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Mindset Dynamics in Risk Taking - How Decision Making and Performance can Profit from Deliberative and Implemental States of Mind

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Preliminary Remarks

A priority of all scientific work should be preciseness and comprehensibility in language. Therefore, repetitive structures are preferable over ambiguity. That said, efforts were made to compose a precise as well as stylistically appealing work. The APA guideliness for publications (6th edition) were followed for citations, tables, graphics, and the bibliography. Decimal places were reported to the extent that they are meaningful. The metric system was used to report most data, with an exception regarding the second experiment. There, readability concerns as well as comparability issues with other research using the same paradigm suggested using the original units (feet).

This dissertation has been written in English. However, with everybody involved in the project being German native speakers, some citations were included in their original German wording. Yet, should non-German speakers want to read this work, all citations are embedded into the topical context in English and this practice should not impair anyone's understanding of the content.

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Summary

This work was set up to investigate whether motivational states can benefit economic risk-taking behavior. Motivational states, or mindsets, are widespread psychological constructs, originating in the Würzburg School in the 20th century. They consititute a crucial part of many psychological theories, such as construal level theory, regulatory focus theory, and the mindset theory of action phases.
The latter stands in the focus of this work, specifically the deliberative and implemental mindset. These mindsets are known to have distinct properties that tune individuals towards certain emotional, cognitive, and behavioral patterns and processes. Discussing these different dimensions of mindset effects (as well as several induction methods for mindset manipulations), it becomes clear that theory cannot unambiguously predict mindset effects on economic risk taking. Emotional effects would suggest the implemental mindset to provide an advantage because of its tendency towards optimism and lower risk aversion, as compared to the deliberative mindset. However, on a cognitive level, the deliberative mindset is more tuned to weigh choice options accurately and less susceptible to biases, which could increase rational decision making. Therefore, two experiments were designed to examine which mindset effects would apply; whether one mindset was more beneficial to economic decision making; and whether these effects depended on external circumstances, such as the level of difficulty or monetary incentives.
In an eye-tracking study, the first experiment focused on differences in the decision-making process between the mindsets and an additional control group. The task consisted of 40 lotteries with different levels of difficulty. Decision times, the number of fixations on different kinds of information, and choices were recorded. Results indicated a more intense decision-making process in the implemental mindset as compared to the deliberative mindset, but choices were the same in all conditions.
In the second experiment, participants played a ring toss game to further investigate the impact of effort and achievement motivation in economic risk-taking tasks. Providing performance-based monetary incentives, participants in an implemental mindset achieved significantly higher profits over the course of 10 rounds than deliberative and control participants.
Overall, findings suggested an increased level of achievement motivation in the implemental mindset in economic risk-taking settings. Implemental participants seemed to interpret the task as a challenge rather than a threat, yet, they only benefitted from the mindset when they could choose their own risk-taking levels and monetary incentives rewarded good performance. Deliberative participants might as well have experienced an increase in achievement motivation, yet, this seemed to activate more of a threat-perception of economic risk taking and emphasized cautiousness.

In relation to the research question, it is suggested that emotional mindset effects dominated in these experimental settings and in relation to economic risk taking in general. This suggests applying a dual-process approach to mindset theory when predicting mindset effects in different contexts.
Moreover, the role of individual differences is discussed, since gender has played a prominent role in achievement motivation research, and gender differences were indeed observed in the second experiment. Also, financial incentives are a novel addition to mindset research which provide external motivation and also seemed to augment deliberating participants' performance in the second experiment.
Limitations in terms of methods and the generalization of the presented findings and implications as well as ideas for future research projects are provided.

1. Introduction

The goal of the research presented in this dissertation is to analyze decision-making processes in different mindsets, specifically their impact on economic risk-taking behavior, and to find out whether they can support better performance and outcomes. This is a major concern of motivation research in general: understanding the reasoning mechanisms that determine actions and using that knowledge to promote healthy and rational behavior. In the present work, this goal related to a specific set of behaviors, that is, decisions under risk and in an economic context. A key strategy to improve outcomes in this field is to increase rational choices. More than that, however, this work also focuses on decision processes that forego rational or irrational behavior, to better understand the nature of mindset effects. Thus, it is not only relevant how individuals decide, but also how they arrive at that decision. To that end, risk-taking situations were examined with repeated measurements, different levels of difficulty, and different incentives. To explain mindset effects and their overall implications for risk taking, achievement motivation, learning processes, and different strategies of goal pursuit are discussed.

In this work, cognitive stimulations were used to create specific states of mind (*mindsets*) that have the potential to improve decision-making processes. Among other things, mindsets are known to impact cognition as well as behavior in decision tasks. The concept of mindsets is featuring in various psychological theories, some of which are discussed in Chapter 2. Specifically, the historical background of the concept is outlined, and the deliberative, implemental, actional, and evaluative mindsets as part of the mindset theory of action phases by Gollwitzer (1990) are introduced. Furthermore, other critical motivational theories employing mindsets are discussed, such as construal level theory by Trope and Liberman (2003) and regulatory focus theory by Higgins (1997). Finally, a brief critique of the concept of mindsets sheds some lights on its perceived shortcomings and prepares for some of the issues raised in later discussions.
In Chapter 3, the methodology of mindset inductions is outlined. Introducing the idea of carry-over effects in mindsets, the chapter gives an overview of established and new procedures to manipulate individuals' states of mind. Also included are discussions of manipulation checks, the usage of control groups, and the idea of neutral mindsets in experiments. Finally, some open questions regarding mindset inductions are introduced, such as issues regarding the durability of mindsets, the strength of different induction methods, the interaction with other motivational factors, specifically monetary incentives, and the utilization of naturally occurring motivational states.
In Chapter 4, the state of research on the effects of mindsets on cognition, affection, and behavior is summarized. Classic effects as well as seemingly contradictory results are addressed and put into context.

Chapter 5 then focuses on mindset effects in situations involving economic risk-taking behavior. Specifically, previous results of mindset studies as well as theoretical expectations involving the deliberative and implemental mindset are discussed to predict the nature and the benefit of mindsets in economic risk taking. Also, using repeated measurements in the empirical investigation of these questions, the idea of mindset dynamics is considered. The durability of mindsets as well as the impact of context on the nature of mindset effects are outlined, and the role of these dynamics in the upcoming experiments is discussed.
In Chapter 6, the first experiment testing mindset effects in an economic risk-taking context is presented. Using eye-tracking technology, the chapter examines differences between mindsets in information processing in a lottery task. Results indicated an increased level of achievement motivation in the implemental mindset.
In Chapter 7, the second experiment follows up on the hypothesis of higher achievement motivation in the implemental mindset in a ring toss task. Applying the game as a means to measure risk taking as well as achievement motivation, some of the findings from the first experiment are supported and complemented by further insights regarding the deliberative mindset. Also, more dynamic aspects of risk taking come to the fore.
Results of both experiments are discussed in Chapter 8, when outcomes are related to each other to give a more general view on mindset effects on economic risk taking. Different strategies that could evolve from increased levels of achievement motivation in both mindsets are debated and disadvantages as well as benefits of both mindsets regarding risk taking, information processing, and outcomes are considered. Also, limitations of these findings are outlined, before Chapter 9 summarizes all findings and lists implications for future research.

All in all, the goal of this work is to provide new insights into risk-taking behavior and decision processes in economic contexts, as they are influenced by different states of mind. In addition, possible measures to help increase rationality in risky situations are outlined to provide some practical applications for the findings of this work. For some, the suggestion of the "improvement" of decisions through manipulations of individuals' states of mind may have an Orwellian ring to it. On the contrary, however, the present research will hopefully increase knowledge about naturally occurring, everyday mindsets and their impact on human perception and behavior, in order to enable or train people to make a targeted use of their mindsets and reach their desired goals.

2. Mindsets

"We see things the way our minds have instructed our eyes to see."
— Muhammad Yunus, *Winner of the Nobel Peace Prize 2006*

2.1. Mindsets in Psychology: Origin and Development

Mindsets, also *mind-sets*, are states of mind, or cognitive orientations that have the power to impact human information processing and perception. As such, they may impact thought contents, emotions, and behavior (Gollwitzer, 1990). Yunus, professor of economics, summarized the idea well in an interview (quotation above, O'Bryon, 2005). Unrelated to the theory of mindsets, he found that the state of the world depended on each individuals' mind. However, the concept of mindsets goes further than that. Apart from individual differences in the perception of the world, mindsets imply that situational factors also shape cognitive processes. Thus, the term conceptualizes the notion that the mind - itself exposed to various situational influences - has the potential to moderate actions.
Mindsets are a crucial factor in a variety of theories in motivation research. The current definition of mindsets was primarily advanced by Gollwitzer (1990) who integrated mindsets as a second layer into the rubicon model of action phases. Also, he traced the origins of the term back to psychologists of the German Würzburg School in the early 20th century. For instance, Watt (1904) observed that task instructions had the power to affect performances by creating *Einstellungen* that could impair or promote goal achievement.[1] In other words, he observed the outcome of a priming effect: the processing of certain contents and phrases in the instruction material influenced participants' behavior when performing the according task. Specifically, Watt found that he could set participants' minds to be more efficient and enhance task completion.
Hamilton, Vohs, Sellier, and Meyvis (2010), also reflecting on the contributions of the Würzburg School, referred to Ach (1905) as one of the sources of the concept of mindsets. Famous for his proceedings on willpower, Ach observed determining tendencies in participants in his experiments. Instructions giving specific rather than abstract directions led to faster and more reliable performance results.

While these are the origins of mindsets in psychology, the phenomenon - the mind impacting behavior - was by no means unknown before the 20th century. The idea, to a certain extent, can already be identified in *The Art of War*, dated back to the 2nd century BC:

[1] German term used in the Würzburg School, actually meaning *attitudes*.

> "Unhappy is the fate of one who tries to win his battles and succeed in his attacks without cultivating the spirit of enterprise; for the result is waste of time and general stagnation." (Tzu, unknown, 15. Advice)

Tzu suggested that a warrior's state of mind could be the crucial instrument that makes the difference between his success and failure in battle. Indeed, the "spirit of enterprise" seems interchangeable with the implemental mindset which is specified in the next chapter. Above all, however, the quote proves that the relevance of the link between goal achievement, motivation, and volition was acknowledged long before it was conceptualized in motivation research.

Still, it was only recently in the 20th and 21st century that the role of mindsets was systematically investigated. Looking at theories employing similar principles as his, Gollwitzer (1990) noted that

> "(t)he classic definition of mind-set (Einstellung) advanced by the Würzburg school suggests that the mechanisms mediating mind-set effects are located in the cognitive processes advancing the solution of the task that stimulated the mind-set. (...) In this sense, the observed mind-set effects are most similar to the cognitive tuning effects originally analyzed by Zajonc (1960) and extended by Brock and Fromkin (1968), Cohen (1961), Leventhal (1962), and most recently by Higgins, McCann, and Fondacaro (1982)." (Gollwitzer, 1990, p. 83)

In fact, the studies listed significantly advanced research on mindset theories. Additionally, early mentions of mindsets include Shales's (1930) and Thorndike's (1949) works on how the mind influenced cognition. Recapitulating this historic development, Shales found temporarily limited as well as time-withstanding mindsets. While the former was already known through the works of the Würzburg School, he focused on the latter. He found, for instance, that rural or urban upbringings could create long-term mindsets that shaped attitudes in various fields (e. g., expectations, problem-solving behavior). However, from today's perspective, these findings reflect individuals' experiences rather than different mindsets. More closely related to Gollwitzer's (1990) definition of mindsets, Thorndike observed that different sets of instructions influenced the frequency of a specific class of words (e. g., proper nouns, common nouns, rare nouns) in a word production tasks. Although compelling, his results must not be overrated, as he primarily relied on himself as his sole subject. Yet, while there are obvious issues with their experiments (Shales asking for experiences rather than mindsets and Thorndike using himself as his only subject), Shales's and Thorndike's understanding of mindsets was very up to date. In fact, Shales's opening sentence does not seem too far from many current introductions to the topic:

> "It is generally accepted psychological principle that the reaction of a human being to any particular situation is to a large extent determined by his mind-set or attitudes." (Shales, 1930, p. 246)

While the term was quite established by the 1950s, important advancements in the studying of mindset effects also took place under different terminology. For instance, Zajonc (1960) conducted very influential experiments aimed to activate cognitive structures called *tuning sets* that either facilitated the transmitting of information or its reception. He suggested that participants induced with a transmitting tuning set would be more detail oriented while receiving-tuned participants would process information on a more general level. He tested these hypotheses by inducing tuning sets with two sets of instructions. In the transmitting condition, participants were told that they were expected to describe a person they had read about, while in the receiving condition, they were prepared to receive information about a person they had read about. When participants were then asked to describe the person they had read about, transmitters gave more detailed reports and receivers concentrated on more general features. Zajonc explained these findings by arguing that receivers maintained a more flexible position and only remembered the main points, in order to be able to incorporate new information. Transmitters on the other hand, expecting to summarize information, had mentally completed the input phase, were thus settled on the information in front of them, and went into more details. In a second experiment, Zajonc then tested participants' resistance to persuasion attempts. When participants expected to either transmit information or to receive information from somebody with a different opinion than them, both tuning conditions formed more unified and rather similar presentations of the person.
Guerin and Innes (1989), who reviewed all fourteen studies on cognitive tuning that existed at the time they wrote their article, listed a few weaknesses in Zajonc's (1960) studies, including inconsistent inductions methods and unclear instructions. Still, they emphasized, his work must still be seen as "pioneering (...) in the idea of tuning sets" (Guerin & Innes, 1989, p. 236).
Consequently, the idea of cognitive tuning and tuning sets spread. A year later, Cohen (1961, p. 235) described them as situational factors that determined how inconsistent information about an individual was merged into a coherent impression. He adopted the two tuning sets of transmitting and receiving, and measured how participants in these different conditions incorporated contradictory information about a person's personality into their description of that person. Again, results indicated strong tuning effects. Cohen observed that transmitters tended to focus either on positive or negative traits, whereas receivers gave a more balanced picture of contradictory information. He concluded that indeed, "cognitive structure may be affected by the nature of the setting in which information is processed" (Cohen, 1961, p. 245). These findings were later replicated by Brock and Franklin (1968) who focused their research on naturally occurring tuning sets. They argued that transmitter and receiver sets existed as situational factors, specifically in the "individual's role in the communication process" (Brock & Franklin, 1968, p. 108).
Despite this replication, one year after Cohen's (1961) publication, Leventhal (1962) reported on an experiment that produced results opposing Zajonc's (1960) findings. In an attempt to explain how people changed initial impressions, Leventhal presented a person called Karl to participants in an experiment. In a first step, only positive information on Karl was shared. Then, in a second step, some negative information was

added. Leventhal found that receivers tried harder to make sense of the contradicting pieces of information and to incorporate all aspects into one, rather complex picture of Karl. Meanwhile, transmitters seemed to update their first impression by replacing positive with negative descriptions. This contradicted Zajonc's initial findings (receivers being more flexible in their positions and transmitters being more detail-oriented), but matched Cohen's results of receivers balancing incoherent information and transmitters being rather partial for one side of an argument. These seemingly inconsistent results are somewhat similar to properties assigned to the mindsets discussed in the second part of this chapter. As discussed later, context might play a role in explaining such results. In this case, however, Leventhal pointed out that he had made considerable adjustments to the experimental design. He gave more information on the person to be depicted and instructed all participants to give comprehensive accounts of that person. In comparison, Zajonc's setup inherently provided receivers with more information than transmitters. Guerin and Innes (1989) added that Leventhal's instructions to receivers (not to jump to conclusions) differed significantly from those given to transmitters (give a complete and clear impression of the person). This could have easily influenced outcomes. However, as Guerin and Innes pointed out, that should not be a reason to disregard Leventhal's findings. The two step design was quite close to Cohen's setup, and findings also followed Cohen's reasoning. Thus, rather than ignoring them, the reasons for the inconsistencies with Zajonc's findings should be discussed. Then, in a small note on Leventhal, Guerin and Innes stated what was just then starting to become one of the major themes of motivation research:

> "Leventhal also suggested a major point: that the goals of the two sets [receiving vs. transmitting, note by author] might have some bearing on the results. So the implicit motivational aspects were suggested to have some effect on the cognitive organization." (Guerin & Innes, 1989, p. 237)

Indeed, Leventhal, and also Cohen before him, introduced this thought of goals playing an important role in cognitive tuning research. Both suggested that the goal of transmitting or receiving information (mostly transmitting, e. g., in persuasion contexts or when sharing information) could in fact be an alternate explanation for their results and determine information processes. Heckhausen and Gollwitzer (1987) later followed up on this exact thought. Examining motivational and volitional aspects of goal attainment, they realized that the closeness to goal attainment, rather than the mode of communication, was the decisive factor that determined thought contents. Before going further into detail, one more study that advanced mindset research significantly before the mindset theory of action phases must be addressed.

