in complex tasks. Zajonc's work has significantly contributed to social psychology and has been further explored in subsequent studies, uncovering the intricate relationship between others' presence and individual performance in different task contexts.

According to Zajonc's research in 1965, the effect of other people on a person's achievements rely on how difficult the activities are. When participants are faced with familiar questions, the presence of others can lead

to improved or "perfect" performance. However, when encountering new or unfamiliar tasks, the presence of others can result in "imperfect" performance (Zajonc, 1965).

To further investigate the impact of social interaction on performance, another study building upon Zajonc's work was conducted by Henchy and Glass (1968). Their research focused on evaluating the impact of the expectation of evaluation on task performance. The results of their study revealed that in a group where participants were aware that their work would be evaluated, the performance was better compared to another group where participants believed their work would not be evaluated. This suggests that the anticipation of evaluation can influence performance outcomes in a social setting (Henchy and Glass, 1968).

Sanders and colleagues (1978) proposed that distraction plays a significant role in influencing task performance. They suggested that when individuals are carrying out an action in front of a crowd, the presence of the audience serves as a source of distraction that can impact the outcome. The researchers introduced the concept of distraction conflict, which occurs when individuals' attention is divided between the task at hand and the desire to gather social comparison information from the audience or competitors. According to their hypotheses, individuals may shift their focus away from the task in order to gain information about their performance relative to others, leading to potential disruptions in task performance (Sanders and colleagues, 1978).

Bond (1982) suggested that individuals have a desire to demonstrate competence in a competitive environment. This desire to be perceived as competent can positively influence performance on easy tasks. In such situations, individuals are more likely to engage in competitive behavior and strive for better results. However, when it comes to difficult tasks, individuals may experience self-doubt and a worry that one won't be able to measure up to the competition's standards. Hence, their performance may decline as they perceive themselves as less capable or knowledgeable in comparison to their competitors. Bond's findings highlight the impact of task difficulty on individuals' willingness to compete and how it can influence their performance outcomes.

Indeed, the presence of different audiences or co-participants can potentially influence performance through various psychological mechanisms. Here are some possibilities to consider:

Predisposition to Evaluation: When individuals believe they are being observed or evaluated by others, they may experience evaluation apprehension. This self-consciousness can lead to a desire to perform well in order to receive praise or avoid criticism, potentially affecting their performance.

Social Facilitation: The presence of others, especially when they are perceived as competent or evaluative, can increase arousal and alertness. This heightened state of arousal can enhance performance on well-practiced or dominant tasks, known as the social facilitation effect. However, for tasks that are novel or complex, social inhibition may occur, making it more challenging to perform effectively.

Social Comparison: When individuals are surrounded by others, they may engage in social comparison, comparing their abilities, performance, or outcomes with those of others. This comparison process can lead to striving to match or exceed the performance of others or adjusting one's effort based on perceived norms. Both motivation and performance can be influenced by this process of comparing oneself to others.

These psychological mechanisms highlight the potential impact of audiences and co-participants on performance outcomes in various contexts. Understanding these influences can help individuals optimize their performance and navigate social interactions effectively.

It is important to acknowledge that the specific effects can vary depending on factors such as task complexity, individual differences, the nature of the audience, and the specific context. Researchers have conducted more in-depth psychological studies on social comparison, social inhibition, and social facilitation, which have provided further insights into how different audiences and co-participants can influence performance. The findings from these studies enhance our understanding of the intricate dynamics of performance in social settings. They provide valuable insights and knowledge that can be applied to develop strategies for optimizing performance in a wide range of contexts. By considering the impact of different audiences and co-participants, as well as factors like task complexity and individual differences, strategies can be tailored to create an environment that fosters optimal performance. Implementing strategies informed by these studies can help individuals and organizations maximize their performance outcomes and achieve their goals more persuasively.

All these papers, mentioned above, contribute to the development of a research framework aimed at deepening our understanding of competition within different groups. By incorporating elements of enhancement and building upon existing knowledge, a clear and focused experiment can be designed. The literature review process allows for the synthesis of theories and models, which in turn helps in the creation of a conceptual framework for data analysis and interpretation. Insights from the reviewed papers, including information about results, outcomes, and survey designs, are considered to inform the design of a new experiment. Factors such

as the number of competitors, the presence of different audiences or co-participants, and the inclusion of information about rewards for task completion are considered during the experiment design phase. By leveraging the knowledge gained from previous studies, the new experiment aims to provide further insights into the phenomenon of competition and its dynamics in different group settings.

2.1.1 Competitive Behavior and Social Comparison

Competition is a pervasive aspect of our daily lives, and its influence extends to the psychological level. Even without conscious awareness of competition, individuals naturally strive to outperform others in various aspects of their routine activities. Festinger (1954) highlighted the inherent drive for self-improvement and the pursuit of excellence that motivates individuals to constantly seek to surpass their peers.

Leon Festinger's 1954 study on social comparison theory was a groundbreaking contribution to our understanding of competitive behavior and the psychological processes underlying it. Festinger's experiment focused on how individuals engage in social comparison to evaluate themselves and their abilities relative to others. The study involved participants estimating the number of beans in a jar. They initially made their estimates individually, without any external reference. Afterward, two groups of competitors were created. During "Comparison Condition," participants were brought into a room with two confederates who were instructed to purposely overestimate the number of beans. Participants were then asked to publicly state their own estimates. On the other hand, in the "Non-Comparison Condition," participants made their estimates without the presence of others or any opportunity for social comparison. Festinger's primary interest was in observing the participants' subsequent behaviors and attitudes after the estimation task. He hypothesized that participants in the comparison condition would experience cognitive dissonance due to the discrepancy between their own estimates and those of the confederates. Festinger predicted that participants would adjust their estimates to align more closely with the confederates' overestimations as a way to reduce the cognitive dissonance. The results of Festinger's study supported his hypothesis. Participants in the comparison condition indeed adjusted their estimates to be more in line with the confederates' overestimations. This adjustment was seen as a strategy to alleviate the cognitive dissonance caused by the mismatch between their initial estimates and the group consensus. Festinger's study highlighted the significant influence of social comparison on individuals' beliefs, attitudes, and behaviors. It demonstrated how people evaluate themselves by comparing their estimates to those of others in competitive situations. This research laid the groundwork for further

exploration of social comparison theory, which has since been applied to various domains, including competitive behavior. It suggests that individuals' motivation to compete and their evaluation of their own performance can be influenced by the social comparisons they make with others in competitive settings (Festinger, 1954).

Festinger's (1954) research on competitive behavior shed light on the important role of social comparison in understanding competitive dynamics. The concept of social comparison becomes crucial in comprehending the underlying mechanisms and potential outcomes of competition. For this paper, social comparison was identified as a mediator between the independent and dependent variables in the research model. Festinger emphasized the significance of understanding the nature of social comparison in order to gain insight into competitive behavior. As humans, we have an innate tendency to evaluate ourselves and compare our abilities with others, particularly in competitive situations. This process involves observing the behaviors and performances of others as a basis for self-assessment. However, it is important to note that these comparisons may not always align with reality. When individuals engage in social comparison that does not accurately reflect their own abilities, they may encounter challenges and difficulties. They might strive to achieve goals or levels of performance that surpass their actual talents or knowledge. Therefore, when comparing ourselves to others in a competitive context, it is crucial that the individuals being compared align with our own abilities and skills. This alignment ensures a more accurate and meaningful basis for self-evaluation and competitive striving.

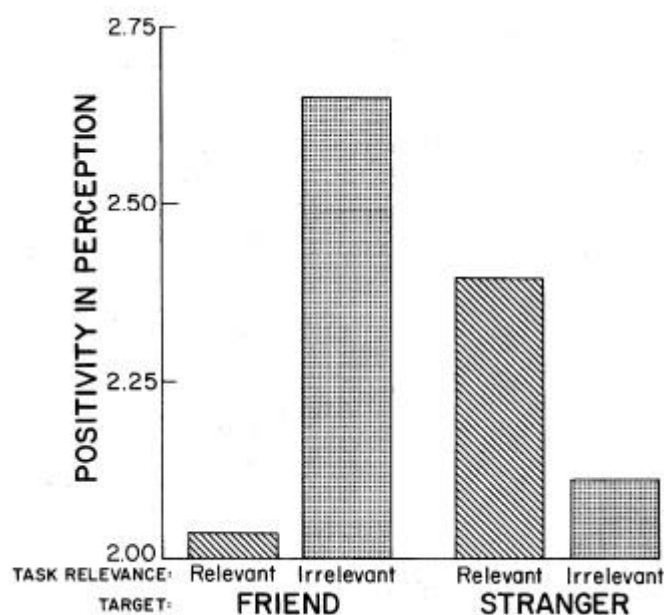
The study conducted by Goethals and Darley (1977) focused on the Related Attributes Hypothesis and its impact on competitive behavior. They explored how the presence of appropriate competitors and the proximity of competitors can influence the level of competition exhibited by individuals. The researchers found that individuals tend to look beyond mere ability when evaluating their competitors. Instead, they consider non-ability attributes that are similar to their own, which in turn enhances their belief in their own competitiveness within the group. The results of this investigation imply that the perceived similarity of attributes between individuals and their competitors plays a significant role in stimulating competitive behavior. When individuals perceive their competitors as more closely aligned with themselves in terms of non-ability attributes, they are more likely to engage in heightened competition. This could be due to the belief that they have a higher chance of success or that the competition is more relevant and meaningful to their own identity. The study highlights the importance of considering factors beyond ability alone when examining competitive behavior. It suggests

that individuals' perceptions of the attributes of their competitors, particularly those that are personally relevant and similar to their own, can significantly influence their level of competitiveness. These factors, in turn, have implications for individual performance in competitive environment.

There are plenty of researchers, who examined social comparison and competition, and they also claimed that social comparison theory (Festinger, 1954) is strongly connected with competition. Jones and Rachlin (2006) examined behavior between friends and strangers. Analogous to Goethals and Darley (1977), they claimed that friends compete harder against each other, rather than against strangers. Thus, the competition between friends is higher than among strangers. In this research it was examined and explained below, what differences strangers' and friends' groups may also have between them.

Tesser (1988) researched self-evaluation maintenance model (SEM). Social psychologist Tesser is well-known for his work in the areas of self-evaluation maintenance theory and self-esteem. The research done by Tesser investigates the ways in which self-evaluation and self-esteem can be impacted by the presence of others and social comparisons. These aspects may have an indirect connection to competition because competing often entails comparing oneself to other people and striving to perform better than them. It explains the importance of the comparison, while competing towards someone and claims that competitive behavior depends on perceived psychological proximity to a competitor. People tend to compare themselves with others, which extremely influences their behavior towards a person. This SEM model includes two components: 1. reflection process; and 2. comparison process. Both processes interact with a person's (opponent's) knowledge and skills while performing a task and closeness of an opponent. Excellent performance of an opponent can decrease self-evaluation and thus, decrease performance in general. While comparing ourselves to others, we create a "block" in our mind, which denies our mind to believe that we can perform better, or to compare with a person at all. Considering an example from Tesser's study (1988) about two friends, who wanted to be in a symphonic band together and applied for it. Only one of the friends was selected. As a result, the one, who was refused for the band started to feel insecure and her self-esteem went down. They were comparing themselves with each other, because they were close (friends) and knew each other better than any other contestant. In this case both would more care to compare the skills, which they have, rather than compare themselves to somebody else. At the same time, if a friend, who wasn't selected for the band would reduce her closeness to the one, who was selected (by doing other things, what matter to her and not meeting the friend that often), the impact of the good performance of the friend, who was selected would be reduced and a self-definition would raise.

Figure 1 Self-Evaluation Maintenance Model



Source: Tesser and Campbell, 1982, pp. 261-279

Figure 1 presents the results of a study conducted by Tesser and Campbell (1982), focusing on the perception of friends and strangers during different types of tasks that are either relevant or irrelevant to a person's self-definition. The bar chart illustrates the level of positivity observed in participants' perceptions and the tendency to help either a friend or a stranger. The findings indicate a distinct pattern depending on the task's relevance to a person's self-definition. When the task is deemed irrelevant to one's self-definition, individuals are more inclined to extend assistance to a friend than a stranger. Inferring from this, in non-personally relevant tasks, people prioritize their established relationships and show a greater inclination to support friends. In contrast, when the task holds personal relevance to one's self-definition, the pattern shifts. Participants were more inclined to help a stranger rather than a friend. This finding suggests that in tasks that directly relate to one's self-identity, individuals may display a willingness to assist strangers, potentially due to a desire to establish a positive impression or gain social approval. By examining the perception and willingness to help friends and strangers in different task contexts, Tesser and Campbell provided insights into the complexities of social dynamics and the interplay between personal relevance, self-identity, and social relationships. These findings contribute to a deeper understanding of how individuals navigate social interactions and decision-making

processes based on the task's relevance to their self-concept and the nature of their relationships with others (Tesser and Campbell, 1982).

Understanding the Structural Equation Modeling (SEM) model requires careful consideration of various factors and complexities. Tesser (1988) conducted multiple experiments to explore the factors influencing human behavior and shed light on the systemic nature of SEM. One notable aspect of Tesser's research is the examination of variables that simultaneously act as both causes and effects. For instance, Tesser investigated the interplay between achievements, actions, results (performance), and the closeness of players during interactions. The findings revealed that these variables are interconnected and mutually influence each other. Performance serves as a result of the interaction between relevance and closeness. In other words, the level of performance during an interaction is influenced by the relevance of the task and the degree of closeness between the individuals involved. Similarly, closeness can be a consequence of the interaction's performance and the relevance of the task. Lastly, relevance is determined by the interaction's performance and the level of closeness between the participants. This reciprocal relationship among performance, closeness, and relevance highlights the complex nature of social interactions and the dynamic interplay between these variables. Tesser's research contributes to a deeper understanding of the systemic nature of the SEM model and the intricate relationships among its components. By considering these findings, researchers can gain insights into the reciprocal effects and influences within the SEM framework. Tesser's work emphasizes the importance of examining multiple variables and their bidirectional relationships, ultimately enhancing our understanding of human behavior and social dynamics (Tesser, 1988, p. 202).

Following Tesser's SEM Model, many further details should also be understood. Antecedent conditions are part of the model. While reviewing them, it's easier to imagine SEM processes and the way they are connected to emotions and behavior.

Let's discuss more how exactly the SEM-Model operates (with antecedent conditions). Reflection and comparison processes are results of antecedent conditions, which include relevance, performance and closeness. (This information was considered while preparing the experiment for this paper, where the performance of 2 experimental groups was compared.). These conditions have possibly perceptible relationships with emotional behavior and behavioral adjustment and possibly influence on them. Moreover,

they can either threaten self-evaluation, or assure a benefit in self-evaluation (through reflection). (Tesser, 1988, p. 209)

Plous (1993) highlighted the problem of overconfidence in decision making, particularly in competitive situations. Overconfidence arises from cognitive biases such as confirmation bias, illusion of control, anchoring bias, and availability heuristic. These biases lead individuals to be excessively confident in their judgments and abilities, which can result in errors and biased decision making. Understanding and addressing overconfidence is crucial for making accurate and rational decisions in competitive contexts.

Plous emphasized that overconfidence can impede decision making by limiting consideration of alternative perspectives, disregarding important information, and promoting excessive risk-taking. He emphasized the importance of recognizing and addressing overconfidence to enhance decision-making processes and outcomes. Plous's work aligns with research in psychology and behavioral economics that explores biases and heuristics in decision making. Understanding the impact of overconfidence enables individuals and organizations to make informed and rational decisions by embracing a wider range of possibilities and being mindful of potential biases (Plous, 1993).

Numerous studies have supported the notion that overestimation is a significant factor worthy of further investigation. In various contests or tasks, individuals exhibit reactions based on the nature of the task, be it simple or difficult. They tend to believe that their performance will be both lower and superior to competing performance on difficult jobs, indicating a connection to overconfidence (Moore and Healy, 2007).

Larrick, Burson, and Soll (2007) conducted an experimental study examining people's responses to hard and easy tasks. The findings revealed that easy tasks led to overconfidence and better-than-average effects, while hard tasks resulted in worse-than-average perceptions and, interestingly, overconfidence as well. These phenomena can be attributed to individuals' inclination to compare themselves to others.

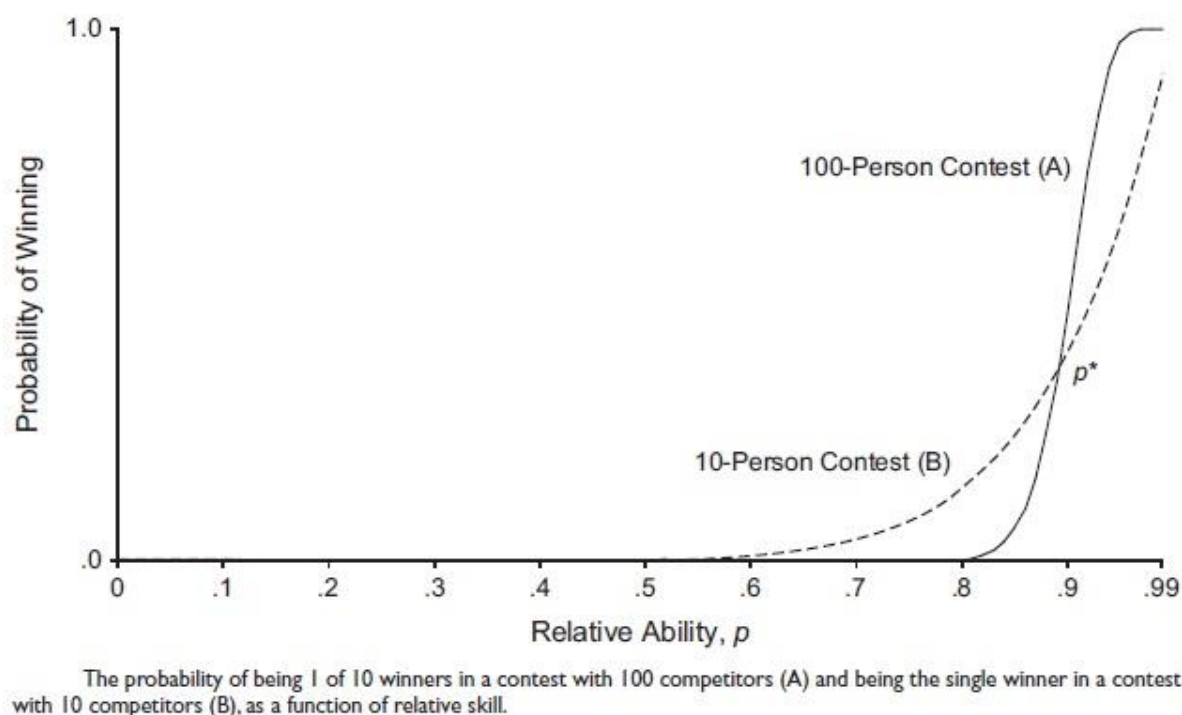
Salvador (2005) conducted research on competitive situations in humans and their implications for understanding the effects of social stress and its relationship with various pathologies. Competitive situations trigger psychobiological coping responses, leading to increased stress levels and changes in behavior compared to non-stressful situations. These psychological processes influence our thoughts and actions, even if we may not be consciously aware of them (Salvador A., 2005, p.195).

Moore and Small (2007) conducted a study that explored the phenomenon of comparative judgment and specifically investigated the differences between better-than-average (BTA) and worse-than-average (WTA) effects. The researchers found that individuals often have a better understanding of their own abilities and skills compared to their knowledge about the abilities of others, especially when encountering someone for the first time. This lack of information can lead to incorrect assumptions about the qualifications or lack thereof of other individuals. In the context of this paper, these findings are relevant as two different groups will be tested with varying levels of information about their competitors: one group will be familiar with their competitors, while the other group will have no prior knowledge of their competitors. The results of this experiment will be presented at the end of the paper.

Hogarth and Mukherjee (2010) conducted a study building upon the research of Garcia and Tor (2009), titled "The N-Effect: Possible Effects of Differential Probabilities of Success", 2010. The study aimed to explain competitive behavior by examining the impact of sample size on the chances of weaker players winning. The researchers found that in a small-sized sample, weaker players had a higher probability of winning, which motivated them to compete harder. However, as the sample size increased, the chances of weaker players winning decreased. The study also emphasized the role of social comparison processes in influencing participants' behavior during competition. The availability of more information about competitors was suggested to potentially lead to different behavioral responses. The paper mentioned that understanding the influence of information about competitors, whether known or unknown, could have implications for motivation and performance. In the context of this paper, groups of strangers and friends were created to explore and analyze how information about competitors affects the outcomes of the competition.

One more figure below (Figure 2) from the research of Hogarth R.M. and Mukherjee K. (2010) was taken to explain some more elements of the N-Effect, which was also tested in this paper under different conditions. In order to specify the N-Effect one more time and see graphically, how number of competitors may influence the result (for the future research understanding), it is important to understand the outcomes of the survey properly. The description of the Figure 2 is written below.

Figure 2 The probability of being 1 of 10 winners in a contest with 100 competitors (A) and being the single winner in a contest with 10 competitors (B), as a function of relative skill



Source: Mukherjee and Hogarth, 2010, p. 746

Figure 2 shows that a probability of winning in each round depends on p . Smaller competition is described by Contest (B) and larger competition by Contest (A). Players of the Contest (B) have a higher chance to win, rather than players of the Contest (A) up to the point when p equals p^* . Above the point p^* players of the Contest (A) have a higher chance to win. The idea behind explains that in a smaller sample, weaker players have more chances to win but it changes when the number of competitors raise.

Delving further into the research, Garcia and Tor conducted a study in 2006 titled "A Comprehensive Model of the Psychology of Competition: From Economic Outcomes to Social Evaluations of Competitors." Their study's major goal was to create a thorough model that accounts for both economic and social elements in order to improve our comprehension of the psychology of competition. They sought to investigate how economic outcomes, such as rewards and incentives, along with social evaluations of competitors, influence individuals' behavior and attitudes within competitive environments. By integrating these diverse factors, the researchers

aimed to provide a more comprehensive and holistic perspective on the intricate dynamics involved in the psychology of competition.

Garcia and Tor (2006) identified two factors that contribute to competitive behavior: proximity to a standard and the N-effect. Proximity to a standard refers to the tendency for competition among similarly skilled rivals to intensify when a meaningful standard is present. In their study, participants had to choose between two reward options, one of which resulted in a higher reward but also a higher payoff for the competitor, while the other option offered a lower reward but an equal payoff for the competitor. In conditions where a high rank was emphasized (proximity to a standard), participants preferred the option with a lower payoff for the competitor. In another article by Garcia and Tor (2009) titled "More competitors, less competition," they explored the impact of reducing the number of competitors on competitive behavior. Their research utilized Scholastic Assessment Test (SAT) and Cognitive Reflective Test (CRT) scores. They conducted experiments with university undergraduates using publicly available tests, collecting data over a period of three years with over 1,000 participants and 22 test-taking opportunities. The findings revealed that as the number of participants increased, the average SAT scores decreased. While replicating this extensive study may not be feasible for the current paper, it could be beneficial to create a condensed version by contrasting different types of competitors, such as strangers and friends, and examining the differences between the two groups within a similar competitive environment. In the procedure of other experiments conducted by Garcia and Tor, a smaller sample of 74 undergraduates was used. Participants were informed that the tasks were time-constrained, and they were competing against either 10 or 100 competitors. Those who ranked in the top 20% would receive a \$5 reward. The results showed that when participants competed against only 10 competitors, they completed the tasks faster compared to when they believed they were competing against 100 competitors. The increase in competitors decreased motivation to compete, which could potentially extend to social comparison effects as well. Taking inspiration from the experimental design of Garcia and Tor's studies, it would be beneficial for this paper to include an increase in the number of competitors to examine the presence of the N-effect. Additionally, providing participants with motivation to compete, such as a reward, could enhance their engagement. Furthermore, incorporating a suitable testing method, similar to SAT or CRT, would be valuable (Garcia and Tor, 2006).

The field of competition psychology explores several key aspects and concepts, including the following:

Economic Outcomes: The effects of rewards, incentives, and monetary gains on motivation, behavior, and performance in competitive situations.

Social Evaluations: How individuals perceive and evaluate competitors, including forming impressions, judging competence, and how these evaluations influence one's own behavior and performance.

Competitive Behavior: Examining various aspects of behavior in competition, such as strategies used, risk-taking tendencies, decision-making under pressure, and how individual differences shape competitive behavior.

Psychological Processes: Understanding the underlying psychological mechanisms that mediate the relationship between competition and behavior, such as self-efficacy, self-esteem, motivation, cognitive biases, and emotions like envy, pride, or anxiety that are relevant to competitive contexts.

Implications for Social and Economic Life: Exploring the broader implications of competition in social and economic contexts, including its impact on well-being, satisfaction, cooperation, and the dynamics of competitive interactions within groups or organizations.

These aspects and concepts provide a framework for understanding the psychological dynamics of competition and shed light on its effects on individuals and society as a whole.

2.2 Definition of Key Terms

The objective of this chapter is to explain main key terms, which are frequently used in the thesis.