Up to their study, Higgins, McCann, and Fondacaro (1982) claimed, all tuning studies were based on a disparate distribution of information. Experimenters consistently told receivers that they would later receive more information on a topic they were then asked to write about, while transmitters had no similar experience of incomplete input. This constituted a major weakness of the whole field of research, since differences in judgment could well be assigned to this procedural difference. While transmitters were sure to possess all information, receivers might have withheld judgment because they thought

there was still more information to come. Higgins et al. aimed to eliminate this difference between the conditions in a study testing how close transmitters versus receivers kept to information they were given if they expected to meet a person that had either read the same text or a different text. They made sure in the induction of tuning sets that half of both transmitters and receivers expected more information to come, and half of both conditions knew that the experimenter had provided them with all the input there was. However, results showed that the expectation of more information did not make a difference within each group. Guerin and Innes (1989) pointed out that the authors ignored the fact that by definition, receivers expected to be on the receiving end of some kind of information. While a case can be made that this also applied to at least half of the transmitters who also experienced a state of incomplete information, it is true that this receiver-problem cannot be wholly eliminated.

Overall, these studies provide ample evidence that tuning sets have the potential to influence information processing and communication behavior. However, some major methodological issues make it difficult to compare findings in all of the above studies and deduce a coherent model. Also, cognitive tuning is a factor that primarily aims at communication modes. Mindsets, however, operate on a broader level, they occur naturally and affect basic cognitive functioning. Thus, the idea of tuning sets more or less disappeared from motivation research after the 1980s. Instead, researchers reclaimed the term of mindsets. Tuning sets mainly survived in Gollwitzer's adaption of the term as a verb, explaining the mechanisms of mindsets. The expression *cognitive tuning* makes the concept easily accessible and captures the essence of the function of mindsets. For instance, Gollwitzer, Heckhausen, and Steller (1990) stated that mindsets allowed "cognitive tuning toward congruous thoughts and information" (p. 1119), explaining that "mind-sets tailor a person's cognitive apparatus" (p. 1119) and that tuning entailed thought production as well as the encoding and retrieval of information.
On a final terminological note, there is still an ongoing minor orthographic variation of the term *mindset*, regarding the usage of a hyphen. While the hyphen gets dropped more and more, the transition phase does not yet seem complete. In Gollwitzer's publications, both forms coexisted between 1995 and 2008. And although recent papers on mindsets within the rubicon model mostly use the hyphen-less form, both forms are still in use in related fields of motivation research (e. g., McCrea, Wieber, & Myers, 2012; C. Harmon-Jones, Schmeichel, Mennitt, & Harmon-Jones, 2011). Also, this review of the evolution of mindsets only considered major developments within psychology towards their usage in the rubicon model. Other disciplines like philosophy or neuroscience that are concerned with similar questions were not taken into account and might well have a different history of mindsets. While those disciplines certainly can contribute to mindset research, it is not within the frame of this work to include their advancements. Rather, some influential psychological models and theories based on mindsets are discussed in the next part.

2.2. Mindsets in Motivation Research

The goal of motivation research is to explain underlying processes of actions and give recommendations to facilitate successful behavior. Mindsets have a prominent role in this endeavor, since they are crucial in determining the direction ideas may take and can even influence action outcomes. This section will first introduce the rubicon model of action phases (Heckhausen & Gollwitzer, 1987) from which evolved the mindset theory of action phases (Gollwitzer, 1990). Then, this theory - which provided the basis for the experiments reported later in this work - are contrasted with other theories involving mindsets. Namely, the merits of construal level theory (Trope & Liberman, 2003, 2010) and regulatory focus theory (Higgins, 1997) and their understanding and application of mindsets are discussed.

2.2.1. The Rubicon Model of Action Phases and Mindset Theory of Action Phases

When performing an action, individuals pass through different phases: from deciding upon a goal, to planning it, executing the action, and finally judging its success. These phases are integrated and conceptualized in the rubicon model of action phases (Heckhausen & Gollwitzer, 1987), see Figure 2.1. According to the model, the phases (deliberation, implementation, action, and evaluation) bring together both motivational and volitional aspects of goal pursuit (Heckhausen, 1987a, 1987b; Gollwitzer, 1990).

Figure 2.1.: Rubicon Model of Action Phases

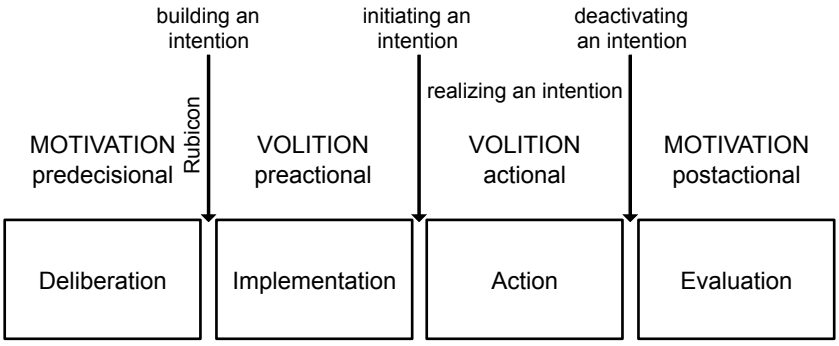

Figure 2.1. Rubicon model of action phases, based on Achtziger & Gollwitzer, 2010, p. 311.

Each phase has very task-specific cognitive demands. For instance, imagine a person in dire need of money. To solve this problem, the person could consider saving money, asking someone for money, working, getting a loan, or stealing money. Depending on the amount of money needed and the severity of the situation, the person might deliberate some of these alternatives, weighting benefits and risks, and think about possible consequences. During deliberation, the person will try to find the best solution and look

at any conceivable idea. Finally, however, a decision has to be made, either to not act at all, or to pursue one of the alternatives. The moment the person makes up his or her mind, the proverbial Rubicon is crossed and the question changes from *what* to do to *how* to do it. The example of a bank robbery illustrates this idea well: the person will need to fix a location, a time, and the modus operandi to even have a slight chance of achieving the goal. Naturally, the option to abandon the plan remains an option until the very moment of action, but if the person is deeply committed to this course of action, he or she might initiate one of the annually recorded 193 bank robberies in Germany (Bundeskriminalamt, 2014). During the robbery itself, the person will strongly focus on the plan and be alert to any obstacles. Afterwards, depending on the outcome, the action is evaluated in terms of success or failure. The person needs to determine whether the problem is solved, if other actions are necessary, or if the goal needs to be terminated unsuccessfully. This critical evaluation of the experience and the outcome will then influence future goals and choices.

While bank robberies are admittedly rare, the example demonstrates very clearly the evolution of a desire to a specific plan of action, its execution and evaluation. In terms of the model, it shows how, in the deliberation phase, a person needs to select one of several competing wishes to pursue. This is the predecisional goal-setting stage, a motivational phase that is dominated by the weighing of desirability and feasibility issues of different goals. A choice is then made by sorting out priorities and reasons, so the decision can later be justified. At the same time, motivation is a temporary state that is affected by personal as well as situational factors. Thus, the choice of a goal does not only depend on an individuals' own preferences, but also on the environment (Heckhausen, 2010). While the length of deliberation can vary, the status of indecisiveness is generally perceived as unpleasant and linked to higher levels of anxiety and lower levels of self-esteem (e. g., Santos, 2001). Thus, the deliberation phase is inherently designed to end and to lead to a decision of either action or inaction. In the model, this is summarized in a metavolitional control process, the *bottom-line tendency* (Heckhausen, 1991) or *facit tendency* (Achtziger & Gollwitzer, 2010). The tendency entails the idea that the longer deliberation lasts, the more alternatives and consequences should be considered, and the deeper consideration should be. Thus, the longer the deliberation, the closer the individual should be to making a decision - as long as "a previously stipulated level of clarification has been attained" (Achtziger & Gollwitzer, 2010, p. 277). Clarification, in this context, increases along with the importance of the decision and decreases in relation to the investment of effort and resources. Ultimately, with achieving a satisfying level of clarification, a decision will end the deliberation phase.

If the goal is not immediately reached by making a decision, the individual then passes into the implementation phase. This transition from deliberation to implementation is the central feature of the model and therefore the origin of its name. The *rubicon model of action phases* refers to the proverb *to cross the Rubicon*, which is based on Julius Ceasar's decision of 49 BC to break the law, cross the border river, and enter Italy with a legion of soldiers. The decision was irreversible and provoked a civil war. While

the incident also introduced the famous quote *alea iacta est*, describing a point of no return, Gollwitzer (1990) pointed out that the metaphor was chosen because it depicted a famous situation in which "incessant deliberation" (p. 62) was put at a rest, rather than its relation to a point of no return. According to the metaphor, the implementation phase is based on the intention to act and an individual's strong commitment towards a specific goal.
The purpose of the implemental, that is, the postdecisional and preactional, phase lies in the planning of goal attainment. It serves to translate intentions into actions.

> "The normal business of the preactional volition phase is the initiation of one of the many competing goal intentions because effective action requires that it be controlled by only one goal intention." (Heckhausen, 1991, section: action initiation, paragraph 2)

Thus, it is a volitional, goal-striving phase in which the individual is mainly concerned with feasibility issues of the intended goal. Questions of how, when, and where to act, as well as the identification of possible obstacles are in the focus of attention. By distinguishing this volitional phase from the previous motivational phase, Heckhausen and Gollwitzer (1987) re-introduced the concept of willpower (Ach, 1905) into the sequence of actions. They combined goal-setting and goal-striving approaches into one model, pinpointing one of the major problems of motivation research: the gap that arises between wishes and actual behavior. Without a volitional aspect in the action sequence, goals would often remain desirable end-states that lacked implementation.
In situations with competing goal intentions, or when a goal cannot be implemented immediately, the *fiat tendency* determines which intention gets implemented as well as the time of action initiation. This tendency is a product of two driving forces: the strength of goal intentions on the one hand and the propitiousness and opportunity to act on the other. While a strong goal intentions might encourage individuals to create favorable circumstances to act, the natural recognition of such opportunities is often necessary for weak intentions to get realized in the first place. Other reasons for goal implementation include urgency, the number of missed opportunities, and previous, unsuccessful realization attempts (Heckhausen, 1991, section: action initiation, paragraph 1). All in all, the second phase is prone interruptions of the action sequence when conditions are unfavorable for action initiation or conditions are favorable to act on another intention. However, an approach that has been proven to increase the likelihood of goal attainment relating to this phase is the creation of implementation intentions (Gollwitzer, 1993). Implementation intentions are plans that do not just specify a goal in itself, but detail specific action steps, including ways of coping with possible obstacles (if-then plans, see Gollwitzer, 1999).

The initiation of the action itself then marks the beginning of the action phase. The realization of a goal is a volitional act and guided by previously set goals and plans. While those goals and plans do not have to be consciously present at all times, they are used to justify behavior in this phase. An important aspect in this context is flexibility; the more complex the nature of an action, the more flexible a person has to be to

account for changing conditions and unforeseen events. Interruptions and distractions can sidetrack an individual executing an action, and to reach the desired goal, the individual might have to increase his or her efforts. Otherwise, it might become necessary to think about early goal disengagement. For instance, in cases with major discrepancies between foreseeable outcomes and one's initial expectations or when encoutering incongruities between one's behavior and values, goal disengagement can be a solution to avoid cognitive dissonance (Festinger, 1957). However, for the most part, individuals in this phase are preoccupied with the realization of their predetermined goals according to the plan made in the implementation phase, and desirability is no longer a concern.
By completing the action (with success, by disengaging early, or by failing to reach the goal), the forth action phase is entered. Evaluation can be a simple and quick, or a more complicated and time-consuming task, depending on the complexity of the action and the goal. The level of complexity also determines the level of consciousness of the evaluation, which is in turn defined by questions relating to goal attainment, reasons for success or failure, and the necessity of goal re-engagement. In this phase, the initial goal is deactivated, but it can be reactivated if a new action cycle is instituted. Evaluation is the second motivational phase in the model and similar to the deliberation phase, in that the desirability of the end-state is evaluated and the feasibility of improvements on that state determine the outcome of the phase.

According to Gollwitzer (2003), the model came to be as an attempt to combine goal-setting research (Heckhausen's (1977) work on achievement motivation in the tradition of Atkinson (1957) and expectancy-value models) and his own goal-striving research (self-completion theory in the tradition of Lewin's (1926) tension system theory). By stressing the difference between motivational and volitional aspects during goal attainment, both were ultimately included in the rubicon model. While the phases represents an ideal sequence of events, Gollwitzer (1990) acknowledged that, in reality, action phases might overlap from time to time. He then further advanced the model by including the concept of mindsets as a second layer.

> "The Rubicon model of action phases postulates that a persons psychological functioning in each of these phases is governed by different principles." (Gollwitzer, 2003, p. 263)

In the second layer, it is assumed that each action phase is accompanied by an according mindset. Mindsets evolve whenever a person pursues a goal, facilitating its realization by providing the necessary cognitive functions to process the demands of a given situation (Gollwitzer, 1990). Already when developing the model, Heckhausen and Gollwitzer (1987) assumed that "contents and mode of information processing are expected to differ for each of these states of mind" (p. 103). This idea was later expanded and four mindsets, one specific cognitive orientation per phase, are now part of the rubicon model and their conceptualization is referred to as the mindset theory of action phases (Gollwitzer, 2012).
The deliberative mindset, as the predecisional state of mind, and the implemental mindset, as the postdecisional and preactional state of mind, have been at the center of

mindset research since the beginning. This is little surprising, given their universal existence in everyday life. While specific actions and their subsequent evaluations only take place under the right circumstances (as determined by the fiat-tendency), deliberation and implementation phases are less bound to specific opportunities. Also, understanding deliberation and implementation and the according mindsets entails promises of intervention opportunities to nudge individuals towards success before action takes place in the first place. Finally, the dominant focus on the first two phases could be assigned to the fact that they cover both, motivational and volitional phases, which then are repeated later on in the model and therefore might contain some similar characteristics.

The Deliberative Mindset

In the deliberative mindset, individuals focus on weighing possible outcomes and estimating expectancies (e. g., Gollwitzer, Heckhausen, & Ratajczak, 1989; Heckhausen & Gollwitzer, 1987). Heckhausen and Gollwitzer (1987, Study 1) analyzed the contents of spontaneous thoughts and found that individuals in this mindset tended to list reasons for and against taking action on a possible goal and considered opportunities as well as dangers before committing to an action. Furthermore, Beckmann and Gollwitzer (1987) argued that there was a deliberation-specific encoding and retrieving mechanism for information in the first phase. Based on an experiment on memory recall, they proposed that a person in a deliberative mindset pays attention to all available information and all choice alternatives, and is able to recall all information equally well. Accordingly, a deliberating individual represents a well-informed decision maker who incorporates all available data into the decision process of picking a goal. While this ideal image has often been rejected due to biases intervening in the decision process (e. g., Kahneman & Tversky, 1979), the deliberating mindset is supposed to strengthen this approach.
Other studies investigating the stream of thought in the deliberative mindset actually found more deliberative thoughts in this mindset than in the implemental mindset. For instance, Gollwitzer et al. (1990) asked participants to continue fairy tale beginnings and found more contemplating (vs. action-taking) contents in the deliberative mindset. Together with similar findings by Taylor and Gollwitzer (1995), this can be interpreted as a sign of dominance of mindset-congruent thoughts. Moreover, Puca and Schmalt (2001) found evidence for more realistic expectancy-value considerations in the stream of thought of participants before (vs. after) choosing a goal.
These studies have led to the overall recognized description of the mindset as prompting realistic and impartial deliberations about the attainability of outcomes as well as about the desirability of potential consequences. And indeed, those features match the original function of the action phase in the model:

> "(T)he probability of attaining a particular outcome needs to be assessed without self-serving bias, and the incentives associated with the outcome (i.e., attributes or consequences that make it attractive or unattractive) need to be appraised critically." (Beckmann & Gollwitzer, 1987, p. 260)

Gollwitzer and Kinney (1989) pointed out that through this filtering function, the deliberative mindset prevents individuals from choosing goals that are undesirable or too difficult to achieve, and that it is helpful to avoid rash decisions and judgments. These features are often summarized under the notions of impartiality and open-mindedness (e. g., Bayer & Gollwitzer, 2005; Gollwitzer & Bayer, 1999)
Overall, there is ample evidence that individuals in a deliberative mindset process information in an open, more balanced, impartial, and rational manner than in other action phases. It has also been argued that the deliberative mindset might be the default mindset of individuals facing new challenges (e. g., Hügelschäfer & Achtziger, 2014; V. Brandstätter & Frank, 2002). Since the rubicon model has a temporal axis and the deliberative mindset is part of the first phase, this is a reasonable assumption for tasks requiring deliberation. For instance, Gagné and Lydon (2001b) pointed out that in experimental setups in which individuals were asked to perform unfamiliar tasks or think about very personal issues, the deliberative mindset might indeed have applied to everyone. Meanwhile, routine tasks and extremely simple or meaningless actions could be exempt. Also, as Heckhausen (2010) noted, motivational states are influenced by context, which could mean that deliberation is not always the status quo. Among others, this question is further discussed in Chapter 3, when the idea of inducing a neutral mindsets is introduced.