N-Effect - refers to the phenomenon where increasing the number of competitors in a competitive situation can actually decrease individuals' motivation to compete. This discovery, as described by Garcia and Tor (2009), highlights the counterintuitive relationship between the number of competitors (N) and competitive motivation. In other words, as the number of competitors increases, individuals may become less motivated to engage in competition. This finding challenges the assumption that more competitors inherently lead to increased motivation and suggests that social comparison processes and other factors play a role in shaping individuals' competitive drive (Garcia, S.M., Tor, A., 2009).

SEM - Self-Evaluation Maintenance Model - is a psychological structure that examines how individuals navigate their self-assessments when considering their place in communal connections (Tesser, 1988).

Social Comparison Theory - (introduced by Festinger in 1954) examines how individuals engage in the act of comparing themselves to others in order to assess and evaluate their own opinions, abilities, and attributes. According to this theory, people possess an innate motivation to evaluate themselves, and they accomplish this by engaging in social comparisons with others.¹

Overestimation - refers to the cognitive bias in which individuals tend to perceive or judge volume, capacity, or benefit to be higher or bigger than its true extent or scale. It involves the tendency to overestimate or overperceive the magnitude or value of a quantity or dimension.²

The better-than-average-effect (BTAE) - is an error in judgment, in which individuals believe that their own skills, qualities, or personal attributes surpass those of the regular person. It is a common anomaly where people rate themselves more positively and perceive themselves as being above average in numerous areas. (Zell, E., Sedikides, C., Strickhouser, J.E., Alicke, M.D., 2020, p. 118).

The worse-than-average-effect (WTAE) - is a cognitive bias in which individuals have a tendency to undervalue their own achievements and capabilities when comparing themselves to others. It stands in contrast to the better-than-average effect (BTAE), where individuals tend to perceive themselves as superior. In the context of WTAE, individuals often perceive themselves as performing below average or having inferior abilities in comparison to their peers.³

¹ <http://noba.to/y4urxhyj> , retrieved on 16.05.2021

² <https://dictionary.cambridge.org/dictionary/english/overestimate?q=overestimation> , retrieved on 16.05.2021

³ <https://www.alleydog.com/glossary/definition.php?term=Worse-than-Average+Effect> , retrieved on 16.05.2021

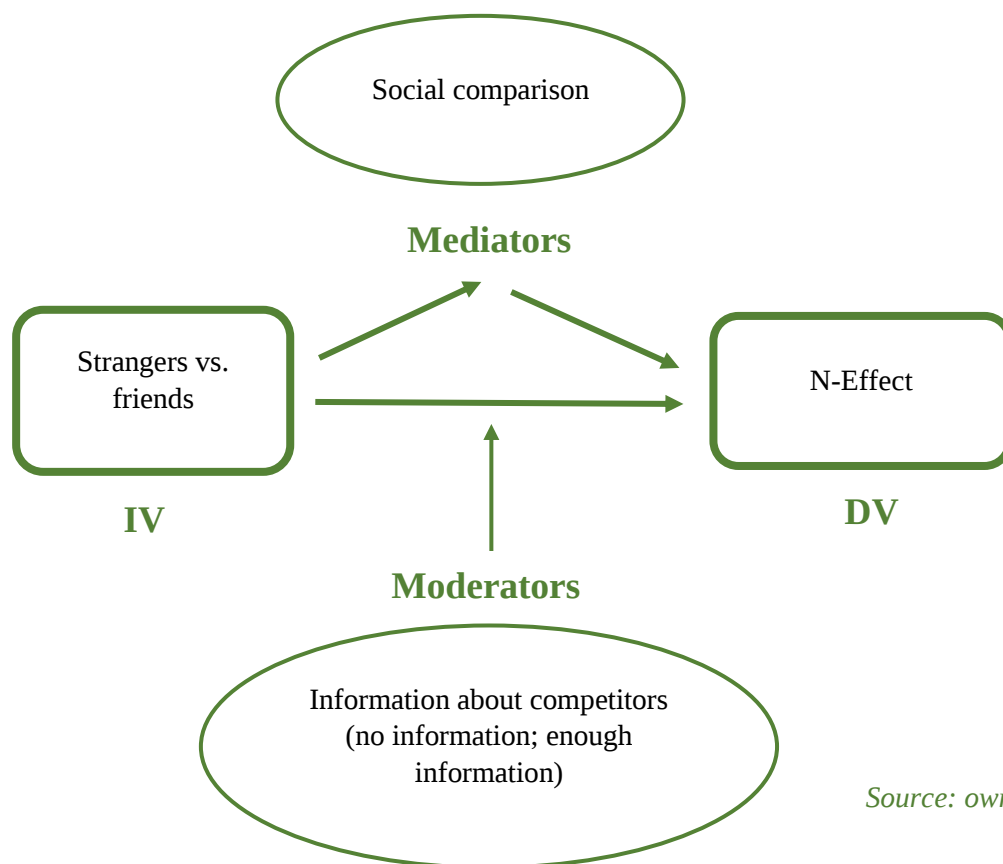
3 Research Design

This chapter is aimed to explain the research design, precisely, research gap and experiment model. Moreover, research question and hypotheses are also introduced below.

3.1 Research Gap and Experiment Model

After conducting an extensive review of the literature, it becomes apparent that there is a limited number of research papers that comprehensively explain the various aspects of the N-Effect. While this phenomenon has been studied, there are still gaps in our understanding of the underlying processes associated with it. The primary aim of this thesis is to investigate whether the type of competitors has an impact on the strength of the N-Effect and to identify other factors that may influence it. Additionally, the study aims to examine the impact of social comparison on two different types of competitors in shaping the N-Effect by manipulating the nature of competitors. By exploring these factors and their interactions, this research seeks to enhance our understanding of the N-Effect and shed light on the underlying mechanisms that contribute to its occurrence.

Figure 3 Experiment Model



Source: own representation

An *Independent Variable* represents strangers and friends, in other words, the nature of competitors. It is expected that IV will have an influence on the DV in this research.

A *Dependent Variable* represents N-Effect. As it was explained before, N-Effect is a process, when increasing number of competitors lead to the decrease of motivation.

Mediators show how are these two variables (Independent Variable and Dependent Variable) connected. In this case, they are related through social comparison. This process influences the decision-making and thus, it has an impact on the N-Effect.

Moderators show how the relationship between 2 variables changes because of different groups of competitors (whether we have enough information to make a comparison or there is no information at all).

3.2 Research Question and Hypotheses

In order to explain and study deeper the experimental model of the thesis, the following research question and hypotheses were created. The aim was to test the study of Garcia and Tor (2009) once again, and check, whether N-Effect is always possible to find, when the number of competitors raise. Therefore, similar hypotheses were created.

Research Question:

How the nature of the competitors (friends vs. strangers) influence the strength of the N-Effect?

Hypothesis (H1): The nature of the competitors does influence on the strength of the N-Effect.

In addition, some other hypotheses would also be studied:

H1a: There is a difference (in time) between the Level 1 and the Level 2 in the Strangers' Group (N-Effect is present).

H1b: There is a difference (in time) between the Level 1 and the Level 2 in the Friends' Group (N-Effect is present).

H1c: There is a difference (in correct answers) between the Level 1 and the Level 2 in the Strangers' Group (N-Effect is present).

H1d: There is a difference (in correct answers) between the Level 1 and the Level 2 in the Friends' Group (N-Effect is present).

Some other hypotheses would also be examined:

H2: There is influence of social comparison on the strength of the N-Effect, when the environment (competitors) changes.

H2a: There is a difference of social comparison between two groups in the Level 1.

H2b: There is a difference of social comparison between two groups in the Level 2.

The anticipated result of this experiment has been the affirmation of H1, specifically, that the nature of the competitors (friends vs. strangers) does influence on the strength of the N-Effect.

4 Methodology

This chapter provides a comprehensive overview of the study's methodology, aiming to test the previously stated hypotheses and determine their validity. The primary research approach employed in this study is experimental in nature. Within this chapter, there are four key subchapters: method selection, platform selection, study design, and procedure. The final subchapter specifically focuses on detailing the participants involved in the study and explaining the specific procedures implemented. Through these methodological components, the study aims to rigorously examine and ascertain the truth or falsehood of each hypothesis.

4.1 Method Selection

In this research, the data was analyzed using a method known as a two-sample t-test. The purpose of this statistical examination is to determine if there exists a substantial distinction between the means of two unrelated groups of data. The two-sample t-test enables the investigation of the magnitude of distinction between the average values of the two groups under scrutiny. Utilizing this kind of a test within the Excel software facilitates the computation of the t-statistic and the corresponding p-value, which is instrumental in evaluating the statistical importance of the observed differentiation. The p-value signifies the likelihood of obtaining the observed data or achieving outcomes that are even more remarkable, assuming that the null hypothesis is accurate. In hypothesis testing, the selected significance level, also referred to as the alpha level, establishes the threshold at which the null hypothesis is rejected. In this particular study, a standard significance level of 0.05 was established. Therefore, if the calculated p-value falls below 0.05, it leads to the rejection of the H_0 in exchange for the alternative hypothesis.

The t-test is a commonly employed statistical analysis technique used to compare the means of two distinct groups. This method is well-suited for studies involving two samples for several key reasons: 1. It exhibits robustness and reliability, even when dealing with small sample sizes, leading to precise results and valid statistical conclusions. This makes it particularly valuable in situations where extensive data may be limited; 2. It assumes the data follows a normal distribution, which is often a reasonable assumption. This allows for the utilization of parametric statistics, enabling more accurate and convincing statistical statements about the populations being compared; 3. T-test takes into account both the within-group variability and the differences

between the means of the groups. By considering these factors, it provides a more comprehensive analysis compared to simply comparing means without accounting for variability; 4. Additionally, the t-test offers a clear and straightforward interpretation of the results. It calculates a t-value and a corresponding p-value, facilitating the determination of the statistical significance of the observed differences between the two groups. This aids in effectively explaining the findings of the study.

Hence, the t-test is a valuable method for conducting two-sample studies due to all above written issues and namely, its reliability, normality presupposition, consideration of within-group variability, and its simplicity of interpretation. It helps to determine trustworthy statistical results and derive significant findings concerning the disparities between the examined groups.

4.2 Platform Selection

Platform selection process was based on the main 8 criteria, which were important for the survey. All the examined online platforms could be seen in the Table 1 below.

The online platform selection process was based on the availability of needed experimental criteria. It had to include the most important for the experiment measures, such as time per question (time limit and the needed time to solve the task per each participant), possibility of more than 30 participants to take a part in it (was crucial, as many online platforms allow only restricted amount of people, not more than 10 to participate in the survey). It was also necessary to see which exactly questions were answered in a wrong way and the needed time for them (as two levels of each survey had to be compared according to these parameters). The possibility of inserting images was also essential, as some of the tasks included questions with pictures. The platform had to show the most difficult questions of the survey (in a comparison to other survey tasks). Criteria, such as time measure, platform cost, maximum number of participants, availability of graphics after surveys, possibility of inserting images, data export tool, instruction page and unlimited amount of questions were also considered.

Table 1 Platform Selection

								
GoogleSurvey	-	-	∞	+	+	+	+	+
ProProfs	+	+	50	+	+	+	+	+
Qualtrics	-	-	100	+	-	(\$)	+	(\$)
QuestionPro	+	+	∞	+	+	+	+	+
SoGoSurvey	-	+	∞	+	+	(\$)	+	+
SurveyCrest	+	-	50	-	-	(\$)	-	(\$)
SurveyLegend	-	-	∞	-	(\$)	+	+	+
Typeform	-	+	∞	+	+	(\$)	+	+
 - Time measure  - Payment need  - Max number of participants  - Availability of graphics after the survey  - Possibility of inserting images  - Data exportation tool  - Instructions page  - Unlimited amount of questions								
*(\$) Need of payment								

Source: own representation

All the chosen criteria were selected in order to be able to understand platforms' capabilities, pros and cons. As it was mentioned before, one of the most crucial indicators in platform selection was *platform cost*. There are plenty of websites, which offer free survey samples but mostly of them don't included important for the experiment features. Moreover, even from the first sight "free" platforms offer for money some other survey extra tools, which makes them not free to use.

Second criteria, which was important, was *time measure*. The possibility to track each participants time flow was needed to be able to compare 2 levels of the experiment (after increasing number of competitors) and 2 survey groups (friends and strangers).