The Implemental Mindset

In the implemental mindset, individuals are preoccupied with their intended goal and its realization (Heckhausen & Gollwitzer, 1987). The attention focus narrows to a selective orientation towards the manner of goal achievement. The mindset thus provokes closed-mindedness regarding the receptiveness and selectiveness of information (e. g., Achtziger & Gollwitzer, 2010). Beckmann and Gollwitzer (1987) observed that individuals in this mindset processed information with the efficient implementation of the intended goal in mind. To that effect, individuals tend to concentrate on cues that are relevant for goal-attainment and disregard information that is irrelevant. For instance, information relating to the desirability of a goal is extraneous to planning individuals, as its attractiveness has already been established in a previous phase. Thus, feasibility is the overall major concern during implementation and individual focus on positive as well as negative information. Indeed, while there is tendency to be overly optimistic about one's chances (e. g., Bayer & Gollwitzer, 2005), only the inclusion of negative information enables a person to identify and maybe even avoid possible obstacles.
Heckhausen and Gollwitzer (1987) reported that individuals in an implemental mindset had a worse memory of expected value information, but that they also remembered implementation-related information better than participants in other mindsets. Moreover, since the purpose of the mindset is the promotion of goal attainment, it consequently fosters positive attitudes and expectations towards the task (Armor & Taylor, 2003). Partial information processing (e. g., Beckmann & Gollwitzer, 1987), a stronger susceptibility to biases (e. g., Hügelschäfer & Achtziger, 2014), and higher risk preferences (e. g., Puca, 2001) are further key features of the cognitive tuning in the implemental

mindset.
This overall positive and optimism-promoting mindset is in line with the idea of postdecisional dissonance reduction (e. g., Festinger, 1957). According to this concept, individuals who have made a decision view their choice in a positive light, even if objectively, they could have made a better choice. They reduce cognitive dissonance and justify their choice by overemphasizing its assets and devaluing alternative ways of action. However, Beckmann and Gollwitzer (1987) stressed an important difference between the function of the implemental mindset and dissonance reduction. Acknowledging that postdecisional dissonance reduction exists, they argued that it only applied to situations in which the first phase, deliberation and the choice of an intended goal, had been unsuccessful. Otherwise, justification seemed unnecessary.

> "We believe that in the postdecisional/preactional phase the individual is first and foremost interested in implementing the chosen action goal, and that it is this implemental concern that leads to partial information processing in favor of the chosen alternative, rather than a need for consistency or justification." (Beckmann & Gollwitzer, 1987, p. 261)

Thus, the implemental mindset has the overall function to transform intentions into actions and individuald should only be concerned with dissonance reduction when the deliberation phase has failed. Rather, the mindset promotes thoughts that help achieve an intended goal, therefore supporting features such as focused attention, optimism, and commitment.

The Actional Mindset

The actional mindset has been subject to much fewer studies than the deliberative and implemental mindsets and most knowledge about the properties of the mindset derive from theory rather than empirical evidence. The volitional nature of the mindset could indicate some commonalities with the implemental mindset. The main concern of individuals in the action phase is to successfully implement goal-directed actions (Achtziger & Gollwitzer, 2010). Thus, the mindset should facilitate the handling of obstacles and distractions, and the re-engagement in an action after interruptions. During action implementation, it might at some points be necessary to increase efforts, so the mindset should also facilitate dynamic adjustments of involvement and commitment capacities. The conscious or unconscious mental representation of a chosen goal is seen as the main reason for completing an action. Thus, the desirability of an end-state might reinforce the efforts put into an action, but feasibility concerns should still dominate the mindset. Theoretically, the mindset should also incorporate characteristics of the state of flow (Csikszentmihalyi, 1975) which is defined as an optimal state of experience when executing an action (Csikszentmihalyi, 1988, p. 3). Individuals who are in a state of flow are completely absorbed in the action they are performing, which equals the basic goal of the actional phase. And indeed, Gollwitzer (1990) linked the actional mindset to flow experiences, explaining that in the mindset

> "(O)nly those aspects of the self and the environment that sustain the course of action are attended to, whereas any potentially disruptive aspects (e. g., self-reflective thoughts, competing goal intentions, distractive environmental stimuli) are ignored." (Gollwitzer, 1990, p. 66)

Based on this analogy, the mindset should then promote closed-mindedness to avoid self-doubt and re-evaluations of the course of action that has been taken, and a high sensibility to events that could facilitate goal attainment.

The Evaluative Mindset

As with the actional mindset, the evaluative mindset has received little attention in empirical research. Partly, this lack of research could be assigned to the assumed similarity of the evaluative and deliberative phases. Theoretically described as a second motivational mindset, its properties are likely to resemble those in the first phase to some degree. In this phase, it is again important to weigh information, in oder to determine the success or failure of an action (Achtziger & Gollwitzer, 2010). The evaluative mindset should therefore facilitate rational and realistic information processing and reduce individuals' susceptibility to biases. This is necessary to make a sound decision regarding future behavior: disengaging from action claiming success, re-engaging to achieve better results, or disengaging admitting defeat or disinterest. Further qualities of the mindset should also include a high receptivity to all kinds of information and an increased degree of impartiality, to correctly account for one's own actions and external circumstances that might have influenced outcomes. Again, empirical evidence in needed to test these ideas.

2.2.2. Mindsets in Construal Level Theory and Regulatory Focus Theory

As the history of mindsets has demonstrated, the concept is present in a number of psychological theories. Referred to as "mental states (...) [that] consist of sets of mental processes that produce a disposition or readiness to respond in a particular manner" (Hamilton et al., 2010, p. 1), they are crucial to psychological priming. Two theories that might also be helpful in the later discussion and that are based on mindsets are construal level theory (Trope & Liberman, 2003) and regulatory focus theory (Higgins, 1997).

In construal level theory, mindsets conceptualize the psychological distance between an individual and events or objects. According to Trope and Liberman (2010), this distance "is a subjective experience that something is close or far away from the self, here, and now" (p. 440). They differentiate between high-level construals (relating to more distant and abstract mental representations) and low-level construals (relating to closer and more concrete mental representations). Initiated by research on temporal distance (Trope & Liberman, 2003), the theory has been extended to also include social, spacial, and hypothetical distances (Trope & Liberman, 2010). Construals have been shown to

affect individuals in stereotyping (Stephan, Liberman, & Trope, 2011), self regulation (Freitas, Gollwitzer, & Trope, 2004), memory (Kyung, Menon, & Trope, 2014), and risk-taking behavior (Sagristano, Trope, & Liberman, 2002). Overall, studies showed that low-level construals evoke more complex and detailed mental representations of objects or events, while high-level construals release more simple and abstract notions. These construals have also been compared to mindsets in the rubicon model, as Fujita, Trope, Liberman, and Levin-Sagi (2006) pointed out the many commonalities between high-level construals and the deliberative mindset and low-level construals and the implemental mindset.
The same is true for regulatory focus theory (Higgins, 1997). Differentiating between prevention and promotion orientations in decision-making processes, Higgins pointed out that individuals act either to avoid negative or to approach positive consequences. Given a prevention focus, an individual concentrates more on responsibilities and safety concerns, while given a promotion focus, one tends to base decisions on hopes and accomplishments (Higgins et al., 2001). This conceptualization of approach-avoidance motivation in decision making is complemented by regulatory fit theory (Higgins, 2000). Regulatory fit is "the relation between a person's orientation to an activity and the means used to pursue that activity" (Higgins, 2000, p. 1218). Higgins (2005) found that regulatory fit increased commitment to tasks and reinforced a positive attitude towards the task as well as a positive self-concept. Among others, it has proven to be beneficial in persuasion, specifically in advertising (e. g., Florack & Scarabis, 2006) and in relation to health issues (e. g., Cesario, Higgins, & Scholer, 2008). Overall, the function of regulatory foci is very similar to that of the mindsets in the rubicon model, supporting an individual to process information in a way that facilitates making a decision or executing a task.

Construal level theory and regulatory focus theory are by far not the only approaches that use mindsets to explain behavior. Hamilton et al. (2010) gave a comprehensive overview of such theories, to which one could still add further applications like counterfactual mindsets (e. g., Kray & Galinsky, 2003), probabilistic mindsets (e. g., Rottenstreich & Kivetz, 2006), or transactional mindsets (e. g., Mandel, 2002). While all these theories speak for a very diverse application of the concept, the fundamental idea remains the same: mindsets are cognitive orientations that shape information processing according to their function in the relevant model. In this dissertation, action mindsets were chosen as the theoretical point of departure, as they are implicitly part of any action, including risk taking. Learning about their properties and their impact on decision making might thus allow individuals to use these mindsets as a tool, or at least to be better informed about the biases they are likely to experience in those mindsets.

2.3. Critique

While the existence of mindsets is widely acknowledged, the extent of their effects is an ongoing topic of discussion. In the recent fraud and replication crisis in the field of social psychology, mindsets were not excluded from the debate. Most prominently, Förster and

Denzler's (2012) work on construals has been retracted, because it came under suspicion of having reported manipulated data to show mindset effects. Also, in the context of the Repoducibility Project (Aarts et al., 2015), 100 studies from *Psychological Science*, the *Journal of Personality and Social Psychology*, and the *Journal of Experimental Psychology: Learning, Memory, and Cognition* from 2008 were replicated. While the definition of a successful replication is vague, it is concerning that only 36% of the replications could produce similar p-values, studies overall reported only 47% of the original effect sizes, and only 39% of the scientists involved indicated that they subjectively felt that they had successfully replicated the studies. In light of this crisis of quality and trust, new studies should employ particularly high methodological standards, such as comprehensive descriptions of all materials used in the experiments and a commitment to report all results and all conducted studies. And while the theoretical construct of mindsets is not attacked per se, researchers should pay close attention to effect sizes and their interpretation of data.

Looking specifically at mindset theory and the rubicon model of action phases, the advantages of the model have been widely recognized. Summarizing all action sequences in one model while differentiating between motivational and volitional phases has been a great accomplishment (Heckhausen & Gollwitzer, 1987; Gollwitzer, 1990). However, critics have pointed at the idealistic nature of the model that is often seen as too static to embody real actions and decisions. In real life, it is argued, a person might dynamically jump from one phase to another, and back. Gollwitzer (1990, 2012) has acknowledged this necessity of switching between phases and pointed out that the initiation of an action is not necessarily preceded by deliberation and implementation-related planning, if the goal and plan have already been set earlier, or if an action has been interrupted. Also, phases can overlap when individuals see preliminary results during the action phase and evaluate them. Yet, the model remains an abstraction. A second angle of critique relates to real-life applications for the results of mindset research. One can reasonably question the benefit of inducing a mindset (that exists to facilitate a specific task) onto a person performing another task (where another mindset would apply) to prove that this could harm goal achievement. However, as a counterpart to that perspective, mindsets have also been shown to benefit decision-makers (e. g., Armor & Taylor, 2003) and can be employed to target and reduce harmful or unwanted behavior. Then, the lack of real-life applications is not due to the incompatibility of theory and reality, but because of problems with educating the public about research findings.

3. Induction of Mindsets

3.1. Induction Methods

While mindsets occur naturally in choosing goals and performing actions, most knowledge about their properties comes from research in which mindsets were purposefully induced. Induction methods range from small and seemingly unimportant decisions to extensive questionnaires. Research has almost exclusively focused on studying the deliberative and implemental mindset, and only induction methods for these two states of mind are discussed in this chapter.
While the concept seems rather straightforward - make people deliberate or have them plan something - the challenges connected to manipulating individuals into having a certain mindset are just as clear: participants cannot suspect any kind of manipulation, otherwise this knowledge could interfere with the induction itself; procedures for inducing different mindsets should be as similar as possible, in order to minimize the impact of unequal procedural effects; finally, the content and framing of deliberative and implemental mindset inductions should also be similar to ensure comparable levels of involvement and to reduce noise. In this chapter, the most frequently used, some uncommon, and some new approaches to induce mindsets as well as their advantages and disadvantages are discussed. Also, different handlings of control groups and the idea of creating a neutral mindsets are reviewed, before considering the overall scope of mindset inductions and the role of external, intervening factors.

3.1.1. Classic Induction

The most common induction method, also called the "classic mindset priming technique" (Fujita, Gollwitzer, & Oettingen, 2007, p. 50) was developed by Gollwitzer and Kinney (1989) at the Max Planck Institute in Munich. The authors designed two sets of questionnaires in which participants either deliberate about a goal or plan an important personal project.
In the deliberative mindset, participants are asked to write down a relevant issue regarding their personal life. They are told that it is important that they have not yet made a decision on whether or not to pursue the goal, thus they should be able to write it down in the form of "Should I do X, or shouldn't I?" They are then asked to list positive as well as negative consequences in the immediate future (within the next four weeks) of what might happen if they choose to act on their goal. Additionally, they estimate the likelihood of each consequence to occur and rate its valence. The same questions are then answered for consequences that might occur in case they choose not to act on

their goal, and for long-term consequences of action and inaction. All in all, individuals deliberate about their goals on four pages with the purpose of activating the cognitive orientation of weighing information open-mindedly and impartially.
In the implemental mindset, individuals are asked to name a personal goal they definitely want to achieve, but have not yet started to put into practice. They then write down five to seven action steps that are necessary to achieve the goal, and explain for each step when, where, and how to act. This questionnaire is used to promote the typical close-minded and focused nature of information-processing in the implemental mindset.
Regarding topics, Taylor and Gollwitzer (1995, p. 222) reported that individuals tended to debate or plan a problem relating to one of three categories: career-related (e. g., studying abroad, 63%), lifestyle-related (e. g., buy a fashionable watch, 25%), or interpersonal problems (e. g., get together with an old friend, 13%). Indeed, using this induction method in Experiment 1 in the present research, individuals' choice of topics was very similar, with most students deliberating about or planning out stays abroad, internship opportunities, or living arrangements.
Bayer and Gollwitzer (2005) mentioned an average time of 20 minutes to finish the induction questionnaires. Experience shows that this was also an accurate estimation for the German sample used in this research, albeit individual finishing times ranged between 10 and 40 minutes. Also, it was noted that participants were generally faster in the induction of the implemental than the deliberative condition.
Nonetheless, the approach has been successfully used in a variety of studies (Gollwitzer et al., 1990; Taylor & Gollwitzer, 1995; Bayer & Gollwitzer, 2005; Fujita et al., 2007; Büttner et al., 2014; Hügelschäfer & Achtziger, 2014). Even in the most recent studies, the induction was usually conducted as a paper and pencil questionnaire. While this was the standard method in the 1980s when the method was developed, it could be argued that the handwritten approach makes the procedure more intense and personal than a computer surface. Nonetheless, researchers have recently started using computerized versions of the induction method and future publications will hopefully show their success, thereby enlarging the pool of participants and facilitating the access to populations outside of universities significantly.
Another positive feature of this induction procedure is participants' feedback. While the method is quite intense, because they are debating or planning out a personal problem, participants often report that the questionnaire helped them clear their mind, or that they had long wanted to get around to plan their goal. On the other hand, this has been perceived as a potential shortcoming of the deliberation procedure: because participants are asked to think about a personal problem, there is a possibility that they actually make up their minds during deliberation and decide whether or not to pursue their goal. Then, according to the model, they are not deliberating any more, but have entered the second, implemental mindset. Thus, manipulation checks, as discussed later, are a vital part of the approach to ensure participants comply with their assigned mindsets.
To sum up, the classic induction is not only the most common procedure, but also one that has been approved by participants and editors alike. While comprehensive manipulation checks are necessary and the method is quite extensive and time-consuming, a wide range of theory-consistent results supports the application of this induction method

for the deliberative and implemental mindset.

3.1.2. Other Induction Methods

For practical reasons, mostly to save time and reduce efforts, a variety of other approaches to induce mindsets has been developed. While none has become as popular as the classic procedure, they have been successfully implemented in several studies. Indeed, Gollwitzer (2003) stated that

> "(p)eople do not have to go through the effortful mental exercises we have induced in our experiments to create a deliberative mind-set; simply trying to achieve clarity in regard to an unresolved personal problem will trigger an intensive deliberation of pros and cons" (p. 266).