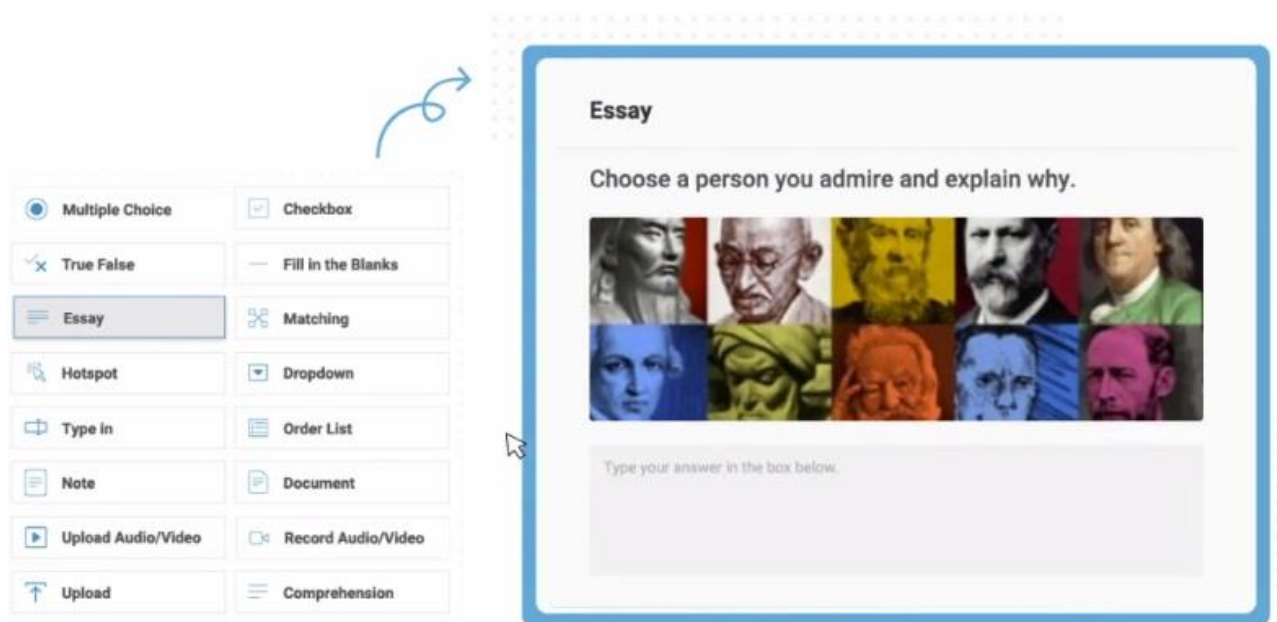
Maximum number of participants was also necessary. Considering, that the research is based on the 2 experimental groups, there was a need to keep a minimum number of people in each group. In our case, each group had to include at least 40 participants.

Instructions page is needed in every survey. Participants must understand what they are dealing with, what are the rules and tasks of the experiment. Many of the online quiz offers don't have such a possibility. That's why it was also considered while choosing a platform.

Availability of the graphics after a survey, data exportation tool, unlimited amount of questions, possibility of inserting images were some extra tools, which were good to use for a survey or after it and see immediately the outcomes.

After comparing all the examined online survey platforms, it was decided to choose the optimal, from the researcher's point of view, survey platform, which is called ProProfs Quiz Maker. A lot of useful tools for designing the survey and the questionnaire for participants made it even comfortable to use.

Figure 4 Platform Tools



Source: ProProfs Quiz Maker. Retrieved on 30.11.2022

Figure 4 above shows what kind of information is possible to use on the slide for each question/task while using ProProfs Quiz Maker. There is a possibility to use multiple choice questions; True/False tasks; write an essay; hotspot some information; just leave a space “type in” for participants to fill them in; to write a note for tasks or inserted pictures; or even upload audio or video for some kind of questions.

Further Pros and Cons are mentioned in the Table 2 below.

Table 2 Pros and Cons of using ProProfs Quiz Maker

Pros and Cons of using ProProfs Quiz Maker	
Pros:	
	• Easy to use (explanation how to create a survey/ quiz is available on the website). • No Software installation needed. • Availability of analysis of the survey in the end (advanced reports and stats). • Possibility to download all the data and the graphics. • Easy audio, video and images insertion. • Tracks individuals and group performances. • Works on all devices.
Cons:	
	• To create a survey for more than 10 participants there is a need to pay at least 20 US Dollars per month. • Even a paid version has its limitations about the number of people, needed for the survey (in the 20 US Dollars version, which is only for one month, the maximum number of participants can't be more than 50).

Source: own representation

There were also some limitations, connected to the platform. As it is shown in the Table 2, after the payment for the needed number of participants (in this case we had 40 people in each research group), there was only 1 month for everyone to answer (participate) in the survey. After the expiration of a paid version (which costs 20 US Dollars per month), there was no more possibility to do the online questionnaire and therefore, in the case, if the needed amount of participants (40 in each group) couldn't finish the experiment in time, there would be the need to create another survey and pay for another extra month.

4.3 Study Design

The study was based on the two experiment groups: strangers and friends (based on Dashiell, 1930, different audiences and co-participants can affect the performance). Each group included 40 people (as it was also in the study of Triplett, 1898). In total 80 individuals were engaged in the experiment. Participants with the age between 21 and 44 participated in the survey. The Mean age for the first group was 28 (strangers), and 31 for the second group (friends). About the gender Data, there were 23 women in each group and 17 men.

Each experimental group received the same type of questions, which were divided into two parts (levels). In general, there were 12 questions, precisely, 6 tasks per each level, concluding CRT (Cognitive Reflective Test) questions and IQ (Intelligence Quotient) questions. The method of the study (CRT testing and IQ) was mainly based on the previous studies of Garcia and Tor "More competitors, less competition", 2009. Information from the previous surveys and experiments of other researchers was also considered, while creating this vary survey. After the end of the online questionnaire, everybody received 6 scaled questions (see Figure 5) about social comparison (self-evaluation) while taking part in the experiment. The aim was to understand how the participants felt themselves towards other competitors (based on the Triplett, 1898) and whether this feeling changed after the level 1 (they got the instructions that the number of competitors is going to raise). During the first level, participants were told only about 5 other competitors, who had to compete with them at the same time. Right after the second level started, the conditions were changed, and they received the description of the next level with rules that they had to compete with 20 competitors at the same time (increase of competitors). Two experimental groups received totally identical questions with the only difference in competitors' descriptions (whether they were competing against a friend/friends, or a strangers/strangers). The

first group was told they had to compete against strangers (they received no extra information about them and their skills), while the second group had to compete against friends (whose skills and knowledge they know about). Each friend group consisted of five persons.

Figure 5 Example of social comparison questions during 2 levels of experiment

During the round 1 in relationship to my competitors I felt											
(define from 1 - 10):											
Anxious	1	*	*	*	*	*	*	*	*	10	Assured
Imperfect	1	*	*	*	*	*	*	*	*	10	Intelligent
Weaker	1	*	*	*	*	*	*	*	*	10	Convinced
During the round 2 in relationship to my competitors I											
felt:											
(define from 1 - 10):											
Anxious	1	*	*	*	*	*	*	*	*	10	Assured
Imperfect	1	*	*	*	*	*	*	*	*	10	Intelligent
Uncertain	1	*	*	*	*	*	*	*	*	10	Convinced

Source: own representation

The whole experiment was based on the questionnaire (qualitative research method). The questionnaire was examined experimentally under conditions of controlled random assignment (Cognitive Reflective Test - CRT and IQ - Intelligence Quotient Test).

4.4 Procedure

Participants were given a link to the online consent form, which described the description of the survey and what everybody had to keep in mind before starting each level. Subsequently, the online survey appeared. After completing the level 1, the participants had to read the description of the survey again and had to be aware that number of their competitors would be raised. Afterwards, the next level was started.

Table 3 Instructions of the survey (for friends' group)

<u>Level 1:</u> Dear Participant, thank you for participating in my survey! Imagine a situation, you're in a group with five of your good friends. After completing a survey, the one of you, who gets the highest score, would be rewarded. The questionnaire consists of 2 parts. Do your best to answer the questions correctly! Good luck!
<u>Level 2:</u> Dear Participant, now the situation changes and the number of your competitors raise till 20. All the participants are your friends! Keep doing your best! You're almost done!

Source: own representation

Strangers' Group received totally similar tasks and description of the experiment with the only difference, that they were competing against strangers (not against friends, as it was for the first experimental group).

Table 4 shows, how the information for the participants looked like for the Level 1 and the Level 2. After the Level 2 was finished, participants received some extra questions about social comparison, which they had to answer. What kind of questions they received and how the described looked like, it is described below in this paper.

Table 4 Instructions of the survey (for strangers' group)

<u>Level 1:</u> Dear Participant, thank you for participating in my survey! Imagine a situation, you're in a group with five strangers. After completing a survey, the one of you, who gets the highest score, would be rewarded. The questionnaire consists of 2 parts. Do your best to answer the questions correctly! Good luck!
<u>Level 2:</u> Dear Participant, now the situation changes and the number of your competitors raise till 20. All the participants are strangers! Keep doing your best! You're almost done!

Source: own representation

After finishing the questionnaire, everybody had to indicate their gender and age. As a result, they could see how many right or wrong answers they gave during the experiment.

In the end, all the data, collected from 2 groups was decoded and results were compared. Findings (which could be found later) show whether there is difference in the strength of N-Effect when the nature of competitors changes.

5 Evaluation of Results and Data Analysis

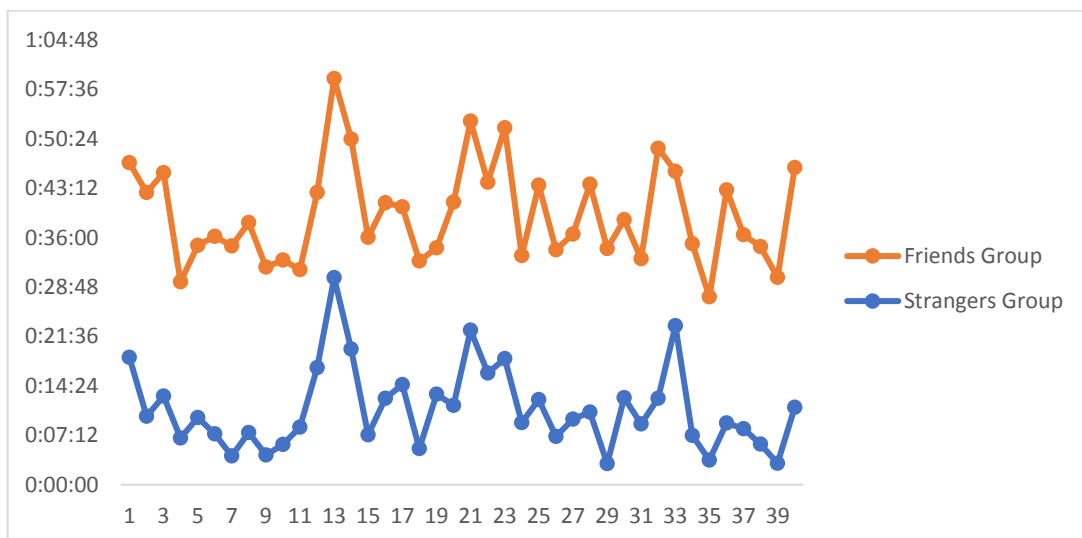
This chapter includes two parts and tends to explain them in detail. Part 5.1 represents the basic results of the survey. It also talks about the way of analyzing the outcomes. Part 5.2 explains results from the statistical point of view.

5.1 Data Analysis

After completing 2 surveys (for strangers' and for friends' group), there was a need to discover which outcomes we got and what exactly they mean. Starting from general results, the comparison of time needed to complete the tasks between 2 groups and the results they got would be explained below.

Figure 6 below represents all 40 participants from each survey group (Strangers vs. Friends) and the time they needed to solve the research tasks. There is a great difference in time between these groups, which could be clearly seen on the graph below. Friends' group needed quite a long time to decide on the answers, which shows a huge contrast to another group.