Accordingly, Taylor and Gollwitzer (1995) instructed participants to name a personal problem (deliberative mindset) or goal (implemental mindset) and to "lean back and think about [that] decision issue" (p. 221) to induce mindsets. Results supported the success of this method, as they observed behavior consistent with theory and other empirical evidence, for instance finding deliberating individuals to evaluate information more impartially than planning individuals (Gollwitzer, 1990). From a resources-centered point of view, the method is very promising; although the induction sequence was not timed, it seems reasonable to expect the procedure to be faster than the classic method, especially since instructions told participants to terminate their efforts when they felt that additional thoughts would not achieve further clarity on the issue (see Taylor & Gollwitzer, 1995, p. 222). The reason why the method still did not widely spread might be connected to the problem of verifying participants' actual thought contents during the induction phase. While control questions can give some indications of success or failure, other approaches have been less vulnerable to this criticism.
For instance, Heckhausen and Gollwitzer (1987) introduced an induction that was based on interrupting participants at the right point in their decision process to create either a deliberative or implemental mindset. They told participants that they could choose from two different sets of test materials. In the deliberative condition, participants were then interrupted before actually making a decision and told to complete another questionnaire before the original experiment could continue. Meanwhile, implemental mindset participants were interrupted only after they made the choice for one test or the other, and then filled out the same second questionnaire. To reduce the likelihood of snap judgments, participants had received negative feedback regarding their choice of a previous test and were reminded not to be impulsive. Results supported the success of the induction, and variations of the method have been used continuingly by Gollwitzer et al. (1990), Puca (2001), Puca and Schmalt (2001), Armor and Taylor (2003), and Fujita et al. (2007). However, while the method is less time-consuming and exhausting than the classic induction, it may also leave participants wanting: First, because they are told there there would be another test, participants expect and mentally prepare for that test that is usually not delivered; second, in some variations of the induction, one test is by design (for the participant unexpectedly) unavailable and participants are asked to make

a forced choice for the only available option (Armor & Taylor, 2003). It could be argued that negative feedback on a previous test, the expectance of another test, and forced choices are all factors that could interfere with mindset orientations. However, results of these studies are in line with other empirical evidence and theoretical assumptions. That leaves the discussion on a more general level that is concerned with questions of experimental conduct and the good faith of participants in experimenters' instructions.[2]
Another, rather subtle, approach to induce mindsets is based on Gollwitzer and Kinney's (1989) first study, in which participants were asked to either try out two different apparatuses one after the other and later decide which allowed them to perform best in the task of onsetting a target light (deliberative mindset), or determining an order in which they would use the two apparatuses and try to onset the light (implemental mindset). In this induction, the procedure of creating a mindset was not separated from the dependent variable (illusion of control). While results indicated a higher level of perceived control over the lights in the implemental mindset, it stands to reason that participants in the deliberative mindset expected the real task to start only after they had tried out both apparatuses. Thus, they might not have put as much effort into their performance during the trial period, which in turn could have decreased the feeling of control over the outcome regardless of the mindset. This relates back to the issue of incomplete information, raised earlier. Studies comparing different induction methods would be necessary to determine the impact of such instructions differences, but as Higgins et al. (1982) found in relation to tuning sets, it might be insignificant.
A more recent induction variation was introduced by V. Brandstätter, Giesinger, Job, and Frank (2015). They had participants read about or listen to a male student in his 20s, thinking about spending a semester abroad. In the deliberative condition, the student considered the advantages and disadvantages of going away, while in the implemental condition, the student made a plan for his time aborad. The procedure is held similar to the classic method, but instead of working on a personal problem, participants were asked to empathize with the student and answer a few questions from his perspective. Also, the technique used observations from the classic induction, as those questionnaires showed that the topic of going abroad is relevant to many students. And even if not affected themselves, most participants at a university should have come in contact with the issue at least through fellow students. Yet, the depth of participants' involvement in the topic and the level of empathy might still depend on students' own experiences (having or not having been abroad themselves, good and bad experiences). Nonetheless, results indicated theory-consistent mindset effects and the method succeeded in vastly cutting down induction times, with audio tape recordings lasting only about three minutes. While no gender differences were reported, it is suggested to include a female stimulus package for female participants in future studies. Also, participants could write down what they imagine a student going abroad might consider during deliberation or planning, instead of emphasizing with someone else's thoughts.
On a final note on existing procedures, Gagné and Lydon (2001a, Study 1 and 2) used

[2]Overall, participants' deception is a wildly discussed topic in experimental research, with varying definitions and standards for different disciplines (e. g., Jamison, Karlan, & Schechter, 2008).

naturally occuring mindsets to study their impact on behavior. In other words, they did not induce mindsets, but asked people during an important transitioning time in their lives (students moving away from home and entering university) about their thoughts on their romantic relationships and coded them into either deliberating or implemental participants. Importantly, the approach showed that induced mindsets do not significantly differ from natural mindsets. The procedure did not spread, probably because it reduced sample sizes considerably to a population with one specific problem. While this could be resolved by opening up to a wide range of topics and issues, the procedure is rather time-consuming for the experimenter, as all answers have to be coded by multiple judges.

3.1.3. The Bicycle Induction

In introducing yet another induction method for mindsets, the main goals were to a) reduce induction times and cognitive efforts as compared to the classic procedure, and b) develop a method that could also be used in online questionnaires. The second aspect would be particularly desirable to expand surveys more easily to non-student populations.

To fit deliberation and implementation purposes, the induction task should involve a topic that is relevant to many people and a question that is not easily answered. These demands were met by the issue of bicycle helmets: while helmets reduce head injuries considerably, only about 10% of German cyclists wear helmets (Sieg, 2015). Moreover, a pretest ($N = 21$) showed that arguments supporting helmets were rated much stronger than arguments opposing them, $t(20) = 9.79$, $p < .001$, $d = 3.47$, $M_{pro} = 5.27$, $SD = 0.67$, $M_{con} = 2.81$, $SD = 0.75$ (on a 7-point scale, 1 = *weak argument* to 7 = *strong argument*). The pretest presented 22 arguments (see Table A.1 in Appendix A) that were presented in an alternating (pro and con) random order. The test also confirmed that the topic was relevant to the population, as 85% of the students used bicycles, 70% even several times a week, and about 50% all year round, regardless of weather conditions.

Moreover, the test indicated a widespread contradiction between behavior and the cognitive evaluation of the problem, as simultaneously to the above ratings, 85% of participants reported not owning or ever wearing a helmet, and the remaining 15% indicated that they only sometimes wore one. To take advantage of this ambiguity, a cover story was developed in which participants were asked to judge the strength of arguments supporting or opposing the introduction of a bicycle helmet law. The two strongest and the two weakest arguments for and against wearing a helmet were used to induce mindsets. The selection of arguments was based on further tests (Augart, 2014; Bürklin, 2014), in which similar arguments were combined into one item (see Table 3.1 and Table A.1 in Appendix A), and new reasons were added to the list. A combination of weak and strong arguments was chosen, because - although rated weak arguments - studies showed that the issues of "looking stupid with a helmet" and it being "uncomfortable and ruining one's hairstyle" were very important for actual behavior (Sieg, 2014). Thus, they were explicitly included in the deliberation process. Also, the deliberation process might be

more intense when participants consider both, weak and strong arguments for both sides, so that all participants consider the qualitative differences of arguments for and against a helmet law. The final list of arguments and their ratings is displayed in Table 3.1.
The final procedural setup for the induction involved two parts for each group. In the deliberative condition, participants first rated the strength of all eight arguments before listing the strongest argument for each side. In the implemental mindset, the same arguments were evaluated, but secondly, participants had to decide if they were in favor of a helmet law or against, and name the most convincing argument supporting their decision. Participants were encouraged to also name arguments that had not been part of the deliberation phase. Overall, the procedure took approximately five minutes. Control questions included the frequency of use of different modes of transportation and the number of children. The latter was an strong predictor for the attitude towards helmets in Augart's (2014) study with a non-student population.
While successful in pretests and in the second experiment presented in this work, the application of this induction method might be culturally confined. Although everyone would probably be able to imagine the problem, the induction might work best with populations that use bicycles regularly and see them as part of everyday traffic, so that a helmet law could be considered a real political possibility. Also countries that have already introduced such laws (e. g., Spain, Finland, Australia, Deutscher Verkehrssicherheitsrat, 2015) would have to adapt the content. Other topics that could be employed in a similar manner might include nutrition (e. g., mandated healthy food in cafeterias), social engagement (e. g., compulsory social work), or the environment (e. g., fining the waste of water). Key for the success of the induction is actual deliberation before making a choice. Thus, topics should be avoided that are either irrelevant, do not have at least two strong points of view, or are politically charged in a way that they attract irreversible preconceived opinions. Strolling a little further away from the bicycle induction, one could also imagine deliberation tasks about moral dilemmas (e. g., the trolley problem) to provide a good starting point. While these variations should be tested in future research, the method already provides the major advantage of being applicable to online studies as well as laboratory experiments.

Table 3.1.: Rating of Arguments Used in the Bicycle Induction

Category	Argument	Pretest 1 $N = 21$	Pretest 2 $N = 12$	Pretest 3 $N = 10$	Study 1 $N = 106$	Pretest 4 $N = 25$	Study 2 $N = 63$
Con 1	Wearing a cycle helmet makes you look stupid, sweat, and ruins your hairstyle.[3]	2.24 2.95 3.10	2.25	1.70	2.96	2.40	2.95
Con 2	Wearing a cycle helmet shows a pessimistic view of life.	1.52				1.84	1.68
Con 3	Cars are involved in 73% of all bicycle accidents. Regulations should target the real causes and not demand additional safety precautions from cyclists, who are already in a weaker position (Richter, Otte, & Haasper, 2005).	3.10	3.00	3.60	3.11	4.52	2.71
Con 4	Cycle helmets only provide safety if they fit perfectly. According to experts, most helmets do not fulfill this requirement (Walker, 2005).					4.64	4.30
Pro 1	A scientific study shows that the absolute number of head injuries strongly decreased after the introduction of a helmet law.	5.43	6.17	5.30	5.79	6.00	6.22

[3]Earlier versions asked separately for looks, sweat, and hairstyle, but items were combined as it represented the overall discomfort, also see Table A.1 in Appendix A.

Table 3.1.: (continued)

Category	Argument	Pretest 1	Pretest 2	Pretest 3	Study 1	Pretest 4	Study 2
Pro 2	Cycle helmets minimize the severity of accidents considerably. According to a study, 60% of severe head injuries, 58% of neurological injuries, and 47% of severe face injuries could be prevented if people wore helmets (Attewell, Glase, & McFadden, 2001).	6.43	6.00	5.50	5.81	6.08	6.57
Pro 3	The more cyclists wear helmets, the less uncool, noticable, and unattractive it becomes.					4.24	4.02
Pro 4	Scientific studies refute the argument that cyclists who wear helmets go faster. This group of risk-seeking cyclists (the "speed happy" cyclists) are usually induced to speed by some other special bike equipment like thin tires (Fyhri, Bjørnskau & Backer-Grøndahl, 2012).					3.68	3.89

Note. Pretest 1 was conducted by the experimenter, Pretests 2 and 3 and Study 1 were conducted by Augart (2014), Pretest 4 and Study 2 were conducted by Bürklin (2014).

3.1.4. The IQ Induction

A more universally applicable induction method has just recently been developed and tested (Angele, 2015). Based on Gollwitzer and Kinney's (1989) approach to have participants choose one of two tests, a procedure was developed that asked participants to choose one of two knowledge tests they would get feedback on. Emphasizing that questions came from an intelligence test further increased the level of seriousness of the feedback. Participants then answered sample questions of eight knowledge categories and were asked to rate their overall proficiency in these categories. Based on these ratings, a set of two knowledge tests was created, each comprising a strongly and a weakly rated knowledge category (Test A: combination of the strongest and weakest category; Test B: combination of the second strongest and second weakest category). In the deliberative condition, participants were then asked to rate all categories included in the two test options again. Then they were told that people usually make better decisions after thinking about them for a while, and meanwhile, they were asked to answer some other questions that were part of a second study (dependent measurements). Then, they made their choice, completed the knowledge test, and received feedback. In the implemental mindset, participants were also asked to rate the categories included in the two test options again, but carried on making a decision for one of the tests before dependent measurements were taken. Finally, they too completed the actual test and received performance feedback.
Indeed, a similar approach has been taken by Puca (2001), when participants were asked to choose an opponent against whom they wanted to compete in an intelligence test. In both approaches, questions were taken from intelligence tests, which supposedly increases commitment to making the best choice and performing well as part of protecting one's self-concept and avoiding bad feedback. However, it is argued that - by creating two tests based on participants individual preferences - the new IQ procedure evoked a deeper level of involvement in the task, as it actually presented two options that were equally appealing. Furthermore, by actually performing the knowledge test, the approach reduced deception to a minimal level. Results indicated a successful induction of the implemental mindset through this procedure, but further tests and adjustments are necessary to refine the method for the deliberative mindset.

3.2. Manipulation Checks

To control for the quality of mindset inductions and to measure their success, three different approaches are commonly used in connection with the classic induction method. First, the success or failure of mindset inductions can be evaluated by reading through the questionnaires deliberating about or planning out a goal (Taylor & Gollwitzer, 1995, Study 1 and 2). This is always a necessary step to ensure that participants generally followed instructions.
Second, some studies (V. Brandstätter et al., 2015; Büttner et al., 2014) include a manipulation check based on questions initially developed by Gollwitzer and Kinney

(1989). Following this approach, participants are asked some version of the following four questions (V. Brandstätter et al., 2015, p. 106):

1. "With respect to what you have just described, are you definitely determined to take action?" (yes/no)
2. "Do you already know when, where, and how to take action?" (9 point-scale)
3. "How sure are you at the moment that you will take action?" (9-point scale)
4. "How much do you feel urged to take action?" (9-point scale)

Next, studies have used quality questions aiming at the whole induction process to determine induction success through participants' involvement and commitment to the procedure (based on V. Brandstätter & Frank, 2002). Such questions include similar items as above, but also refer to the clarity of instructions and the amount of effort that went into deliberation or planning. A similar approach has been taken to check for the success of other induction methods (Gollwitzer et al., 1990), if manipulation checks were conducted at all (exceptions, e. g., Heckhausen & Gollwitzer, 1987, Study 2; Gollwitzer & Kinney, 1989, Study 1).
Another, less frequently used manipulation check relates to mood. For instance, V. Brandstätter et al. (2015) included five bipolar adjectives (good - bad, cheerful - sad, discouraged - optimistic, calm - tense, active - passive) to assess mood. The effect of mindsets on mood is an often cited effect (Taylor & Gollwitzer, 1995) and has thus been adopted in some cases as an indirect way to check inductions. However, mood effects only occur inconsistently (V. Brandstätter & Frank, 2002; Büttner et al., 2014). It could be that experiences of success or failure in experiments using performance-related tasks interfere with mood ratings, especially if experiments also involve performance-based incentives. Thus, mood can only be an indirect manipulation check and does not apply to all setups.
Finally, the issue of the durability of mindset effects, their mutability and attenuation should be addressed. While it is intuitive that mindset effects decline over time, passing from one task to another might also affect mindsets. Thus, manipulation checks have the inherent problems of the experimental sequence and of cover stories emphasizing that different parts of the experiment are unrelated. Positioned at the very end of the experiment after a seemingly unrelated task, the checking questions might not always reflect the mindset that was indeed active during the main task. This further underlines the importance of quality check questions regarding the understanding of instructions and individuals' answering behaviors, in addition to traditional manipulation checks.

3.3. Control Groups and the Neutral Mindset

Some experiments do not include control groups, either because the setup inherently forbids a third group (Büttner et al., 2014; Armor & Taylor, 2003), or because it is argued that the deliberative mindset in fact equals a default, neutral mindset (V. Brandstätter & Frank, 2002; Henderson, de Liver, & Gollwitzer, 2008; Hügelschäfer & Achtziger,

2014). While circumstances exist where this may apply, the second point needs to be qualified. In fact, it might depend on the dependent variable that is measured whether the deliberative mindset equals a neutral mindset. Some studies have found differences between the deliberative mindset and the control group (e. g., regarding thought contents, Gollwitzer et al., 1990), or even the opposite effect, the control group being very similar to the implemental mindset (e. g., regarding mood, optimism, and self-esteem, Taylor & Gollwitzer, 1995). The spectrum of these findings would suggest that control groups should be included in any research investigating mindsets. Yet, the question remains, how control groups can be included into research. Many experiments have the control group not perform any substitute task instead to the mindset induction (e. g., Gollwitzer & Kinney, 1989; Taylor & Gollwitzer, 1995). While this approach prevents participants from being primed in any other way, it can however be argued that any effects on dependent variables in the mindset conditions actually stem from spending cognitive effort during the induction process, or being involved in another previous task at all. Thus, some studies have employed substitute tasks in the control condition. For instance, Gollwitzer et al. (1990) had control participants passively view photographs of various outdoor scenes, Fujita et al. (2007) asked participants in the control group to list the first 20 thoughts that came to their minds, and Büttner et al. (2014) asked them to take part in a concentration performance task.