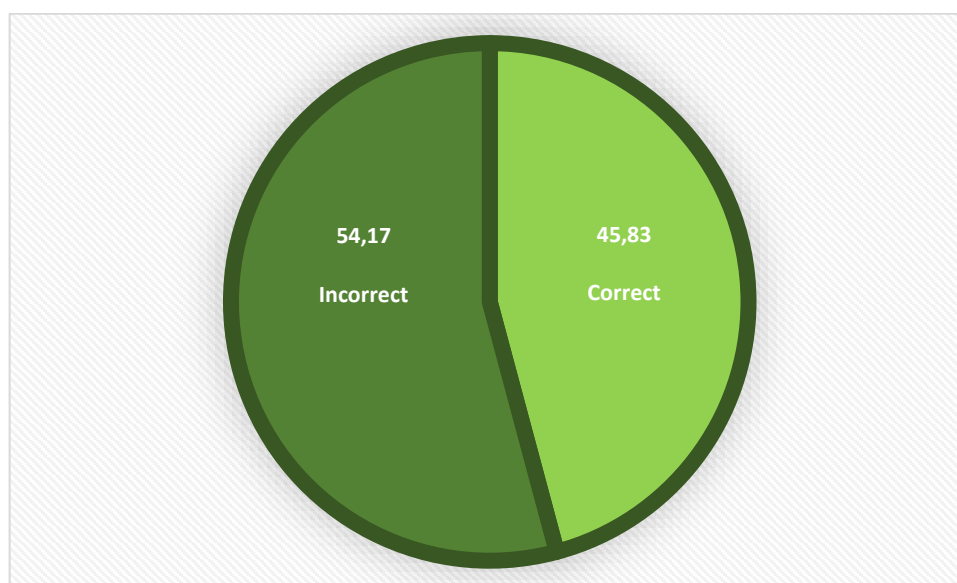
Figure 6 Time needed to complete all the survey tasks "Friends vs. Strangers"



Source: own representation

“Strangers” group was the fastest to complete all the given tasks. At the same time, they showed lower results. Within this group nobody knew each other, and they were concentrating only on their own knowledge and skills. It was hard to guess, which participants were more intelligent and tend to show higher results and backwards. Females showed the fastest results in this group (average 0:10:03 pro person vs. males 0:12:22 pro person). In general, there were 23 females and 17 males. Furthermore, in general, “strangers” group showed lower results in the correctness of the answers. They reached only 45,83% (out of 100%) of the correct answers. It could be better seen in the Figure 7 below. Between the levels, could also be seen a slight difference in the right/wrong answers, precisely, in total for the level 1 there were 45,42% of the right solutions (hence, 54,58% of the incorrect ones) and for the level 2, participants had 46,25% of the right solutions (53,75% wrong answers).

Figure 7 Comparison between correct and incorrect answers in the Strangers' Group

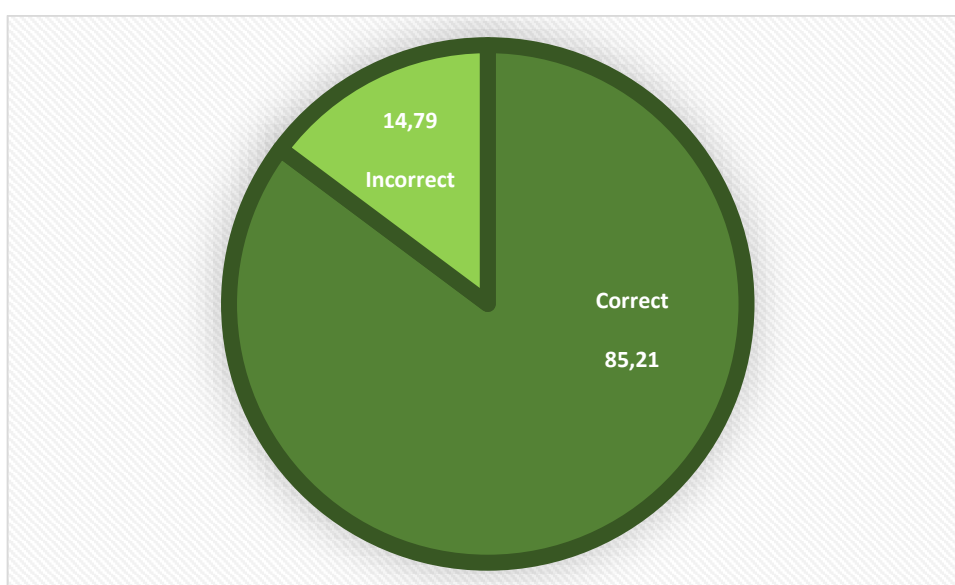


Source: own representation

“Friends” group needed in total more time to complete the tasks, what can be explained by the willingness to think more (takes more time to give the answer) in order to be able to show the knowledge among the group. In this case a person is afraid to give a wrong answer while competing among those, whom he/she knows personally. Males showed the fastest results in this group (average 0:27:57 pro person vs. females 0:28:40 pro

person). In general, there were also 23 females and 17 males (even though, before the survey it wasn't specifically agreed to take the same amount of men and female for the research test). Hence, "friends" group showed high results in the correctness of the given answers. They reached 85,21% (out of 100%) of the correct answers. For the level one, participants reached 82,50% of correct answers (17,50% wrong ones) and for the level 2, they reached 87,92% of correct answers (and only 12,08% incorrect ones). Figure 8 below shows the total difference of the answers of the Friends' Group after the research was over.

Figure 8 Comparison between correct and incorrect answers in the Friends' Group



Source: own representation

5.2 Evaluation of Results

As previously mentioned in section 5.1, a significant disparity in performance was observed between the two survey groups. However, the presence of the N-Effect during the survey remains uncertain. At first glance, it may appear evident that there should be definitive evidence of its existence, but further analysis is required to confirm its validity. This section provides more detailed statistical insights and results, utilizing t-test analysis.

Initially, a decision was made to employ a two-sample t-test, executed in Excel, assuming unequal variances, with a significance level ($\alpha = 0.05$). The objective was to compare the duration in both periods (1 and 2) for the Strangers' Group (and subsequently for the Friends' Group) in order to assess the variation among the results and determine whether it is possible to accept or reject the survey hypotheses.

Exploring the differences between the two levels within each group alone (based on time values and correct answers) was of particular interest to ascertain the presence of the N-Effect.

First, there was a need to test hypothesis H1a through a t-test analysis, which states that there is a difference (in time) between Level 1 and Level 2 in the Strangers' Group (indicating the presence of the N-Effect). Figure 9 illustrates all the findings.

To conduct the t-tests, it was necessary to convert the time values from minutes and seconds into a numerical format, specifically seconds. Let us proceed with the conversion of the time values into seconds. Here are the converted data sets for Level 1 and Level 2:

Level 1: 319 343 347 195 327 332 155 259 203 217 268 474 1011 539 215 518 338 244 423 531 575 415 507
204 443 269 218 272 123 497 239 302 777 207 140 340 253 146 134 226 466

Level 2: 793 254 428 213 260 113 97 197 56 135 235 555 798 646 221 238 536 71 368 162 775 560 595 338
300 154 355 364 61 264 292 454 612 223 75 199 236 209 52 450

To examine the hypothesis H1a, which suggests a distinction between Level 1 and Level 2 in the Strangers' Group, an independent samples t-test can be employed. H0 postulates that there is no dissimilarity in the means between two levels in the Strangers' Group, while the alternative hypothesis (H1) proposes a substantial distinction.

Received data from the online survey can be utilized for the t-test by following the seven main steps to be able to analyze the outcomes and interpret them:

In the *first step*, sample means, sample standard deviations, and variances have to be calculated for both Level 1 and Level 2 in the Strangers' Group:

Level 1:

Sample size (n_1) = 40

Sample mean ($\bar{x}_1$) = 337.925 seconds

Sample standard deviation (s_1) $\approx$ 183.402 seconds

Variance (s_1^2) $\approx$ 33655.923 seconds squared

Level 2:

Sample size (n_2) = 40

Sample mean ($\bar{x}_2$) = 339.825 seconds

Sample standard deviation (s_2) $\approx$ 215.668 seconds

Variance (s_2^2) $\approx$ 46576.308 seconds squared

The standard deviation of Level 1 (s_1) is approximately 183.432 seconds, while the standard deviation of Level 2 (s_2) is approximately 215.741 seconds. They show insights into how individual data points per each Level deviate from the mean. Concerning this data, the standard deviation aids in understanding the range of response times within each level (Level 1 and Level 2) in the Strangers' Group.

Notably, the standard deviation for Level 1 is smaller than that of Level 2, implying that the response times in Level 1 display less variability or are more tightly clustered compared to Level 2.

Through the integration of the mean and standard deviation, we acquire a holistic comprehension of the dataset, which aids in the interpretation of data dispersion and variation. This process holds immense significance in conducting statistical examinations and deriving significant insights.

In the context of my dataset, variance depicts the diversity or distinctions in response times between Level 1 and Level 2 in the Strangers' Group. A greater variance in Level 2 indicates that the response times within each group are more widely dispersed or varied around the mean.

In the preceding calculations, the variances (s_1^2 and s_2^2) were utilized to estimate the standard error of the mean difference (Level 1 against Level 2), a crucial factor in determining the t-statistic. This statistic assists in evaluating the statistical significance of the observed disparity in means between Level 1 and Level 2.

In conclusion, variance functions as a measure that describes the degree of spread or scattering within a dataset. It plays a significant role in diverse statistical analyses, such as t-tests. By quantifying the variation within each

group and contrasting it with the observed disparities between groups, variance assists in evaluating the significance of differences. A thorough comprehension of variance provides valuable perspectives on data distribution and attributes, enabling the interpretation and assessment of statistical results.

2. It becomes necessary to comprehend the hypotheses that will undergo examination in the t-test. Initially, the hypotheses denoted as H1o and H1a were considered. As previously stated, H1o assumes an absence of disparity between the means of Level 1 and Level 2 within the Stranger's Group, H1o: $\mu_1 = \mu_2$. Conversely, H1a posits a distinction between the means of Level 1 and Level 2 within the Stranger's Group, H1a: $\mu_1 \neq \mu_2$.

3. A significance level (α) for each t-test has to be defined. The designated significance level is $\alpha = 0.05$, which aids in ascertaining the statistical significance of the observed disparity between the Levels (means).

4. The t-statistic has be computed by employing a mathematical equation:

Table 5 Calculating of t-statistic

$$t = (\bar{x}_1 - \bar{x}_2) / \sqrt{(s_1^2 / n_1) + (s_2^2 / n_2)};$$

where

- $\bar{x}_1$ and $\bar{x}_2$ correspond to the average values of the samples;
- s_1^2 and s_2^2 indicate the variances of the samples;
- n_1 and n_2 denote the sizes of the samples.

Based on: Student, 1908

5. Based on Student (1908), the degrees of freedom for a t-test should be calculated as follows,

$$(df): df = n_1 + n_2 - 2$$

Degrees of freedom for an independent sample:

$$(df) = 40 + 40 - 2 = 78.$$

However, in the case of a two-sample survey with equal sample sizes, the degrees of freedom formula, mentioned above should be divided by 2. It leads to $df = (40 + 40 - 2) / 2 = 39$ (based on Student, 1908).

The value of $df = 39$ indicates that there are 39 independent pieces of data that may be used to estimate the parameters and draw conclusions about the population from the sample data. This value is determined by the sample sizes of Level 1 and Level 2 in the Strangers' Group.

Greater degrees of freedom translate into more accurate estimates and more statistical power in statistical analysis. The amount of df influences on the t -distribution by considering its t -critical values, which play a vital role in determining the statistical significance of the computed t -statistic, and by understanding the increase in df , it is possible to see how the t -distribution resembles the standard normal distribution more closely.

By estimating alpha ($\alpha = 0.05$), t -critical becomes more similar to the corresponding z -scores. This convergence towards the standard normal distribution allows for more accurate determination of statistical significance. Overall, higher degrees of freedom enhance the reliability and strength of statistical inferences.

In summary, the degrees of freedom (39) in this t -test comparing Level 1 and Level 2 in the Strangers' Group represent the number of independent observations available for estimating parameters and drawing statistical inferences.

6. Determine the t -critical. For a two-tailed test at $\alpha = 0.05$, with $df = 39$, t -critical can be calculated by using a statistical calculator and is equal to ± 2.021 .

7. Based on the received t -value and t -critical value, we can make a conclusion of the above written hypothesis.

Since the calculated t -static value (-0.100) does not exceed the t -critical equals ± 2.021 , the t -absolute is lower than 2.021. Therefore, the p -value will be greater than 0.05.

In this situation, the calculated t -statistic of approximately -0.100 represents the difference between the means of Level 1 and Level 2 in the Strangers' Group, standardized by the standard error. It quantifies the strength of the disparity between the sample means relative to the variability within the groups. A negative t -statistic indicates that the mean of Level 2 is lower than the mean of Level 1.

In relation to the variation within each group, the size of the t -statistic represents the significance of the observed difference between the two groups' averages. The t -statistic's absolute value is a measure of how much the group means differ from one another. It means that the observed difference is more significant than

the inherent variability that exists in each group. In other words, a bigger absolute t-statistic denotes more support for a significant difference between the group averages under comparison.

To establish the statistical significance of the observed difference between the averages, it is required to compare the t-absolute with the t-critical. The difference between the averages is statistically significant if the absolute t-statistic is higher than the critical t-value. This shows that the observed difference is unlikely to have occurred by chance alone and is probably the result of an actual effect.

In contrast, if the absolute magnitude of the computed t-statistic is smaller in comparison to the critical t-value, it indicates that the noticed dissimilarity lacks statistical significance. In such cases, the difference between the means could be due to random variability, and we do not have enough confirmation to claim that there is a true difference between the groups.

The critical t-value is determined based on the chosen significance level (typically denoted as α), which represents the threshold for considering a difference as statistically significant. Through the comparison of the t-statistic and the t-critical, it is possible to derive conclusions concerning the statistical significance of the observed disparity between the averages.