The goal of having individuals performing such tasks is to induce them with a neutral mindset. Thus, a comparison between no task, some task, and mindset tasks can be achieved. Also, when no mindset induction is suggested to be similar to a deliberative mindset, creating another group for comparison would be an interesting step. To formalize this approach, a neutral mindset questionnaire that asks participants to list things they do on a typical day was developed (E. Harmon-Jones & Harmon-Jones, 2002). While any task can be argued to prime participants in a certain way, this procedure has the advantage of being similar to the classic induction method in that it is personal to every individual and participants write about their own routines instead of deliberating or planning personal projects. It remains debated whether a neutral mindset can be achieved at all (see discussion in Henderson et al., 2008, p. 400), but only including such groups in research will shed further light on the issue.

All in all, the use of control conditions is usually necessary in mindset research to distinguish mindset effects from baseline measurements. The adequacy of any specific approach to create a control group must ultimately be defined by the content and the measurement sensitivity of the dependent variable. New research might include both, a control condition with no substitute task and a neutral mindset condition. Although this approach hugely increases the number of participants and thus increases the workload for the experimenter, such setups have the potential to further the understanding of mindsets, about default states, and about the impact of any kind of cognitive involvement before measuring dependent variables.

3.4. Open Questions

Against this extensive background on mindsets and induction methods, a few questions still remain unanswered. Two issues raised in the discussion on manipulation checks shall be revisited first: the durability and mutability of mindsets and the role of external motivators, such as monetary incentives.

While the nature of mindsets is well researched, little is known about their consistency and durability. While there is agreement that the effect of mindsets decreases over time, few studies include the time frames in which mindset effects were measured. Moreover, despite the decay-assumption, mindset effects are often assumed to be consistent over the course of an experiment. Chapter 5 takes a closer look at this problem, laying out the consequences of looking at mindsets as dynamic states of minds instead of dichotomous on/off-conditions. On a related note, one could also ask whether all mindset inductions - if successful - are equal, or if mindsets can be induced to different degrees and in different strengths. Along with context (e. g., studies on memory, emotions, or risk taking) this could offer explanations for inconsistent findings (see Chapter 4).

Next, the impact of financial incentives has only recently started to play a role in mindset research (V. Brandstätter et al., 2015). Yet, external motivators such as monetary rewards do influence individuals' behaviors (Camerer & Hogarth, 1999) and are thus likely to interact with any other motivational variable. This question will be further discussed in the second experiment presented in this work, in which performance-based incentives were used in combination with mindset inductions.

Another question that needs to be addressed are individual predispositions and traits in relation to mindsets. While individuals undergo each phase and thus each mindset during the completion of an action, it can be argued that different types of personality reinforce or impair certain mindsets. While the author is not aware of any research examining the relationship between personality types and the impact of mindsets, Chapter 4 will outline how individual traits such as gender or economic status have been shown to interact with mindsets.

4. Mindset Effects

This chapter introduces the underlying mechanism that explains how mindsets influence unrelated tasks, and provides a general overview of mindset effects on the cognitive, affective, and behavioral level. Reviews on mindset effects have been provided by Gollwitzer (2012), Achtziger and Gollwitzer (2010), and Gollwitzer and Sheeran (2006). This chapter is based on these works, but provides a new categorization of the effects and also includes some more recent studies on mindsets. Finally, individual traits interacting with mindsets are considered as well as inconsistencies in finding mindset effects in the first place.

4.1. Mindset Effects

4.1.1. Carry-Over Effects

Carry-over effects constitute the standard procedure to investigate mindsets. They describe the phenomenon that mindsets have the potential to impact cognitive processes, emotions, and behavior on unrelated subsequent tasks. This is based on the definition of mindsets as shaping cognitive structures according to the function they fulfill in an action sequence. The cognitive structure then remains active during the next task, constituting a procedural priming, and comparisons of dependent-variable parameters between mindsets and control groups present the opportunity to draw conclusions back on mindset characteristics. Gollwitzer and Kinney (1989) explained that

> "the mind-set notion implies that the associated cognitive orientation can also be demonstrated in a context for which it is not immediately instrumental to task performance. As pointed out by Gibson (1941) in a comprehensive review of the concept of set, the demonstration of a potent mind-set requires that its cognitive orientation generalize to tasks not responsible for its induction. In other words, demonstrating a mind-set necessitates that it be shown to be more than a task-set. Thus, deliberative and implemental mind-sets need to be created independent of the (...) task at hand. Moreover, the associated cognitive orientation should carry over to and prevail on subsequent tasks." (Gollwitzer & Kinney, 1989, p. 537)

Not only did the authors emphasize that mindsets remain active in an unrelated second task, they also claimed that their persistence is the necessary proof of a mindset being more than only a task-related operating mode. Rather, they argued, mindsets operate on a higher level, universally influencing information processing. This underlines the

relevance of researching their properties and the nature and extent of their influence.
It lies within the nature of the carry-over effect that nothing may interfere with the cause-and-effect structure of the experiments set up to investigate mindsets. Also, because of the assumption that mindsets decay over time (Taylor & Gollwitzer, 1995, p. 217), researchers are bound to limit their experiments to a reasonable time frame. Indeed, while V. Brandstätter et al. (2015) also investigated long-term effects of mindsets, their findings on future behavior strongly correlated with immediate estimations of future behavior. Thus, while the specific time frame of carry-over effects may vary depending on the induction method, external circumstances, or personality traits, as a rule of thumb and based on experience, experiments should not last longer than 20 minutes after the induction.

4.1.2. Cognitive Effects

Because mindsets themselves are defined as cognitive orientations, cognitive effects make up the ground work of mindset research. In this context, cognitive effects are defined as effects regarding information processing, including the perception of stimuli, memory, and thought contents. In fact, the first studies on mindsets were designed to analyze thought contents, to see if mindsets tuned thoughts into either a deliberative or implemental direction, as theory predicted. For instance, Gollwitzer et al. (1990) let participants continue fairy tales after inducing either a deliberative or implemental mindset. They found a tendency of congruent thoughts, that is, more deliberative thoughts in the deliberative mindset and more implementation-oriented contents in the implemental mindset. Moreover, they found that participants also recalled more mindset-congruent information. Similar findings were reported by Heckhausen and Gollwitzer (1987), Gollwitzer et al. (1989), and V. Brandstätter and Frank (2002).
Furthermore, mindsets affect the manner of perceiving and processing information, as Gollwitzer and Kinney (1989) found that "different modes of information processing characterize predecisional and postdecisional phases" (p. 259). Numerous studies provided evidence that individuals in deliberative mindsets process a broader range of information than people in an implemental mindset (e. g., Heckhausen & Gollwitzer, 1987; Gollwitzer & Kinney, 1989; Fujita et al., 2007; Nenkov & Gollwitzer, 2012; Büttner et al., 2014). This in turn lead to a more realistic versus a more optimistically biased evaluation of information. For instance, in the prediction of the duration of romantic relationships, participants in a deliberative mindset were significantly more accurate and realistic than implemental participants (Gagné & Lydon, 2001a). This partial manner of processing information in favor of their choice is typical for individuals in implemental mindset, as also supported by Beckmann and Gollwitzer (1987). They had male participants read about potential female conversation partners and found that implemental participants recalled more information on the chosen partner than deliberative participants, and less on the non-chosen partner. At the same time, the authors found better memory recall of goal-relevant information in the implemental mindset, especially regarding possible obstacles that might endanger goal achievement.
Memory recall has been a general point of interest in mindset research early on. For

instance, Heckhausen and Gollwitzer (1987) found evidence for a broader working memory span in the deliberative mindset, with an enhanced receptivity to many sources and different kinds of information. Later, Fujita et al. (2007) specified these findings, conducting concentration tests with goal-relevant and irrelevant information. They inferred that the deliberative mindset facilitated the processing of incidental information, but that memory recall of goal-relevant information was better in the implemental mindset (also, Moskowitz, 2002).
Moreover, studies have shown that individuals in a deliberative mindset are less prone to cognitive biases, such as overstated optimism or impartiality in information processing (Beckmann & Gollwitzer, 1987; E. Harmon-Jones & Harmon-Jones, 2002; Bayer & Gollwitzer, 2005). Also, they experience lesser degrees of illusion of control over uncontrollable events (Gollwitzer & Kinney, 1989) or anchoring effects (Hügelschäfer & Achtziger, 2014). The former found that implemental participants strongly over-estimated their influence on the random off-set of an electric light, thus diagnosing a particularly pronounced illusion of control for planning individuals. The latter found evidence for a mindset $\times$ gender interaction and reported a higher susceptibility to anchors for males in an implemental mindset than in a deliberative mindset. They explained this finding by referring to a second category of mindset effects, that is, differences in the emotional response to stimuli. According to this explanation, cognitive mindset effects can sometimes be outrun by emotional effects, as they are part of different systems in the dual-process model (Epstein, 1994; Evans, 2008). In the above context, Hügelschäfer and Achtziger (2014) pointed out, the deliberative mindset was more likely to trigger information processing using the slower, cognitive path, as the mind was tuned to critically weighing up all information and to be open to new input. Meanwhile, being more close-minded, implemental participants were more prone to the faster, more emotionally-focused path and ended up making more biased and irrational judgments. This link between dual-process models and mindsets is rather new and should be considered in future research.
Finally, regarding the perception of risk, Puca (2001) found evidence for stronger risk avoidance in individuals in an deliberative mindset than in the implemental mindset. Meanwhile, Hügelschäfer and Achtziger (2014) found another interaction of mindsets and gender on the issue, reporting a preference for less risky options in the deliberative mindset versus the implemental mindset only for females, and even a marginally significant opposite trend for males. These findings and emotional as well as behavioral effects intervening in risk-taking situations are discussed later in the further course of this work.

4.1.3. Affective Effects

Affective mindset effects are those effects that either provoke certain emotions or make emotional responses in general more likely. The most influential study on mindset effects and emotions are Taylor and Gollwitzer's (1995) experiments on mood, self-esteem, and the perceived vulnerability to risks. Mood, as assessed with the multiple affective adjective checklist (Zuckerman & Lubin, 1965) was found to be poorer in the deliberative than in the implemental mindset. This is little surprising, considering the less optimistic

cognitive processing of information discussed earlier. Also, similar effects were reported by V. Brandstätter and Frank (2002, Study 2) and V. Brandstätter et al. (2015), while V. Brandstätter and Frank (2002, Study 1 and 3), Fujita et al. (2007), and Büttner et al. (2014) did not find evidence for mood effects.

In the meantime, findings on self-esteem (Taylor & Gollwitzer, 1995), based on the Rosenberg self-esteem scale (Rosenberg, 1965), are relatively uncontested. Self-esteem was reportedly lower in the deliberative than in the implemental mindset. While self-esteem might be linked to mood, as argued by Taylor and Gollwitzer (1995, p. 217), self-esteem might also be related to performance-outcomes (Baumeister, Campbell, Krueger, & Vohs, 2003). From this perspective, its mutability through mindset manipulations is intriguing, but might not occur with every induction technique or in any context. While the classic deliberation questionnaire consists of a task that is not designed to produce a solution to a problem, the implemental manipulation results in a tangible outcome, a step-by-step action plan to achieve a goal. This could be interpreted as some kind of performance success. Without such an experience, other induction procedures might not be able to produce the same mindset effect on self-esteem.

The perception of one's own vulnerability to risks is also classified as an emotional effect, because it reflects personal and irrational feelings of threat rather than objective evaluations of risks. Taylor and Gollwitzer (1995) measured the perceived vulnerability to risks using a scale developed by Perloff and Fetzer (1986), measuring the individual and the perceived average college student's risk to be affected by controllable as well as uncontrollable risks. Participants in an implemental mind felt overall less vulnerable to risks than participants in the deliberative or the control group. The authors then argued that the result might in fact lead to more risky behavior for individuals in implemental mindsets:

> "The implications of these different patterns is that deliberation may not particularly increase perceived vulnerability to risk, but implementation may especially blind people to risk." (Taylor & Gollwitzer, 1995, p. 220)

This would contradict earlier findings, indicating that the implemental mindset increases awareness of all goal-relevant information, including possible obstacles. Thus, an alternate interpretation of the data could consider that an increased feeling of invulnerability does not necessarily reflect a blindness towards risks, but the degradation of risks through preparation: forewarned is forearmed.

Apart from these well-known emotional effects, E. Harmon-Jones and Harmon-Jones (2002) found stronger valences for positive and negative attitudes in the implemental than in the deliberative mindset. In line with findings on partiality in information processing, this also fits Nenkov and Gollwitzer's (2012) findings, reporting an increased level of defensiveness in implemental participants. Having put effort into the decision process and the planning of a goal, stronger and more protective feelings towards the goal in implemental participants are functional qualities, especially in comparison to deliberating participants who are tuned to indecisiveness and doubt. Supporting the assumption of doubt as a result of deliberation, Rasso (2013) found that professional skepticism, a from of mistrust, was stronger in the deliberative than the implemental

mindset.
Finally, Gagné and Lydon (2001b) reported mindset effects on relationship illusions. The authors found more positive delusions about the partner and relationship goals in participants in an implemental mindset, whereas deliberating participants made rather accurate judgments. While the effect was moderated by the level of commitment to the relationship, it also reflects feelings of invulnerability in the implemental mindset and is well complemented by findings by C. Harmon-Jones et al. (2011) who reported more determination to pursue a goal in the implemental mindset compared to a control group.[4] The fine line between these effects, benefitting an individual (e. g., increased optimism and determination) or having a damaging impact (e. g., delusions and naivety), is a reminder that these states of mind originally exist to fulfill a specific purpose in the process of making a decision. Applying them to unrelated tasks naturally bears risks of unwanted consequences. Nonetheless, it is part of everyday life that mindsets have carry-over effects on unrelated actions.

4.1.4. Behavioral Effects

Behavioral effects are those effects that occur when mindsets have an impact on performance, the realization of intentions, and attention. Such behavioral and sometimes even physiological effects are especially interesting to researchers, as they can be measured more directly than cognitive or emotional effects. And while cognitive and emotional effects are the cornerstones of mindset research, its recent focus has shifted towards finding rather practical applications and reporting performance-related effects.
Armor and Taylor (2003) reported some of the best known mindset effects on performance. Recording performance expectations as well as outcomes, participants in different mindsets were sent on a scavenger hunt to collect tokens all over a university campus. Not only did the authors find deliberative participants to be more pessimistic in their expectations, they also significantly underperformed compared to implemental participants. Similar results were reported by V. Brandstätter and Frank (2002) who tested individuals' persistence in solving puzzles. And while Puca (2001) did not find differences between mindsets in the performance of a motor-skill task, V. Brandstätter et al. (2015) found implemental mindset participants to return questionnaires earlier than deliberative participants, as long as the desired behavior was not additionally incentivized. Overall, these findings reflect the implemental mindset's most elemental function, which is the realization and facilitation of goal pursuit. V. Brandstätter et al. (2015) suggested higher levels of motivation (without specifying any kind of motivation) to be responsible for the increase in performance in the implemental mindset, and fittingly, Armor and Taylor (2003) describe the other side of the medal and how relative pessimism in the deliberative mindset might tigger some caution that depresses performance. Moreover, they refer to Iyengar and Lepper (2000) who found that uncertainty - a quality inherent in the deliberative mindset - undermined motivation.
Furthermore, the implemental mindset has been found to facilitate the realization of

[4]The study did not include a deliberative mindset condition.

goals. Pösl (1994, as cited by Gollwitzer, 1996) found implemental participants to initiate action faster than deliberative participants, and Dennehy, Ben-Zeev, and Tanigawa (2014) found the implemental mindset to reduce stereotype threats in participants with low socio-economic status. Henderson et al. (2008) also found that implemental participants followed a low-fat diet more reliably, yet their findings failed to replicate in Lane and Gararian's (2015) replication report.
The success of the implemental mindset, related to performance, has been attributed to its focus on the process of achieving something (Pham & Taylor, 1999). Rather than the hope for success, the concentration on the task at hand was responsible for enhanced performances, the authors found. This advantage provided by the implemental mindset to achieve desired behavior has created a sub-field in mindset research, specifically dedicated to implementation intentions (Gollwitzer & Brandstätter, 1997; Gollwitzer, 1999). Instead of relying on the carry-over effect, implementation intentions directly address the issue at hand and behavior that is to be changed. Thus, the process of creating implementation intentions is very similar to the creation of an implemental mindset, just related to a more specific goal. The effect of implementation intentions is rather strong; to name just a few, Sheeran and Orbell (2000) found implementation intentions to help make and uphold doctoral appointments. Also, Wieber, von Suchodoletz, Heikamp, Trommsdorff, and Gollwitzer (2011) showed that implementation intentions decreased the susceptibility to attractive distractions in children, and Höner (2007) reported an enhanced receptiveness to their team mates' hand signs in football players.
Going back to mindsets, E. Harmon-Jones, Harmon-Jones, Fearn, Sigelman, and Johnson (2008) even found some physiological evidence for higher performance tendencies in the implemental mindset. Conducting an EEG study, they found a stronger activation in the left frontal cortical region in the implemental mindset than in a control group, an indicator for increased approach motivation and a heightened tendency to resolve inconsistencies. Finally, regarding attention, Büttner et al. (2014) reported implemental participants to perform worse on accuracy tasks, as they were more susceptible to optical illusions. Also, they showed in an eye-tracking study that a deliberative mindset widened the focus of attention when individuals looked at naturalistic pictures.