In this case, the calculated t-statistic of approximately -0.100 does not exceed the critical t-value. This indicates that the observed difference between Level 1 and Level 2 in the Strangers' Group is not statistically significant at the chosen significance level ($\alpha = 0.05$).

To calculate the exact p-value for a two-tailed test with a t-value of -0.100 and $df = 39$, we can consult a t-distribution table or use statistical software. Using a statistical software, the exact p-value is approximately 0.920.

Therefore, the exact p-value $P(T \leq t)$, two-tailed for the calculated t-value of -0.100 and $df = 39$ is approximately 0.920.

The value $P(T \leq t)$ two-tail = 0.920 represents the probability of receiving a computed t-statistic that is as unusual or even more uncommon, provided that H_0 is true.

To clarify, H_0 in this case would be that there is no difference between the means of Level 1 and Level 2 in the Strangers' Group. The probability of 0.920 suggests that the observed difference is likely to occur by chance alone, rather than being a true effect.

In summary, $P(T \leq t)$ two-tail = 0.920 indicates that the observed difference between Level 1 and Level 2 in the Strangers' Group is not statistically significant at the chosen $\alpha = 0.05$.

Therefore, it explains that there is no statistically meaningful difference between the Level 1 and the Level 2 (when the number of competitors raise) in the Strangers' Group and it leads to the conclusion that Hypothesis (H1a) has to be rejected. It also shows that there is no N-Effect found in the Strangers' Group during the experiment. Nevertheless, in the experiment paper of Garcia-Tor "More competitors, less competition", was proven the opposite and in their research, right after the number of competitors was raised, the N-Effect could had been found and clearly seen. As it was mentioned before, Festinger (1954), was also one of the researchers, who had proven how subjective factors influence competition and hence, how it leads to the N-Effect presence.

Figure 9 t-test: Difference (in time) between the Levels in the Strangers' Group

	Level 1	Level 2
Mean	337,925	339,825
Variance	33655,923	46576,308
Observations	40	40
df	39	
t-Stat	-0,100	
P(T<=t) two-tail	0,920	
t Critical two-tail	2,021	

Source: own representation

It is interesting to observe that from the first sight evident issues (about the presence of the N-Effect within a group during two levels) were not found in the analysis. How it is with the Friends' Group, the next t-test analysis will present the outcomes.

As it was for the previous t-test from the Figure 9, for another t-test analysis, we have to convert all the numbers into seconds to test H1b (time difference between the levels) for the Friends' Group.

Level 1 data in seconds: 823 1084 995 692 915 914 842 639 798 894 705 914 882 630 1001 767 796 937 663 815 490 962 934 873 724 806 690 1076 783 924 754 983 707 716 790 1138 822 705 768 1163

Level 2 data in seconds: 880 872 957 673 590 813 994 1196 844 719 671 617 858 1206 726 941 759 703 617
961 1339 706 1083 587 1151 823 928 915 1097 631 689 1200 642 960 636 899 875 1020 858 934

With the same procedure, as it was done for the Strangers' Group (Level 1 vs. Level 2), the following calculations were done.

Level 1 sample mean = $(823 + 1084 + 995 + \dots + 1163) / 40$

Level 1 sample mean = 836.05 seconds

Level 2 sample mean = $(880 + 872 + 957 + \dots + 934) / 40$

Level 2 sample mean = 867.85 seconds

Level 1 sample standard deviation = 148.035 seconds

Level 2 sample standard deviation = 172.399 seconds

To calculate the variances, we square the sample standard deviations:

Level 1 variance = 21902.83 seconds²

Level 2 variance = 29729.22 seconds²

According to Student (1908),

$t_{\text{stat}} = (836.05 \text{ seconds} - 867.85 \text{ seconds}) / \sqrt{((21902.83 \text{ seconds}^2 / 40) + (29729.22 \text{ seconds}^2 / 40))}$

$t_{\text{stat}} = -31.8 \text{ seconds} / \sqrt{(547.57 \text{ seconds}^2 + 743.23 \text{ seconds}^2)}$

$t_{\text{stat}} = -31.8 \text{ seconds} / \sqrt{1290.8 \text{ seconds}^2}$

$t_{\text{stat}} = -31.8 \text{ seconds} / 35.94 \text{ seconds}$

$t_{\text{stat}} = -0.884$

The computed t-statistic is equal to -0.884. The calculated t-statistic of -0.884 explains two facts about the difference between the sample means of Level 1 and Level 2 in the Friends' Group. First, it shows the size of the difference between the means. Second, it tells us the direction of the difference, whether Level 1 is higher or lower than Level 2. The t-statistic takes into account the variability within each group to provide a reliable measure of the difference.

The calculated t-statistic of -0.884 represents the magnitude and direction of the difference between the sample means of Level 1 and Level 2 in the Friends' Group, relative to the variability within each group.

Degrees of freedom remain the same, as it was for the Strangers' Group and equal 39.

For a two-tailed test at $\alpha = 0.05$, with $df = 39$, the *critical value* is approximately ± 2.021 .

To calculate the probability $P(T \leq t)$ for a two-tailed test, we need to determine the field under the t-distribution curve. This will give us the probability of observing a t-value as extreme as or more extreme than the calculated t-statistic.

Given that the t-statistic is -0.884 and the degrees of freedom is 39, we can calculate $P(T \leq t)$ using statistical software or a t-distribution table. For simplicity, a statistical calculator was used:

$$P(T \leq -0.884) = 0.192$$

Since this is a two-tailed test, we are interested in the probability of observing a t-value as extreme as or more extreme than -0.884 in either tail. Therefore, we multiply the result by 2:

$$P(T \leq t) \text{ two-tail} = 2 * P(T \leq -0.884) = 2 * 0.192 = 0.384$$

The probability $P(T \leq t)$ two-tail is approximately 0.384.

According to the Figure 10, after all the calculations were done, *p*-value was found. $P = 0.384$, which shows we have to reject the hypothesis (H1b) because there is no statistically significant difference between the Level 1 and the Level 2 in the Friends' Group (the number is larger than $\alpha = 0.05$). It also means, there no N-Effect during two periods (with increasing number of competitors) was found. Why could it happen, and which further analysis could have been run again, will be explained in the Section 6 (Conclusion and Further Research).

Figure 10 t-test: Difference (in time) between the Levels in the Friends' Group

	Level 1	Level 2
Mean	836,05	867,85
Variance	21902,83	29729,22
Observations	40	40
df	39	
t-Stat	-0,884	
P(T<=t) two-tail	0,384	
t Critical two-tail	2,021	

Source: own representation

To test H1c: There is a difference (in correct answers) between the Level 1 and the Level 2 in the Strangers' Group (N-Effect is present), there was a need to run another t-test. Figure 11 will provide us with the most important numbers and the interpretation will follow the figure.

Figure 11 t-test: Correct answers analysis for the Strangers' Group between Level 1 and Level 2

	Level 1	Level 2
Mean	2,600	2,825
Variance	3,578	3,047
Observations	40	40
df	39	
t-Stat	-0,554	
P(T<=t) two-tail	0,29	
t Critical two-tail	2,022	

Source: own representation

Data for Level 1 (Strangers' Group - correct answers):

5.00, 6.00, 3.00, 3.00, 3.00, 0.00, 2.00, 4.00, 2.00, 1.00, 2.00, 5.00, 3.00, 3.00, 3.00, 4.00, 3.00, 2.00, 4.00, 6.00, 3.00, 6.00, 2.00, 1.00, 4.00, 2.00, 1.00, 2.00, 2.00, 2.00, 1.00, 1.00, 2.00, 1.00, 1.00, 5.00, 1.00, 1.00, 0.00, 6.00

Data for Level 2 (Strangers' Group - correct answers):

5.00, 4.00, 1.00, 2.00, 3.00, 2.00, 1.00, 3.00, 2.00, 4.00, 3.00, 4.00, 2.00, 3.00, 3.00, 5.00, 4.00, 3.00, 4.00, 3.00, 1.00, 4.00, 4.00, 1.00, 3.00, 3.00, 6.00, 3.00, 0.00, 0.00, 1.00, 3.00, 2.00, 3.00, 3.00, 2.00, 2.00, 3.00, 3.00, 2.00

Step 1: Calculate the sample means:

$$\bar{x}_1 = (5.00 + 6.00 + 3.00 + \dots + 0.00) / 40$$

$$\bar{x}_2 = (5.00 + 4.00 + 1.00 + \dots + 2.00) / 40$$

$$\bar{x}_1 = 2.600$$

$$\bar{x}_2 = 2.825$$

Step 2: Calculate the sample variances:

$$s_1^2 = (5.00 - \bar{x}_1)^2 + (6.00 - \bar{x}_1)^2 + (3.00 - \bar{x}_1)^2 + \dots + (0.00 - \bar{x}_1)^2 / (40 - 1)$$

$$s_2^2 = (5.00 - \bar{x}_2)^2 + (4.00 - \bar{x}_2)^2 + (1.00 - \bar{x}_2)^2 + \dots + (2.00 - \bar{x}_2)^2 / (40 - 1)$$

$$s_1^2 = 3.578$$

$$s_2^2 = 3.047$$

Step 3: Calculate the t-statistic (according to Student, 1908):

$$t\text{-statistic} = (2.600 - 2.825) / \sqrt{((3.578 / 40) + (3.047 / 40))}$$

$$t\text{-statistic} = -0.225 / \sqrt{(0.08945 + 0.076175)}$$

$$t\text{-statistic} = -0.225 / \sqrt{0.165625}$$

$$t\text{-statistic} = -0.225 / 0.406$$

$$t\text{-statistic} = -0.554$$

Step 4: Determine the critical value or p-value to compare with the t-statistic.

Using the given degrees of freedom (df = 39), we can find the critical value or p-value. Let's assume alpha (α) level = 0.05.

With $\alpha = 0.05$ and $df = 39$, the critical values are approximately ± 2.022 .

Since the calculated t-statistic (-0.554) is within the range of -2.022 to 2.022, it does not exceed the critical values. Consequently, we are unable to support the null hypothesis. Based on the t-test results, there is no significant difference between the results of correct answers during Level 1 and Level 2 for the strangers' group. This means that the change in the number of competitors did not have a statistically substantial impact on the participants' performance in terms of correct answers.

We may use the t-distribution with the specified $df = 39$ and the estimated t-statistic (-0.554) to calculate $P(T \leq t)$ for the t-test. The p-value connected to the t-statistic can be discovered using the t-distribution table or statistical software.

The p-value is around 0.290 for the provided t-statistic (-0.554) and degrees of freedom ($df = 39$).

Greater than the selected significance threshold ($\alpha = 0.05$) is the estimated p-value, which is 0.290. As a result, we cannot rule out the null hypothesis. This shows that there is not enough data to claim that there is a substantial difference between the strangers' group's performance for correct responses at Levels 1 and 2.

In other words, the chance of finding a t-value under the null hypothesis that is as extreme as or more extreme than the observed t-statistic is 0.290. This suggests that, rather than being the result of a significant influence, the observed difference in the number of right responses between the two levels might be properly attributed to random chance.

There is one more hypothesis, concerning correct answers in a Friends' Group. **H1d:** There is a difference (in correct answers) between the Level 1 and the Level 2 in the Friends' Group (N-Effect is present). Figure 12 shows all the findings of the t-test for this hypothesis.

Figure 12 t-test: Correct answers analysis for the Friends' Group between Level 1 and Level 2

	Level 1	Level 2
Mean	5,05	5,25
Variance	0,915	0,22
Observations	40	40
df	39	
t-Stat	-1,186	
P(T<=t) two-tail	0,243	
t Critical two-tail	2,022	

Source: own representation

Data for Level 1 (Friends' Group - correct answers):

6.00, 3.00, 5.00, 5.00, 5.00, 5.00 4.00, 4.00, 6.00, 4.00, 4.00, 6.00, 5.00, 5.00, 6.00, 5.00, 6.00, 4.00, 5.00, 5.00,
6.00, 4.00, 4.00, 6.00, 6.00, 6.00, 5.00, 4.00, 6.00, 4.00, 6.00, 5.00, 5.00, 5.00, 4.00, 5.00, 6.00, 3.00 4.00 6.00

Data for Level 2 (Friends' Group - correct answers):

5.00, 5.00, 6.00, 5.00, 4.00, 6.00, 4.00, 5.00, 6.00, 3.00, 5.00, 5.00, 5.00, 5.00, 5.00, 6.00, 5.00, 6.00, 5.00,
6.00, 6.00, 5.00, 6.00, 5.00, 6.00, 4.00, 6.00, 6.00, 5.00, 5.00, 6.00, 5.00, 6.00, 5.00, 6.00, 5.00, 5.00, 6.00,
6.00, 5.00

Level 1 (Friends' Group):

Mean 1 ($\bar{x}_1$): 5.050

Variance 1 (s_1^2): 0.915

Standard Deviation 1 (s_1): 0.957

Level 2 (Friends' Group):

Mean 2 ($\bar{x}_2$): 5.250

Variance 2 (s_2^2): 0.220

Standard Deviation 2 (s_2): 0.469

$$t\text{-statistic} = -0.200 / \sqrt{(0.022875 + 0.0055)}$$

$$t\text{-statistic} = -0.200 / \sqrt{0.028375}$$

$$t\text{-statistic} = -0.200 / 0.168487$$

$$t\text{-statistic} = -1.186$$

The calculated t-statistic is approximately -1.186.

With the use of a t-distribution table or statistical software, we may determine the t-critical value. The t-critical value, which we define as the t-value that cuts off the upper and lower tails with an area of $\alpha/2$ each, is around ± 2.022 when we assume a two-tailed test.

So, with $\alpha = 0.05$ and degrees of freedom = 39, the t-critical value for the most recent test is around ± 2.022 .

Let's now get the p-value for this t-statistic.

The p-value is around 0.243 when using a two-tailed test and the 39-degrees-of-freedom t-distribution. The p-value that was obtained, 0.243, is higher than the significance threshold that was selected (0.05). As a result, we cannot rule out the null hypothesis. This shows that there is not enough data to draw the conclusion that there is a substantial difference between the friends' group's Level 1 and Level 2 outcomes for correct responses.

In other words, the chance of finding a t-value under the null hypothesis that is as extreme as or more extreme than the observed t-statistic is 0.243. This suggests that, rather than being the result of a significant influence, the observed difference in the number of right responses between the two levels might be properly attributed to random chance.

The additional t-tests were conducted using the additional hypotheses. During the experiment, it was necessary to examine how social comparison affected the participants' performance and output. Social comparison questions were posed following the completion of the online survey, as was already described in Figure 5. Another t-test was carried out (see Figure 13) on them, and they had 6 questions.

Figure 13 t-test: Social Comparison during the Level 1 between Strangers' and Friends' Group

	Strangers	Friends
Mean	9,108	8,233
Variance	0,791	2,980
Observations	40	40
df	39	
t-Stat	2,850	
P(T<=t) two-tail	0,007	
t Critical two-tail	2,024	

Source: own representation

Strangers' Group, Level 1:

Mean: 9.108333333

Standard Deviation: 0.888832858

Variance: 0.790515278

Friends' Group, Level 1:

Mean: 8.233333333

Standard Deviation: 1.724918542

Variance: 2.979515278

According to the previous information, level of significance remains the same (α) = 0.05; df = 39 degrees of freedom and N = 40 for the sample size.

Calculating t-statistic (based on Student, 1908):

By replacing the values, we get the following result:

$$t\text{-statistic} = (9.108333333 - 8.233333333) / \sqrt{((0.790515278 / 40) + (2.979515278 / 40))}.$$

$$t\text{-statistic} = 2.849987453$$

To determine the critical value and assess the significance of the t-statistic, we can use statistical tools or compare it to the critical value from the t-distribution table. T-critical for a two-tailed test with a significance level of 0.05 and 39 degrees of freedom is around ± 2.024 .

Since the computed t-statistic (2.849987453) above the 2.024 critical threshold, we deny the null hypothesis.

Therefore, it can be claimed that the difference is statistically substantial between the average of the Strangers' Group and the Friends' Group in Level 1 at a significance level of 0.05.

$P(T \leq t)$ should now be calculated.

We may use statistical software or a t-distribution table to obtain the equivalent p-value given the estimated t-statistic of 2.849987453 and the (df) of 39.

The p-value for the given t-statistic of 2.849 and $df = 39$ is around 0.0074.

The computed t-statistic is statistically significant, as indicated by the fact that the p-value (0.0074) is lower than alpha (0.05).

As a result, according to the Figure 13, we may draw the conclusion that there is compelling evidence to reject the null hypothesis and argue that the mean social comparison scores at Level 1 between the Friends' Group and the Strangers' Group are significantly different from one another. It seems unlikely that random chance alone caused the discrepancy.

In other words, the information offers strong support for the conclusion that the scores on the social comparison task at Level 1 between the groups of strangers and friends differ statistically. The Strangers' Group often has higher mean ratings than the Friends' Group, demonstrating a difference in how each group views its own confidence, talent, and competitiveness.

Figure 14 t-test: Social Comparison during the Level 2 between Strangers' and Friends' Group

	Strangers	Friends
Mean	7,725	7,075
Variance	1,244	1,021
Observations	40	40
df	39	
t-Stat	2,732	
P(T<=t) two-tail	0,0053	
t Critical two-tail	2,0227	

Source: own representation

To perform a t-test for the Level 2 of social comparison scores between the Strangers' Group and the Friends' Group, we can calculate the necessary statistics (can be seen in the Figure 14). Here are the calculations:

Strangers' Group, Level 2:

$$\text{Mean } (\bar{x}_1) = (8 + 6 + 8 + \dots + 9) / 40 = 7.725$$

$$\text{Variance } (s_1^2) = [(8 - 7.725)^2 + (6 - 7.725)^2 + \dots + (9 - 7.725)^2] / (40 - 1) = 1.244$$

$$\text{Standard Deviation } (s_1) = \sqrt{s_1^2} = \sqrt{1.244} = 1.115$$

Friends' Group, Level 2:

$$\text{Mean } (\bar{x}_2) = (9 + 8 + 7 + \dots + 9) / 40 = 7.075$$

$$\text{Variance } (s_2^2) = [(9 - 7.075)^2 + (8 - 7.075)^2 + \dots + (9 - 7.075)^2] / (40 - 1) = 1.021$$

$$\text{Standard Deviation } (s_2) = \sqrt{s_2^2} = \sqrt{1.021} = 1.010$$

Calculating t-statistic:

$$t\text{-statistic} = (7.725 - 7.075) / \sqrt{((1.244 / 40) + (1.021 / 40))}$$

$$t\text{-statistic} = 0.65 / \sqrt{0.0311 + 0.0255}$$

$$t\text{-statistic} = 0.65 / \sqrt{0.0566}$$

$$t\text{-statistic} = 0.65 / 0.2381$$

$t\text{-statistic} = 2.732$

Using an *alpha level* of 0.05 and the *degrees of freedom* (df) of 39, we can find the critical t-value. In this case, since it's a two-tailed test, we divide the alpha level by 2, resulting in an alpha level of 0.025 for each tail.

Using a t-distribution table or statistical software, the *t-critical* with df = 39 and alpha = 0.025 is approximately ± 2.0227 .

We may infer that the difference in Level 2 social comparison ratings between the Strangers' Group and the Friends' Group is statistically significant as the estimated t-statistic (2.732) is higher than the threshold t-value (± 2.0227).

In other words, there is compelling evidence that the mean social comparison scores at Level 2 between the Friends' Group and the Strangers' Group are considerably different.

We must determine the cumulative probability connected to the t-statistic in order to calculate $P(T \leq t)$. In this instance, the degrees of freedom (df) are 39, and the t-statistic is 2.732.

We may determine the p-value connected to the t-statistic using statistical software or a t-distribution table.

Under the null hypothesis, the p-value indicates the likelihood that a t-statistic as severe as the computed t-statistic (or more extreme) would be seen. A lower p-value denotes more compelling evidence that the null hypothesis is false.

The p-value for the given t-statistic of 2.732 and df = 39 is around 0.0053.

The computed t-statistic is statistically significant, as indicated by the fact that the p-value (0.0053) is lower than alpha (0.05).

As a result, we may draw the conclusion that there is compelling evidence to reject the null hypothesis and argue that the mean social comparison scores at Level 2 between the Friends' Group and the Strangers' Group are substantially different from one another. It seems unlikely that random chance alone caused the discrepancy.

In other words, the information gives strong support for the claim that there are significant variations between the two groups' scores on the Level 2 social comparison.

Figure 14's findings make it obvious that the p-value ($p = 0.0053$) is lower than the significance level ($= 0.05$). The hypothesis H2b must be supported if there is a statistically substantial difference in social comparison between the two groups at Level 2.

6 Conclusion and Future Research

This sector finalizes all the research findings, explains the limitations of the study and talks about possible future research.

6.1 Summary and Conclusion

The aim of this paper was to test already known and proved facts with some elements of extension of the experiment, namely to check the difference between two experimental groups (Friends and Strangers), whether their motivation to compete, their results and social comparison would differ or not. As it was already discussed in the study of Garcia and Tor, social comparison is one of the most important mechanisms of the N-Effect. Following the Triplett's studies (1898), Allport (1920) and other researchers' experiments, the study was expended, and another type of a survey was conducted.

As it was mentioned before, there were 40 participants in each group of a different age. Mean age for the Friends' Group was 31 and for the Strangers' Group 28. Even without earlier decision, in each group were 17 males and 23 females.

Based on the other literature review and all of the researched papers from the found studies, it had to be clear that right after the experiment with increasing number of competitors for the Level 2, the well-known N-Effect had to be found, which didn't happen in any of the researched groups (neither in a friends' group, nor in a strangers' group). **H1a:** There is a difference (in time) between the Level 1 and the Level 2 in the Strangers' Group (N-Effect is present). Founded p-value, $p = 0,920$, didn't allow to accept the hypothesis, as it was higher than alpha ($\alpha = 0.05$). **H1b:** There is a difference (in time) between the Level 1 and the Level 2 in the Friends' Group (N-Effect is present). Same, as it was for the H1a, founded p-value, $p=0,384$, is greater than alpha ($\alpha = 0.05$), which also shows that we had to reject the hypothesis H1b. Therefore, based on the analysis, hypotheses H1a and H1b had to be rejected.

Hypotheses **H1c:** There is a difference (in correct answers) between the Level 1 and the Level 2 in the Strangers' Group (N-Effect is present) and hypothesis **H1d:** There is a difference (in correct answers) between

the Level 1 and the Level 2 in the Friends' Group (N-Effect is present), also had to be rejected. Their p values were 0,29 and 0,243 (greater than the alpha) and we couldn't accept none of them.

Nevertheless, after testing social comparison in both groups, the results showed, that the participants were aware of the competition, or their attitude to their competitors during two levels. Their perception and attitude changed after the level 1. In other words, they started to be more aware of their competitors after they discovered that the number raised. **H2a:** There is a difference of social comparison between two groups in the Level 1. Calculated p -value, $p = 0,007$, let us accept the Hypothesis H2a, as the number was lower than alpha ($\alpha = 0.05$). **H2b:** There is a difference of social comparison between two groups in the Level 2. Also allows us to accept the Hypothesis H2b, as the p -value ($p = 0,0053$) is lower than alpha ($\alpha = 0.05$). Hence, we observed and proved that Hypothesis 2a and Hypothesis 2b were accepted.

6.2 Limitations

6.2.1 Participants Sample Limitations

It is important to acknowledge that almost all surveys have inherent limitations. A constraint of this study is the comparatively limited sample size. In order to obtain more accurate and representative results, a larger sample should be considered. It is possible that the findings of the study could differ when applied to a larger and more diverse sample. However, it is worth noting that even studies with small sample sizes, such as Garcia and Tor (2009), which included only 50 participants (25 men and 25 women), can yield significant and meaningful results.

Additionally, the choice of the Quiz Maker platform, Pro Profs, imposed a constraint on the number of participants that could be included in each survey. The platform only allowed a maximum of 40 participants per survey. While the platform was paid for a month, increasing the number of participants beyond 40 would have required an additional payment, effectively doubling the cost. This limitation should be considered when interpreting the results, as a larger participant pool might have provided more comprehensive insights.

Moreover, the motivation of the participants is an important aspect to consider. Since the participants were aware that the survey was conducted for the purpose of a thesis (and the reward wasn't that valuable for them) or incentives offered may not be as good as in a real-life scenario, their level of motivation and competitiveness

might have been affected. In a real-life situation with genuine job prospects or highly valuable rewards, participants would likely exhibit different levels of motivation and competition. Therefore, the findings of this study may not fully capture the true extent of the N-Effect and its impact on performance under highly motivating and rewarding circumstances.

In summary, the limitations of the study include the small sample size, the limitations imposed by the chosen Quiz Maker platform, and the potential impact of participant motivation. Future research with larger samples, different survey platforms, and more highly motivating scenarios could provide a more comprehensive understanding of the N-Effect phenomenon.

6.2.2 Questions Sample Limitations

The current experiment was conducted online, using an Online Quiz Platform. For future research, it would be beneficial to conduct the study in a live setting where participants have the opportunity to physically interact with their competitors. This face-to-face dynamic, especially when the number of competitors increases, could elicit different perceptions and reactions towards the tasks and competition process.