All in all, mindsets can affect cognition, affection, and behavior, either separately, or simultaneously. Information processing is not a one-dimensional operation and mindsets can evoke different effects at the same time. Hügelschäfer and Achtziger (2014) put it best, explaining that

> "different processes induced by a mindset might play a role simultaneously (i.e., cognitive and self-evaluative processes). These processes might come into conflict, but one of them should finally dominate. However, the current state of research on mindset theory (...) does not imply which of these processes might win the race and determine the outcome in a given moment." (Hügelschäfer & Achtziger, 2014, p. 34)

4.2. Individual Differences and Inconsistencies

Individual differences, such as physical characteristics (e. g., gender, health), personality traits (e. g., self-esteem, chronic levels of achievement motivation), or external factors (e. g., economic status, social status) also have the potential to interact with mindsets. For instance, Hügelschäfer and Achtziger (2014) found that gender can play a role in reinforcing or impairing mindset effects. They argued that higher levels of risk aversion in females could reinforce cautiousness in risk taking and low performance expectations in a deliberative mindset more than in men. At the same time, a lesser degree of risk aversion in males could foster the realistic evaluation of information also promoted by the deliberative mindset.
Moreover, Dennehy et al. (2014) found that an individual's socio-economic status also has the potential to interfere with mindset effects. In their study, individuals with low social and economic status that were induced an implemental mindset exhibited similar confidence levels and performed at a comparable level with participants with a high social and economic status who were not induced any mindset. In line with these results, Bayer and Gollwitzer (2005) reported evidence of positive illusionary self-evaluations (vs. realism) in the implemental mindset (vs. the deliberative mindset) only in participants with high self-views. In fact, results were even reversed for participants with low self-views. The authors suggested that the deliberative mindset triggered a self-defense mechanism in participants with low self-views that in turn increased self-evaluative ratings. Thus, while mindsets might have had the same effect in low and high self-view individuals (the deliberative mindset decreasing positive illusions), consequences of provoking a self-threatening situation were markedly different.
Overall, these examples show that individual differences can be vital to explain mindset effects. While it is the inherent logic of mindset theory that mindsets affect everyone in a similar way, it is also reasonable to assume that physical or context-relevant variables can interact with those cognitive orientations. Henderson et al. (2008) go even further, proposing chronic predispositions reinforcing either deliberation or planning:

> "(I)t is also important to draw attention to the fact that while some studies in the tradition of mind-set theory have found no differences between deliberative and neutral mind-set groups (...), other studies have found no differences between implemental and neutral mind-set groups (...). Moreover, other studies have found theoretically consistent differences between all three mind-set groups (...). Such inconsistent findings might also be due to the existence of an unexplored individual difference in chronic preferences for deliberative versus implemental mind-sets. Indeed, recent work by Grant, Gollwitzer, and Oettingen (2006) supports this possibility, and we look forward to additional work that directly tests this idea." (Henderson et al., 2008, p. 407f.)

Also, on a side note, one field that has yet been neglected in this regard but could contribute a lot to advance mindset research, are intercultural mindset studies. Claiming universal applicability, mindset theory has had an almost exclusive focus on American

and German-speaking samples and comparing effects across cultures would benefit the whole line of research.

Part of the reported inconsistencies of mindset effects and likely related to the impact of individual differences, is the issue of null-results. It is only recently, and partly because of the replication crisis in social psychology, that it has become slightly more common to publish studies including null-results. And while individual differences are one explanation, they might also happen to be a reflection of reality. Type I errors, that is, false positives, are disproportionately common in publications in social psychology (Murayama, Pekrun, & Fiedler, 2014). In fact, Bakker, van Dijk, and Wicherts (2012, p. 543) pointed out that 96% of psychological papers using null hypothesis testing report significant results. One major reason for this unlikely finding, they argued, are underpowered sample sizes. As a reaction to these concerns, more and more researchers have started reporting several experiments at once to argue their point, sometimes including null-results, and journals have started asking their authors to report effect sizes and sometimes also confidence intervals along with their results to give a more complete impression of their data (e. g., Cumming, 2012).
It is thus also a goal of this work to present outcomes with adequate methodological caution, to consider the impact of individual differences on mindset effects, and to report null-results as they occurred and discuss their meaning in relation to other mindset experiments.

4.3. Overview Mindset Effects

Based on an overview of mindset effects by Achtziger and Gollwitzer (2010, p. 322), the following tables summarizes mindset effects including classic as well as recent findings, some studies including implementation intentions, and the according sources.

Table 4.1.: Overview of Mindset Effects

Topic	Deliberative Mindset	Implemental Mindset	Paper
Thought Contents	More deliberative thoughts	More implemental thoughts	Heckhausen & Gollwitzer, 1987 Gollwitzer, Heckhausen & Ratajczak, 1987 Gollwitzer, Heckhausen, & Steller, 1990 V. Brandstätter & Frank, 2002
Memory	Better broad memory recall	Better goal-relevant recall	Heckhausen & Gollwitzer, 1987 Beckmann & Gollwitzer, 1987 Gollwitzer, Heckhausen, & Steller, 1990 Fujita, Gollwitzer, & Oettingen, 2007
Selectiveness	Open-minded	Closed-minded	Heckhausen & Gollwitzer, 1987 Beckmann & Gollwitzer, 1987 Gollwitzer & Kinney, 1989 Bayer & Gollwitzer, 2005 Fujita, Gollwitzer, & Oettingen, 2007 Nenkov & Gollwitzer, 2012
Receptivity	Feasibility and desirability	Feasibility	Heckhausen & Gollwitzer, 1987 Beckmann & Gollwitzer, 1987 Gollwitzer & Kinney, 1989 Höner, 2005 Nenkov & Gollwitzer, 2012 Büttner et al., 2014
Information Processing	Accurate/realistic and impartial	Optimistic and partial	Heckhausen & Gollwitzer, 1987 Beckmann & Gollwitzer, 1987 Gollwitzer & Kinney, 1989 E. Harmon-Jones & Harmon-Jones, 2002 Bayer & Gollwitzer, 2005 Henderson, de Liver, & Gollwitzer, 2008

Table 4.1.: (continued)

Topic	Deliberative Mindset	Implemental Mindset	Paper
Susceptibility to Biases[b], e.g., Illusion of Control	Weaker biases, more realistic estimation of personal control	Stronger biases, illusionary optimism of control	Beckmann & Gollwitzer, 1987 Gollwitzer & Kinney, 1989 Taylor & Gollwitzer, 1995 Hügelschäfer & Achtziger, 2014
Risk Preferences[a,−b]	Little risk	Higher risk	Puca, 2001 Hügelschäfer & Achtziger, 2014
Prediction of Relationships	Realistic	Optimistic	Gagné & Lydon, 2001a
Expectation of Performance	Pessimistic	Optimistic	Armor & Taylor, 2003 Puca, 2001[1] Hügelschäfer & Achtziger, 2014 V. Brandstätter, Giesinger, Job, & Frank, 2015
Mood	Poor	Better	Taylor & Gollwitzer, 1995 Brandtstätter & Frank, 2002 (Study 2) V. Brandstätter & Frank, 2002 (Study 1, 3)[1] Fujita, Gollwitzer, & Oettingen, 2007[1] Büttner et al., 2014[1]
Determination		Higher	C. Harmon-Jones et al., 2011
Self esteem	Lower	Higher	Taylor & Gollwitzer, 1995
Strength of attitudes	Lower, more balanced	Higher, clearer preferences	E. Harmon-Jones & Harmon-Jones, 2002 Henderson, de Liver, & Gollwitzer, 2008
Professional skepticism	Stronger	Weaker	Rasso, 2013
Goal commitment		Higher	Diefendorff & Lord, 2003[1]
Relationship illusions	High (if committed)	High	Gagné & Lydon, 2001b

Table 4.1.: (continued)

Topic	Deliberative Mindset	Implemental Mindset	Paper
Vulnerability to risk	Higher	Lower	Taylor & Gollwitzer, 1995
Left frontal cortical activation		Higher	C. Harmon-Jones et al., 2008
Performance	Underperformance	Better performance	Puca, 2001[1] V. Brandstätter & Frank, 2002 Armor & Taylor, 2003 Diefendorff & Lord, 2003 Diefendorff & Lord, 2003[c] Büttner et al., 2014 Dennehy, Ben-Zeev, & Tangiwa, 2014 V. Brandstätter, Giesinger, Job, & Frank, 2015
Attention	Background and foreground	Foreground	Büttner et al., 2014
Realize goals	Fewer follow-throughs, slower	Follow through more often, faster	Pösl, 1994 Sheeran & Orbell, 2000[c] Höner, 2005[c] Henderson, de Liver, & Gollwitzer, 2008 Nenkov & Gollwitzer, 2012

Note. [a] = females (Hügelschäfer & Achtziger, 2014); [b] = males (Hügelschäfer & Achtziger, 2014); [c] = implementation intentions; [1] = no effect

5. Present Research: Risk Taking and Mindset Dynamics

One overall question constituted the starting point of this work: How do mindsets affect economic risk taking? The question then evolved in more tangible research questions, regarding the precise nature of mindset effects, their benefit, and their development over time. To find answers, decision-processes, choices, and outcomes were analyzed in two experiments.

5.1. Mindsets and Risk Taking

Identifying the optimal level of risk taking is crucial in the attempt to maximize profits. In economic settings, rational choices, that is, choices for higher expected values, will result in higher average outcomes. Yet, it has become popular knowledge that individuals are rather bad at objectively judging risks. Kahneman and Tversky (1979) put forward the hypothesis that individuals tend to put an excessive emphasis on risk avoidance and are very vulnerable to systematic errors, known as cognitive biases. Among others, studies have shown that individuals assessing probabilities and estimating values disregard prior probabilities and samples sizes (Tversky & Kahneman, 1974), get influenced by framing (Tversky & Kahneman, 1981), and overestimate the value of their property (Kahneman, Knetsch, & Thaler, 1991). And while these biases can help simplify decisions, they tend to harm individuals in terms of objective outcomes. Thus, the present research was set up to test whether mindsets could be used as tools to improve economic risk-taking behavior from an outcome-oriented perspective.

Previous mindset studies give mixed impressions of how the deliberative and implemental mindsets might affect economic risk taking. Cognitive, affective, and behavioral effects recorded so far point in rather different directions.

In the deliberative mindset, risk avoidance has been found to be stronger than in the implemental mindset in some studies (Puca, 2001), while others qualified this finding by pointing at interactions with gender (Hügelschäfer & Achtziger, 2014). Moreover, there is a higher level of perceived vulnerability to risks in combination with lowered self-esteem (Taylor & Gollwitzer, 1995), and more pessimistic predictions for future performance (Armor & Taylor, 2003). While such effects speak for careful, rather than objectively rational behavior, cognitive effects suggest the opposite. Based on an impartial manner of information processing (e. g., Heckhausen & Gollwitzer, 1987; E. Harmon-Jones & Harmon-Jones, 2002) and a decreased susceptibility to biases (e. g., Taylor & Gollwitzer, 1995), the path to an economically sound decision should be facilitated by a deliberative

mindset.
In turn, the implemental mindset supposedly supports economic risk taking on an emotional level, but might be damaging on the cognitive level: While implementation-related thoughts are linked to more optimistic predictions of performance (Armor & Taylor, 2003), higher self-esteem, and feelings of invulnerability to risks (Taylor & Gollwitzer, 1995), they give also room to an increased illusion of control (Gollwitzer & Kinney, 1989), biased attention foci (Büttner et al., 2014), and partial information processing (e. g., Beckmann & Gollwitzer, 1987; Bayer & Gollwitzer, 2005). However, the implemental mindset has also been shown to increase approach motivation (C. Harmon-Jones et al., 2011) and persistence in problem solving (V. Brandstätter & Frank, 2002), two behavioral qualities that could indeed facilitate rational decision making.

Overall, both mindsets have the potential to improve or impair rational decision-making, depending on which (cognitive or affective) effects dominate in the response. The nature of effects could also interact with mindsets, or seemingly contradicting effects might cancel each other out. At the same time, however, it should be kept in mind that many of the reported mindset effects were not always consistent and that different context could favor either the cognitive or the emotional side. From a behavioral perspective, the implemental mindset seems to provide individuals with some advantages when confronted with difficult tasks, as it could increase the effort individuals put into the decision process. Yet, the question remains whether that would ultimately pay off, or if the deliberative mindset is more advantageous for augmenting rational behavior. Moreover, it is unclear how mindset effects might develop over time and how influential contextual variables are in risk taking.

5.2. Mindset Dynamics

If risk taking is analyzed not only once, but repeatedly, one can assume that earlier behavior would influence later behavior. More than that, however, one might also ask whether the effects of mindsets undergo changes over time.
Theoretically, mindsets remain active until they are replaced by another mindset, but carry-over effects employ a different logic. Rather than being functional states, carry-over effects interfere with other cognitive orientations. Based on experiments by Gagné and Lydon (2001a, 2001b), carry-over effects are assumed to deteriorate over time. That said, it is unclear how durable the effects are, whether personal characteristics impact durability, if their annulment depends on certain events, and if longevity is the same for all mindsets. Büttner et al. (2014) found that mindset effects persisted over the whole course of their experiment, but empirical data is too scarce to make further assumptions. Moreover, the impact of mindsets could not only decay, but change over time. Mutability has not yet been discussed as a feature of mindsets, as most research did not include repeated measurements or long-term observations. Yet, experience and feedback gained in tasks could well interact with mindset effects and weaken or strengthen certain aspects of their impact. For instance, it would be reasonable to assume that experiences of

success could reinforce optimism in planning individuals, whereas failure might dampen it. Thereby, the impact of emotional or cognitive effects might not always be fixed, but interact with past performance.
Finally, mindset effects could vary depending on content, as Calcott and Berkman (2014) found that context has a significant impact on motivational states. Thus, not just topics, but also framing or different levels of complexity in a task could trigger either more emotional or more rational qualities of mindset effects. While this has not yet been researched in relation to action mindsets, it is clear that context is a crucial factor in risk taking. Behavior immensely differs for gain and loss scenarios (Kahneman & Tversky, 1979), and Atkinson (1957) and McClelland, Atkinson, Clark, and Lowell (1953) found that the level of difficulty is largely influential in risk taking. With tasks at the limit of an individual's capabilities, achievement motivation is at its peak and could well be an interfering factor.
Thus, apart from durability issues of carry-over effects, mindset effects in risk taking could change over time depending on feedback and context. Based on these considerations, the following research questions were formulated.

5.3. Research Questions

Three questions summarize the research interest behind this work:

1. Which mindset effects apply in economic risk-taking tasks?
2. Which mindset benefits economic risk taking?
3. Which dynamics apply to economic decision-making processes in different mindsets?

To investigate these questions, two experiments were conducted, using economic risk-taking tasks as dependent variables. The first experiment focused on the decision-making process using eye-tracking technology and examining behavior at different levels of difficulty to make the best decision. Specifically, it was investigated how information on lotteries was collected in a deliberative or implemental mindset. Measurements of eye-movements during the evaluation of two gambling options were taken to provide information on preferences for either probability- or outcome-related information, the overall effort put into the decision-process, and the commitment towards one's choices.
The second experiment introduced performance-based incentives to reward smart risk taking. The task allowed participants to individually choose risk-taking levels and to take success/failure feedback into consideration for future behavior in the game. A ring toss game was therefore set up and the choice of distances, hit rates, reactions to feedback, and payoffs were recorded.
Both experiments employed multiple measurements, because process data was necessary to examine mindset dynamics in risk taking. Overall, individuals' paths to come to their decisions were as much of interest in this investigation as the games' outcomes.

6. Experiment 1: Mindset Effects in an Eye-Tracking Study on Rational Decision Making

6.1. Summary

In the first experiment, mindset effects on information processing and decision making in economic risk-taking tasks were examined. After a classic induction of mindsets, eye-movement measurements were taken during 40 lottery-tasks with different levels of difficulty. The number of fixations was higher and decision times were longer for participants in an implemental than in other conditions in difficult decisions, although choices did not differ significantly. Results indicated that an implemental state of mind provoked a more effortful information search and higher levels of achievement motivation.

6.2. Introduction

Rationality does not come naturally to most risk takers (e. g., Tversky & Kahneman, 1981). It demands more cognitive effort to objectively analyze choice alternatives than relying on heuristics to make a decision (Kahneman, 2003). And while heuristics are necessary facilitators of everyday life, outcomes suffer from irrationality in economic risk taking. Given, individuals have only a limited ability to make rational choices, as put forward by Simon (1955) in the concept of bounded rationality. According to Simon, decision makers rarely possess all the relevant information needed to make a rational decision, nor do they always have the time or cognitive abilities to process them. Still, "motivational styles characterized by persistence and continuous effortful engagement are key contributors to success and achievement" (Granic, Lobel, & Engels, 2014, p. 70f.), and trying to apply rational rules could sometimes already be enough to improve economic risk-taking behavior.
Thus, the first experiment was set up to see whether mindsets can be facilitators for rational decision making. Set in an economic context, all relevant information was available, and mindsets were induced to see if they increased efforts and outcomes.

6.3. Present Research

To investigate information processing, mindset research has hugely relied on self reports and participants' memories regarding information processing (Heckhausen & Gollwitzer, 1987; Taylor & Gollwitzer, 1995). Only recently, Büttner et al. (2014) have contributed the first eye-movement study examining physical differences in attention in the deliberative and implemental mindset. However, there is no comparable research on mindset effects on attention patterns in decision-making processes, yet. This experiment was a first step to close this gap. Over the course of 40 decision tasks asking participants to indicate their preferences for one of two lotteries, fixations, decision times, and choices were recorded. The data was used to provide a comprehensive account of deliberative and implemental information-search patterns.
As outlined in the previous chapter, it is not explicitly clear how mindsets would influence risk-taking behavior. If cognitive effects dominate, the deliberative mindset should provide an advantage, as it has been shown to decrease biases and processes all information impartially (Beckmann & Gollwitzer, 1987; Bayer & Gollwitzer, 2005). In a task in which rational choices make the best strategy, this would optimally translate into better outcomes. However, Hügelschäfer and Achtziger (2014) have argued that the deliberative mindset also reinforces affective attributes that would possibly impair rational risk taking. Lower levels of self esteem, a higher perceived vulnerability to risks (Taylor & Gollwitzer, 1995), and lower risk preferences (Armor & Taylor, 2003) could mean that the deliberative mindset increases insecurities that interfere with the in-depth evaluation and consideration of all choice alternatives.
Given that implemental thought processing is more prone to biases and less realistic, studies have also shown that participants in an implemental mindset have repeatedly out-

performed deliberative participants in a variety of tasks, (e. g., scavenger hunts, Armor & Taylor, 2003; puzzles, V. Brandstätter et al., 2015; estimation tasks, Büttner et al., 2014). Persistence and higher performance expectations seemingly paid off, two qualities that also apply to the present risk taking task. And although there are no known results on economic risk taking, the lower perceived level of vulnerability to risks (Taylor & Gollwitzer, 1995) and the higher risk preferences (Puca, 2001) in implemental participants would be beneficial in economic risk taking as well.
Thus, the properties of the task at hand allow a specification of the predictions for mindset effects on economic risk taking. Calling for individuals to withstand excessive risk aversion, maintain efforts over 40 trials, and face different levels of difficulty, outcomes might overall benefit from an implemental mindset. The following hypotheses predicted economic risk-taking behavior in detail.

First, there is evidence that - up to a point - more difficult decisions will lead to more intense information searches and prolonged decision times (Schotter, Berry, McKenzie, & Rayner, 2010). Thus, independent from mindset, more fixations and longer decision times were expected for more difficult decision categories.

Hypothesis 1: Intensity of information search

H1_1: The more difficult a choice, the more intense the search for information, indicated by the number of fixations and decision times.

It is assumed that the economic nature of the task would cause very specific mindset effects. Because the implemental mindset reinforces goal achievement (Gollwitzer & Kinney, 1989; Nenkov & Gollwitzer, 2012) and strong focus on goal-relevant information (Beckmann & Gollwitzer, 1987), information search was expected to be more intense in this mindset than in other conditions. This should reflect in more fixations and longer decision times overall. Meanwhile, deliberative mindset participants should have more fixations and longer decision times than the control group, because cautiousness would slow down judgment, and individuals would be more likely to consider all available information (Bayer & Gollwitzer, 2005).

H1_2: Information search is more intense in the implemental mindset than in the deliberative mindset, indicated by more fixations and longer decision times.

H1_3: Information search is more intense in the deliberative mindset than in the control group, indicated by more fixations and longer decision times.

The task included trials with five different levels of difficulty. McClelland et al. (1953) suggested that individuals with high levels of achievement motivation are more likely to look for challenges and want to succeed in difficult tasks. At the same time, V. Brandstätter et al. (2015) found indicators for higher achievement motivation to be related to an implemental mindset. Thus, implemental participants should pay particular atten-

tion to more difficult decision tasks.

H1_4: Interaction of level of difficulty and mindset: The level of difficulty will impact participants in an implemental mindset more than other participants.

Regarding the content of information search in the two mindsets, it was suggested that individuals in a deliberative mindset would concentrate on all information equally, because the mindset promotes an impartial and comprehensive information gathering of desirability- and feasibility-related facts (Beckmann & Gollwitzer, 1987; Nenkov & Gollwitzer, 2012). Conversely, individuals in an implemental mindset should focus more on the feasibility aspect of choices.

Hypothesis 2: Content of information search

H2_1: All information is equally important in the deliberative mindset, indicated by an equal number of fixations on all pieces of information.

H2_2: Feasibility information is more important than desirability information in the implemental mindset, indicated by a higher proportion of fixations on probabilities.

Furthermore, numerous studies have shown that individuals fixate more on the option they end up choosing (i.e., utility effect, E. Brandstätter & Körner, 2014; Orquin & Mueller Loose, 2013). Krajbich, Armel, and Rangel (2010) found that the effect was especially strong during the last stage of the decision-making process, so that the last fixation is generally a good predictor of the chosen alternative. They argued that, by fixating on the chosen alternative, the value of the non-chosen alternative is discounted. Meanwhile, the implemental mindset is related to stronger preferences (E. Harmon-Jones & Harmon-Jones, 2002; Henderson et al., 2008) and increased goal commitment (Gollwitzer, 2012). Thus, it was also expected that the last fixation would a better predictor in the implemental mindset than in the other conditions.

Hypothesis 3: Commitment

H3: Commitment to the choices made is higher in the implemental mindset than in the other conditions, indicated by the power of prediction by the last fixation.

Finally, as performance outcomes of previous studies are better for implemental than deliberative participants (e. g., Armor & Taylor, 2003), and considering the increase in risk aversion in the deliberative mindset (Puca, 2001; Hügelschäfer & Achtziger, 2014), it was expected that implemental mindset participants would perform better than participants in a deliberative mindset. At the same time, deliberative participants' cautiousness could protect them from rushed judgments, making them perform better than the control group.

Hypothesis 4: Choices

H4_1: Participants in an implemental mindset have better outcomes than participants in a deliberative mindset.

H4_2: Participants in a deliberative mindset have better outcomes than participants in the control group.

By testing these hypotheses, it was hoped to gain some new insights into mindset effects on decision-making processes and risk-taking behavior in economic contexts. Before going into the results, however, a brief methodological provides some background information on the procedures used and helps understand the validity of the presented findings.

6.4. Measuring Information Processing with Eye Tracking

6.4.1. A Methodological Note on Eye Tracking

In the past decade, the number of studies involving eye-tracking methods has dramatically increased. Gaze patterns, fixation durations, and pupil dilations have been analyzed in a variety of fields, including psychology (e. g., Armstrong & Olatunji, 2012; Colombo, Rodella, Riva, & Antonietti, 2013) and economics (e. g., Reutskaja, Nagel, Camerer, & Rangel, 2011; Stewart, Hermens, & Matthews, 2015). First records of eye-movement data date back to 1879 (for a historical review, see Rayner, 1998). Not surprisingly, the technology has much evolved since then, especially over the last ten years, becoming more and more accurate, time-sensitive, easy to use, and affordable.
Motivation psychology aims to explain the reasoning behind decision making, and the ways in which humans process and evaluate information. Eye-movement research can contribute to this goal by measuring visual attention which, according to the eye-mind assumption (Just & Carpenter, 1980), is an indicator of the information that is being processed in the working memory. The close link between attention and cognitive processing has found enormous support in numerous eye-tracking studies (e. g., Glaholt & Reingold, 2009; Orquin & Mueller Loose, 2013). Overall, fixations are used to integrate information into the working memory or as external memory spaces, using a just-in-time strategy to gather information and reduce working memory load (Droll & Hayhoe, 2007). Since the human mind cannot store infinite quantities of information, this latter function is especially important in decision tasks that confront participants with an overwhelming amount of input. However, in both cases eye-tracking can provide data to analyze which information is gathered to make a decision and how it is processed. The method offers valuable information, because it records both conscious and unconscious eye-movements. This ability to pick up on subconscious processing is only one of many advantages of eye-tracking over earlier approaches to measure attention. It also provides researchers

with information about gaze patterns without influencing choices through the measurement method itself. Other methods and earlier, less sensitive trackers heavily relied on individuals' self-descriptions of their watching behavior. Apart from being incomplete, these techniques were also prone to influence the exact behavior that was meant to be recorded. Finally, modern trackers' time accuracy allows for very sophisticated temporal analyses of eye movement, an advantage that is especially valuable in the analysis of decision-making processes (Glöckner & Herbold, 2011).

In the present study, the pupil and corneal reflection method was used to record data, computing the position of the gaze through the spatial relation between the pupil and the conreal relection. This is the most frequently used measuring method in eye tracking, as it is highly accurate and compensates for small head movements (Holmqvist et al., 2011, p. 21).
Eye trackers can measure a variety of data, including pupil dilation, scan paths, fixation durations, fixation coordinates, and saccades (movements between fixations). The present experiment used fixations defined as "the state when the eye remains still over a period of time (...) [which] lasts anywhere from some tens of milliseconds up to several seconds" (Holmqvist et al., 2011, p. 21) to test the above hypotheses. Specifically, the number of fixations on areas of interest (AOIs) was recorded, as well as decision times. An AOI is a spatially defined area on the screen, containing a single piece of information. When a fixation falls within an AOI, this is considered a hit on the according piece of information.
Despite the many benefits of eye-tracking measurements, the method and equipment also imposed some limitations on the findings in this experiment. Using a table-mounted tracking device, participants were rather aware of their gaze patterns being observed. Thus, participants might have felt a higher pressure to perform well or according to the rules than they would have in another setup (e. g., using less disruptive equipment or paper and pencil experiments). There are new eye-tracking devices that are much less noticeable and are likely to reduce such noise significantly.
On a more general level, it should be considered that eye-tracking data quality always depends on device-specific properties, which usually cannot be influenced by the experimenter. However, the experimenter can control for some participant-specific properties, such as glasses, mascara, and individual calibration insufficiencies. In the present study, the majority of participants did not wear glasses, since reflections in glasses increased drop out rates considerably. Participants wearing soft contact lenses could be included up to a certain threshold regarding the debility of sight (e. g., the data of one participant with -8.5 diopters had to be excluded because the position of the recorded fixations did not fit the stimulus material at all). Participants with hard contact lenses had to be excluded from the study because the pupil and corneal reflex could not be measured reliably. Finally, although Just and Carpenter's (1980) mind-eye assumption has largely been supported by research, eye movements remain an indirect measurement of attention. Triesch, Ballard, Hayhoe, and Sullivan (2003) found instances where fixations were not linked to working memory processes, and Underwood, Chapman, Bocklehurst, and Crundall (2003) made the rare observation that participants sometimes recalled informa-

tion that had never been fixated in the first place. Nonetheless, Holmqvist et al. (2011) come to the conclusion that

> "(i)t is generally considered that when we measure a fixation, we also measure attention to that position, even though exceptions exist that separate the two." (Holmqvist et al., 2011, p. 22)

Thus, although there are findings that urge researchers to remain cautious when drawing conclusions based on eye-movement data, it opens a unique door to observing decision-making behavior through the eyes of the decision maker.

6.4.2. Offset Compensation

Offset compensation is a method to alter raw eye-movement data. Its application in the present experiment requires a brief explanation of the procedure. Under specific circumstances, in order to retrieve as much information as possible, participants' eye movements were adjusted to fit the stimulus material. That is, in cases of measurements with low accuracy but high precision, an algorithm was used to correct the data.
Accuracy in eye tracking describes the level of concurrence between the true position of the eye and the position that is measured by the tracker. It is thus "the [average] difference between the true gaze position and the recorded gaze position" (Holmqvist et al., 2011, p. 33). Among others, reasons for accuracy to decrease include individual properties, such as glasses, contact lenses, eye-color, different eye-physiologies, and head movements (p. 42). Precision, on the other hand, is the degree to which an eye tracker is able to reproduce a measurement, thus guaranteeing quality over time. Overall, the two parameters are measurements of research quality that are synonymous with validity and reliability, respectively.
In the present experiment, in cases of measurements with high precision but low accuracy, an automatic offset compensation was conducted (Hyrskykari, 2006). In other words, upon encountering clusters of fixations outside or partially outside an AOI, the position of the AOI was moved to where the fixations of a specific individual participant actually clustered. This method is commonly used to avoid false negatives, as proposed by Holmqvist et al. (2011, p. 224). In fact, experimenters facing this problem of low accuracy but high precision can either move the position of the AOI or shift the data, so that the offset is neutralized. A less commonly used method to include offset fixations requires the experimenter to enlarge the initially defined AOIs. However, this is only possible when the positioning of the AOIs allows for larger margins without creating ambiguity or AOI overlaps. Any of the compensation techniques must be conducted individually for each affected participant and only when scanpaths and heatmaps indicate a systematic drift or offset. Only when it is obvious to an observer how the gaze shifted from an AOI, offset compensation is performed, so no false positives are produced. With the present data, systematic offsets were thus identified visually together with a second observer.
There are different approaches to using offset compensation as a method to deal with inaccurate data (e. g., Nyström, Andersson, Holmqvist, & van de Weijer, 2013). Given the stimulus material in this study, the adjustment of AOIs was appropriate, given

the clear geometrical format of the decision task (see Figure 6.1). The probability of wrongfully assigning fixations to other AOIs was extremely low in this setup. Also, the offset compensation was only performed in cases with systematic deviations of fixations from AOIs. It was not done for individual trials, but only whole datasets of individuals with constant issues of accuracy. Next, previous studies using the same stimulus material did not report huge accumulations of fixations outside the defined AOIs and reported 87% of all fixations hitting AOIs. Using offset compensation, the present data achieved a similar hit rate of 86%. Thus, not only does it seem reasonable to assume that individuals given a task would focus more on information than on the blank screen next to it; these previous results also provided evidence that the compensated data corresponded the attention patterns that could be expected in the first place. Therefore, an automatic offset compensation was implemented in the experiment. Interestingly, this manner of data correction has also been implemented in some eye-tracking software (Hyrskykari, 2006), which is an indicator that this procedure has been used more and more frequently. Since accuracy can strongly depend on individual characteristics and not compensating for the deviations would exclude otherwise reliable data, this is a commendable development, as long as experimenters are aware of it.

6.4.3. Eye Tracking Studies and Mindset Research

To understand the scope and meaning of eye-tracking data, a few common areas of application are briefly reviewed, before relating the technique specifically to mindset research. Measuring the position of the gaze at any point in time (depending on measurement frequency) and pupil dilation of either one or both eyes, researchers can draw a number of conclusions regarding information processing and behavior. For instance, Velichkovsky, Rothert, Kopf, Dornhöfer, and Joos (2002) examined individuals' driving behavior and found that fixations of different lengths indicated different levels of cognitive processing of information. Participants used shorter fixation spans in order to scan landscapes, whereas longer fixations occurred to process unexpected visual stimuli and to evaluate their level of threat to the driver. Other research has generalized this finding, longer fixations signifying more in-depth processing of information than short fixations (Glöckner & Herbold, 2011).