Expanding the number of questions and selecting them more extensively for a diverse range of competitors could provide a clearer assessment of individuals' knowledge and the overall performance of the group. By incorporating a larger set of questions, a more comprehensive evaluation of participants' abilities can be obtained, allowing for a more robust comparison in relation to the N-Effect phenomenon.

As previously mentioned, individuals are often motivated when they perceive the significance of achieving success. In the current experiment, it may not have been suitable to increase the number of questions since the ultimate goal or reward may not have been perceived as substantial enough. Merely imagining the potential reward may not have been sufficient to fully engage participants. However, if participants were offered a tangible and valuable prize, their level of motivation might increase significantly, and they may not be as concerned about the duration of the test, even if it took more than an hour. It is worth noting that despite there being only 12 questions in total (6 questions per level), some participants expressed that the test took a considerable amount of time.

6.3 Future Research

Based on the literature review, numerous research papers, and the current survey, it is crucial to comprehend the underlying purpose and significance of each experiment and study related to the N-Effect. Each of these endeavors serves a specific purpose and holds its own value, driven by the intentions and preparations of the researchers. Even minor components of experiments can significantly influence the overall understanding and objectives of a study. Therefore, when planning future research, it is essential to consider and incorporate the insights gained from previous findings.

Considering the aforementioned limitations, it would be more effective to replicate the same study with a similar procedure, but this time incorporating a genuine job opportunity or vacancy for individuals who are actively seeking employment and possess a high level of motivation to secure a job. Drawing on the insights of Triplett (1898), it is important for individuals to exert effort and concern themselves with the outcome of the competition, which can be more effectively achieved when engaged in a competitive environment with other participants. By doing so, we would likely gain a clearer understanding of participants' true attitudes towards the survey process and their genuine opinions regarding the level of difficulty or ease in competing and achieving results. Furthermore, this scenario would undoubtedly reveal the presence of the N-Effect.

The way survey questions are expanded can also impact the final results. Nonetheless, it would be more advantageous to carry out a live experiment involving face-to-face competition. Additionally, it could be intriguing to interchange the composition of the groups (Friends and Strangers) following Level 1 and observe their behavior in a different environment during Level 2.

Furthermore, conducting the experiment in a live setting, where participants can directly interact with their competitors and experience the intensity of competition firsthand, would provide a more authentic and dynamic research environment. The face-to-face nature of the competition would likely evoke different responses and emotions compared to an online setting. Participants would have the opportunity to gauge their competitors' reactions, engage in nonverbal communication, and experience the real-time pressure associated with in-person competition.

Moreover, mixing the groups of participants, both Friends and Strangers, after Level 1 and observing their behavior in a different environment during Level 2 could yield valuable insights. This approach would allow

for the examination of how individuals adapt to new social dynamics and interact with unfamiliar competitors. It may uncover distinct patterns of behavior, as participants navigate through changing group dynamics and potentially adjust their strategies or attitudes based on the composition of their new group.

Additionally, expanding the number of questions in the survey could provide a more comprehensive assessment of participants' knowledge and skills. By including a wider range of questions, the survey would offer a more robust measure of individuals' competencies, enabling a more thorough comparison of performance and the potential manifestation of the N-Effect. A greater number of questions would ensure a more accurate representation of participants' true capabilities and provide a more reliable basis for evaluating the impact of competition on performance.

In conclusion, through a combination of live experimentation, group mixing, and an expanded question set, future research can enhance our understanding of the N-Effect phenomenon. These modifications would provide a more realistic and engaging research context, enabling a deeper exploration of participants' attitudes, behaviors, and performance in competitive settings. By addressing the limitations identified and incorporating these enhancements, researchers can further contribute to the existing body of knowledge on the N-Effect and its implications in various domains.

Appendix

Which are the most difficult questions?



#	Question	% Correct	Correct	Incorrect / Unanswered	Responses
1.	> A bat and a ball cost \$1.10 in total. The bat costs \$1.00 more than the ball. How much does the ball cost?	37%	15	26	41
2.	> If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100...	44%	18	23	41
3.	> In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the...	34%	14	27	41
4.	> Which of the following figures is the odd one out?	37%	15	26	41
5.	> Which number should come next in this series? 3, 5, 8, 13, 21.	90%	37	4	41
6.	> The day before the day before yesterday is three days after Saturday. What day is it today?	32%	13	28	41
7.	> What numbers should replace the question mark?	66%	27	14	41
8.	> Which of the following is not a boat?	49%	20	21	41
9.	> Which is the odd one out?	59%	24	17	41
10.	> Consider the following passage and answer the questions that follow: Humans may have reached northern Europe...	24%	10	31	41
11.	> Without the amino acid evidence, which one of the following is the best estimate of the age of the tools?	22%	9	32	41
12.	> Of the following, which best indicates the value of the water vole fossils to the dating of the site?	51%	21	20	41

Abstract - English

Since decades, over a long period of time, people were and are competing towards each other. Competition is a part of our everyday lives. A lot of effects have influenced on human's decisions over ages and we are trying till now to understand the rational behavior of people, why they act in a certain way, or why they make any kind of decisions while being a part of a competition. Many factors influence their behavior and till now we started to understand some processes, as researchers provided us with plenty of papers and studies, which show us connections with internal/external factors and human behavior.

This study aims to explain and show experimentally, how people behave in different kind of environment (namely, in 2 different groups: strangers and friends). The objective is to test, whether N-Effect (increasing number of competitors leads to decrease in motivation to compete) is present in any of the groups (by providing participants with tasks, which are divided into 2 levels with less and more competition), while solving the quiz and competing toward other people (in 2 different experimental groups) with an increasing number of competitors during the level 2. These types of tasks were selected based on the previous studies of Garcia and Tor, Festinger and other researchers. Moreover, this study aims to show the presence of social comparison in 2 survey groups.

After completing the experiment, N-Effect wasn't found in any of the groups (neither Friends', nor Strangers' Group). There is no statistically significant difference found between the Level 1 and the Level 2 in both groups. Hence, social comparison, which served as a Mediator between Independent Variable (Strangers' or Friends' Group) and Dependent Variable (N-Effect), was defined and we can claim that there is a statistically significant difference of social comparison between two groups (Strangers and Friends) in the Level 1 and the Level 2.

Zusammenfassung – Deutsch

Seit Jahrzehnten, über einen langen Zeitraum, standen und stehen Menschen in Konkurrenz zueinander. Wettbewerb gehört zu unserem Alltag. Viele Einflüsse haben die Entscheidungen der Menschen über Jahrhunderte hinweg beeinflusst und wir versuchen bis heute, das rationale Verhalten von Menschen zu verstehen, warum sie auf eine bestimmte Weise handeln oder warum sie irgendwelche Entscheidungen treffen, während sie Teil eines Wettbewerbs sind. Viele Faktoren beeinflussen ihr Verhalten und bis jetzt haben wir begonnen, einige Prozesse zu verstehen, da Forscher uns mit vielen Papieren und Studien versorgt haben, die uns Zusammenhänge mit internen/externen Faktoren und menschlichem Verhalten zeigen.

Diese Studie zielt darauf ab, experimentell zu erklären und zu zeigen, wie sich Menschen in unterschiedlichen Umgebungen (nämlich in 2 verschiedenen Gruppen: Fremde und Freunde) verhalten. Ziel ist es zu testen, ob der N-Effekt (zunehmende Anzahl an Wettkämpfern führt zu sinkender Wettkampfmotivation) in einer der Gruppen vorhanden ist (indem den Teilnehmern Aufgaben gestellt werden, die in 2 Stufen mit immer weniger Konkurrenz unterteilt sind), während Sie das Quiz lösen und gegen andere Personen (in 2 verschiedenen experimentellen Gruppen) mit einer zunehmenden Anzahl von Konkurrenten während des Levels 2 antreten. Diese Arten von Aufgaben wurden basierend auf den früheren Studien von Garcia und Tor, Festinger und anderen Forschern ausgewählt. Darüber hinaus zielt diese Studie darauf ab, das Vorhandensein eines sozialen Vergleichs in 2 Umfragegruppen aufzuzeigen.

Nach Abschluss des Experiments wurde N-Effect in keiner der Gruppen gefunden (weder in der Gruppe der Freunde noch in der Gruppe der Fremden). Es gibt keinen statistisch signifikanten Unterschied zwischen Level 1 und Level 2 in beiden Gruppen. Daher wurde der soziale Vergleich definiert, der als Mediator zwischen unabhängiger Variable (Gruppe von Fremden oder Freunden) und abhängiger Variable (N-Effekt) diene, und wir können behaupten, dass es einen statistisch signifikanten Unterschied im sozialen Vergleich zwischen zwei Gruppen gibt (Fremde und Freunde) im Level 1 und im Level 2.

References

- Allport, F. H., 1920. The influence of the group upon association and thought. *Journal of Experimental Psychology*, 3, pp.159-182.
- Badalian, A., 2012. The N-Effect and the Size of the Competitive Venue, pp. 1-24.
- Bond, C. F., 1982. Social facilitation: a self-presentational view. *Journal of Personality and Social Psychology*, 42, pp. 1042-1050.
- Dashiell, J., 1930. An experimental analysis of some group effects. *Journal of Abnormal and Social Psychology*, 25, pp.190-199.
- Festinger, L., 1954. A theory of social comparison. *Human Relations*, 7, pp. 117–140.
- Garcia, S. & Halldorsson, A., 2021. Social comparison. In R. Biswas-Diener & E. Diener (Eds), *Noba textbook series: Psychology*. Champaign, IL: DEF publishers. Available at: <http://noba.to/y4urxhvj> [Accessed 16.05.2021].
- Garcia, S.M. and Tor, A., 2009. The N-Effect: More Competitors, Less Competition. *Association for Psychological Science, Volume 20—Number 7*, pp. 871-877.
- Garcia, S. M., Tor, A., & Gonzalez, R. D., 2006. Ranks and rivals: A theory of competition. *Personality and Social Psychology Bulletin* 32, pp. 970–982.
- Goethals, G.R., & Darley, J., 1977. Social comparison theory: An attributional approach. In J. Suls & R.L. Miller (Eds.), *Social comparison process: Theoretical and empirical perspectives*, pp. 259-278.
- Henchy, T., & Glass, D. C., 1968. Evaluation apprehension and the social facilitation of dominant and subordinate responses. *Journal of Personality and Social Psychology*, 10, pp. 446-454.
- Jones, B., Rachlin, H., 2006. Social Discounting. *Psychological Science, Volume 17, Number*

4, pp. 283-286.

Larrick, R.P., Katherine A.Burson, K.A. & Soll, J.B., 2007. Social comparison and confidence: When thinking you're better than average predicts overconfidence (and when it does not). *Organizational Behavior and Human Decision Processes*, Vol. 102, pp. 76–94.

Moore, D. & Healy, P.J., 2007. The Trouble with Overconfidence. *Tepper School of Business*. Paper 341. Available at: <http://repository.cmu.edu/tepper/341>
[Accessed 16.05.2021].

Moore, D. A., & Small, D. A., 2007. Error and bias in comparative social judgment: On being both better and worse than we think we are. *Journal of Personality and Social Psychology*, 92(6), pp. 972-989.

Mukherjee, K. and Hogarth R.M., 2010. The N-Effect: Possible Effects of Differential Probabilities of Success. *Psychological Science*, 21(5), pp.745–747.

Plous, S., 1993. The psychology of judgment and decision making. McGraw-Hill Book Company.

Salvador, A., 2005. Coping with competitive situations in humans. *Neuroscience and biobehavioral review*, Vol.29 (1), pp.195-205.

Sanders, G. S., Baron, R. S., & Moore, D. L., 1978. Distraction and social comparison as mediators of social facilitation effects. *Journal of Experimental Social Psychology*, 14, pp. 291-303.

Student, 1908. The probable error of a mean. *Biometrika* 4, pp.1-24.

Tesser, A., 1988. Toward a Self-Evaluation Maintenance Model of Social Behavior. *Advances in Experimental Social Psychology*, Vol. 21, pp. 181-227.

Tesser, A. and Campbell, J., 1982. Self-evaluation Maintenance and the Perception of Friends and Strangers. *The Journal of Personality*, 50:3, pp. 261-279.

Triplett, N., 1898. The dynamogenic factors in pacemaking and competition. *The American*

Journal of Psychology, 9, pp. 507-533.

Zajonc, R., 1965. *Social facilitation*. *Science*, 149, pp.269-274.

Zell, E., Sedikides, C., Strickhouser, J.E., Alicke, M.D., 2020. The Better-Than-Average Effect in Comparative Self- Evaluation: A Comprehensive Review and Meta-Analysis. *Psychological Bulletin*, Vol. 146, No. 2, pp. 118–149.