Scientists in the field of reading research are probably the most experienced in using eye-movement measurements to track behavior (Rayner, 2009a, 2009b). The analyses of reading patterns in native and foreign languages, with different levels of proficiency, and of different sentence constructs make up a vast amount of eye-tracking research and have provided insights into the understanding of meaning in text. For instance, eyes tend to jump forth and back while reading words and sentences, (Drieghe, Rayner, & Pollatsek, 2005), and the size of pupil dilation can be a reliable indicator of emotional arousal (Bradley, Miccoli, Escrig, & Lang, 2008). Thus, there is a broad scope of applying and interpreting eye-tracking data. Regarding the present research, Glaholt and Reingold (2011) provided an extensive review on eye-tracking studies in the field of decision research. They emphasized the advantage of the high level of objectiveness regarding the measurement method, especially compared to earlier techniques that were mostly based

on verbal protocols given simultaneously with task performance or retrospectively. The same problem exists in mindset research. While a number of studies found evidence for a desirability and feasibility focus in the deliberative mindset, and a feasibility-only focus in the implemental mindset (e. g., Beckmann & Gollwitzer, 1987; Heckhausen & Gollwitzer, 1987; Taylor & Gollwitzer, 1995), none of the experiments leading to such results had the advantage of unfiltered data that eye tracking can provide. More than that, the technology opens a whole new field of possibilities for mindset research. Pupil dilation measurements could be used to investigate the strength of emotional responses in different mindsets (e. g., when confronted with positive or negative stereotypes); fixation durations could indicate differences between scanning and in-depth information processing (e. g., when agreeing to terms and conditions on websites); and gaze patterns could give evidence for differences regarding individuals' susceptibility to persuasion attempts (e. g., advertisements on websites). As mentioned earlier, Höner (2007) and Büttner et al. (2014) are the exception to the rule, having already conducted mindset studies using eye-tracking technology. They proved that eye-movement data can indeed be a valuable addition to the field and their findings supported the claims regarding a more narrow-minded focus of individuals in an implemental mindset.
Thus, the technique seems promising for mindset research and has the potential to make valuable contributions to the field. In the present study, the method was used to examine mindset effects on economic risk taking. Eye movements were taken to analyze information search patterns, the level of commitment to choices, and to investigate mindset effects over time.

6.5. Method

6.5.1. Participants

One hundred ten students were recruited on the campus of Zeppelin University, Friedrichshafen. Twenty persons were excluded from analysis for the following reasons: measurement and calibration difficulties (14), misunderstandings regarding the main task (2), health problems (1), failed mindset induction (1), dyscalculia (1), and extreme decision times (more than four times the mean of the rest of the sample, 1). Thus, the final sample included 90 students (30 per group, 50% female), ranging from 17 to 32 years ($M = 22.92$, $SD = 3.13$). The majority of participants studied economics (40%) or communication and cultural management (40%), the rest studied various majors (excluding psychology). Participants were paid 5€ for their participation in individual sessions that took approximately 50 minutes.

6.5.2. Design

The study followed a mixed between-within design, specifically a 3 (between; mindset: control vs. implemental vs. deliberative) × 5 (within; level of difficulty: Type I vs. Type II vs. Type III vs. Type IV vs. Type V) mixed design. Participants were randomly

assigned to the mindset conditions. Dependent variables were the number of fixations on AOIs, decision times, and choices.

6.5.3. Procedure

The experiment was conducted in the eye-tracking laboratory at Zeppelin University. After participants arrived, they were greeted and screened for the experiment.[5] They were asked if they wore hard contact lenses, had a strong debility of sight, or if they required glasses to work on a screen. If participants wore mascara, they were asked to remove the make-up on their left eye, because mascara deviated measurements of the infrared camera of the eye-tracking device. Then, participants started the first phase of the experiment.
Mindsets were induced using the classic induction method introduced by Gollwitzer and Kinney (1989). Deliberative participants were asked to write down an unresolved personal issue in the form of "Should I do X, or shouldn't I?" They then listed short-term and long-term positive and negative consequences of what could happen in case they acted or did not act on their problem. Moreover, they rated the valence each consequence and estimated the probability of its occurrence.
Meanwhile, implemental participants indicated a personal project they were set on pursuing, but had not yet taken any action on. They described the goal in the form of "I want to do X!" Then, they broke their project down into five to seven action steps and planned each step in detail, describing when, where, and how they were planning on carrying out their plan. The induction of the mindsets took between 20 and 30 minutes. Control participants immediately began the second part of the study.

In the second phase of the experiment, all participants were handed the instructions to a lottery game (for a translated version, see Appendix B.1), including an example (see Figure 6.1). After reading through the instructions, they were asked to indicate their preference for either the left- or right-hand gamble in the example, as they would during the task, imagining real monetary winnings. Participants were encouraged to make quick decisions, so that they might be more inclined to use decision heuristics. However, slow decision times were not punished. Participants were then introduced to the eye tracker and the response pad, by which they could indicate their decisions. The main task started after a 9-point device-controlled calibration, followed by four short validation tasks to check the preciseness of the eye-tracking measurements and to ease participants into working with the eye-tracker and the response pad. The main task involved 40 decision trials. After the task, participants completed a final paper questionnaire including questions concerning the quality of the mindset induction, the decision task, and demographic information. They were then paid, thanked and debriefed.

[5]Screening questions were also already included in the recruitment process.

Figure 6.1.: Example Stimulus Material

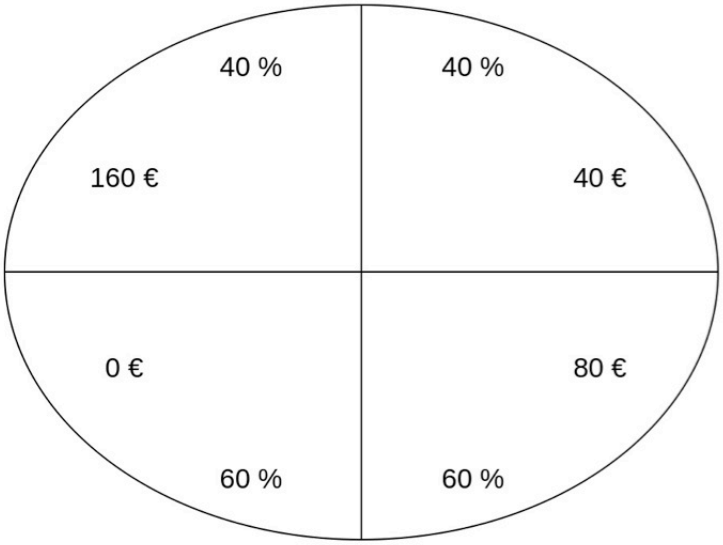

Figure 6.1. Example of lottery as presented to participants.

6.5.4. Material and Equipment

The task, adopted from Glöckner and Herbold (2011), consisted of 40 lotteries, each made of two gambles, which were presented one after the other in the form of an ellipse (see Figure 6.1).[6] In each trial, participants indicated their preference for one of the gambles, either left or right (e. g., Gamble A (left): win 160€ with a probability of 40% or win 0€ with a probability of 60% vs. Gamble B (right): win 40€ with a probability of 40% or win 80€ with a probability of 60%). Participants pressed the left or the right button on the response pad (Cedrus RB-530) in front of them to make their choice. Each piece of information was presented at the same distance from the center of the screen and in the same size.

Five types of lotteries were presented in a fixed randomized order (for an overview of all lotteries, see Table B.1 in Appendix B). Decision tasks differed primarily in terms of the similarity of the two gambles. The task was originally designed to analyze a number of economic decision strategies (e. g., the priority heuristic vs. cumulative prospect theory; see Glöckner & Betsch, 2008a). However, it also provided a solid background for investigating information search patterns in lotteries with different levels of difficulty. Choices got increasingly more difficult from Type I to Type V lotteries, with the type with the most similar choices being the most difficult type, provoking the longest decision times, see Table 6.1.

The idea that very similar options make up the most difficult choices has repeatedly

[6]The original experiment by Glöckner and Herbold (2011) measured eye movements of 18 participants and was part of an experimental battery, thus participants' monetary compensation was approximately three times as high as in the present study.

Table 6.1.: Lottery Types

Level of Difficulty	I	II	III	IV	V
Mean Decision Time in sec (SE)	8.4 (0.3)	8.6 (0.3)	8.8 (0.3)	9.7 (0.3)	11.8 (0.3)
Outcome A	medium or medium	low or high	medium or medium	zero or medium	medium or medium
Outcome B	zero or high	zero or medium	low or high	medium or high	medium or medium

Note. Properties of the five lottery types regarding the level of difficulty to make a decision.

been observed (e. g., Schotter et al., 2010; Causse, Baracat, Pastor, & Dehais, 2011). Moreover, results on decision times regarding the stimulus material have repeatedly been validated (Glöckner & Betsch, 2008a, 2008b; Glöckner & Herbold, 2011).
Based on pretest feedback, the material was slightly adjusted from its original form. Because students lost track of time during the 40 decision tasks and were preoccupied with the thought of how long the experiment would take, a progress bar was inserted between trials. The progress bar was inserted at the same position as the fixation cross. Because of the overall successful replication of the main results in relation to earlier studies (see below), it can be assumed that this variation did not have a strong influence on participants' decision-making behavior.
Thus, the presentation of the stimulus material included a screen with a progress bar (4 seconds), a screen with a fixation cross (1 second), and the lottery (until a decision was made by the participant), see Figure 6.2.

Stimuli were presented on a 19″AOC Monitor (model AOC LM927U LCD), using the native 1280 × 1024 pixel (px) resolution with a 60 Hz refresh rate. The physical stimulus dimensions were 376 mm × 301 mm with a 700 mm distance between the monitor and the eyes. For recording eye movements, a tower-mounted monocular SMI iView XTM Hi-Speed eye-tracker with an infrared camera was used that took measurements with a 240 Hz frequency. As for accuracy, a mean fixation deviation of 0.47° on the x-axis and 0.49° on the y-axis was calculated (Nyström et al., 2013). Fixations as well as saccadic movements within and between AOIs were measured. An automatic offset compensation for fixations outside of AOIs in cases of high precision but low accuracy was performed. Furthermore, SMI iView X 2.2 software was used to record data, while the experiment ran on Presentation® software (version 17.1). For the analysis, fixation detection parameters were set on a minimal duration of 50 ms and a maximal dispersion of 20 px. To record the number and duration of fixations on each piece of information of the lotteries (i.e. probabilities and outcomes), non-overlapping 170 × 100 px AOIs were defined around each piece of information.

Figure 6.2.: Stimulus Procedure

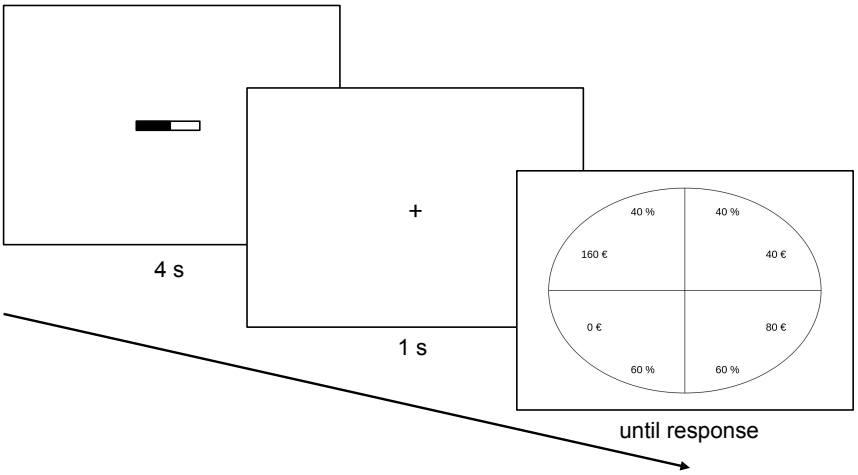

Figure 6.2. Presentation of stimulus material.

6.6. Results

6.6.1. Mindset Manipulation Check

After checking the contents of all induction questionnaires to make sure that instructions were followed, the quality of mindset inductions was tested using a battery of questions based on V. Brandstätter and Frank (2002). Questions evaluated the depth of the mindset induction by looking at the seriousness with which is was executed and participants' commitment to their problems or goals.

On 9-point scales (1 = *not very much* to 9 = *very much*), participants in the deliberative mindset indicated that they took the induction task seriously. They put a lot of thought into deliberation ($M = 7.53$, $SD = 1.31$) and considered both positive as well as negative consequences of action and inaction ($M = 7.47$, $SD = 1.46$). They were fairly undecided upon goal pursuit ($M = 5.97, SD = 1.75$), whereas participants in the implemental mindset indicated they were set to act upon the plan they had developed during the induction phase ($M = 7.53, SD = 1.50$). They, too, had taken the induction seriously, as they had put many thoughts ($M = 6.97, SD = 1.38$) and effort ($M = 7.17, SD = 1.10$) into the planning process.

Moreover, all participants followed instructions well. Only one participant had to be excluded for not deliberating upon an issue. When self-evaluating the quality of their work during the induction phase, deliberative particpiants scored significantly higher than implemental participants, $t(58) = 4.40$, $p < .001$, $d = 1.13$, with $M_d = 8.23$, $SD = 0.86$ and $M_i = 6.90$, $SD = 1.42$. This could be either because the deliberative induction questionnaire was more sophisticated and required participants to read instructions with more attention, or because the mindset caused a more accurate information processing (Bayer

& Gollwitzer, 2005), or both.
Finally, participants in the implemental mindset indicated a stronger commitment to taking action than deliberative participants, $t(44.94) = 2.91$, $p = .006$, $d = 0.75$, with $M_d = 6.64$, $SD = 2.38$ and $M_i = 8.08$, $SD = 1.30$. This is a classic finding (e. g., Nenkov & Gollwitzer, 2012) and altogether, these results speak for a successful and high quality induction of the deliberative and implemental mindset in the experiment.

6.6.2. Data Quality and Comparability

The main task, playing 40 trials of lotteries, was also taken seriously. Asked how much they tried to choose the best gamble in the eye-tracking task (1 = *not at all* to 9 = *very much*), participants scored a mean of 7.82 ($SD = 1.00$, $Min = 5$, $Max = 9$) with no differences between the groups ($p = .302$).
Furthermore, the main results published by Glöckner and Herbold (2011) were successfully replicated with only minor deviations.[7] There was a higher average number of fixations in the present experiment ($M = 55.0$, $SE = 4.5$ vs. $M = 36.4$, $SE = 0.83$), but both studies counted similar proportions of fixations within AOIs (86% vs. 87%). Moreover, the choice pattern was very similar, with different types of lotteries provoking different choices, $\chi^2(4, N = 1200) = 172.03$, $p < .001$, vs. the original with $\chi^2(4, N = 719) = 118.5$, $p < .001$ (see Figure B.1 in Appendix B). Regarding saccades between gambles, the present study counted 92% within-gamble and only 8% between-gamble transitions (compared to 83%/17%).
Furthermore, decision times in the control group were very similar to Glöckner and Herbold's data, with means of 8.6 s ($SD = 4.7$), 8.9 s ($SD = 4.7$), 9.7 s ($SD = 6.1$), 10.2 s ($SD = 4.7$) and 11.3 s ($SD = 6.0$) for Type I to Type V lotteries, in that order (see Figure 6.3).

Decision time were trimmed by excluding trials with decision times < 3.5 s and > 30 s, based on an estimation of how long one decision would reasonably take. Then, trials with decision times $+/-3SD$ from individual means were excluded (9.5% of all trials). A repeated ANOVA (level of difficulty: Type I vs. Type II vs. Type III vs. Type IV vs. Type V) using log-transformed decision times showed that decision times in both experiments increased significantly along with the level of difficulty of the lottery, $F(4, 116) = 17.1$, $p < .001$, $\eta^2 = .37$, compared to $F(4, 68) = 15.2, p < .001, \eta^2 = .43$ (also see Figure 6.4).

6.6.3. Mindset Effects

Information Search Intensity

Overall, the lottery task took participants approximately 8 minutes to complete (in increasing order: $M_d = 7.37$, $SD = 1.53$, $M_c = 8.24$, $SD = 2.39$, $M_i = 8.25$, $SD = 1.57$).[8]

[7] When comparing results, findings relating to the present experiments listed first, followed by results by Glöckner and Herbold.
[8] d = deliberative mindset, c = control group, i = implemental mindset.

Figure 6.3.: Comparison Decision Times

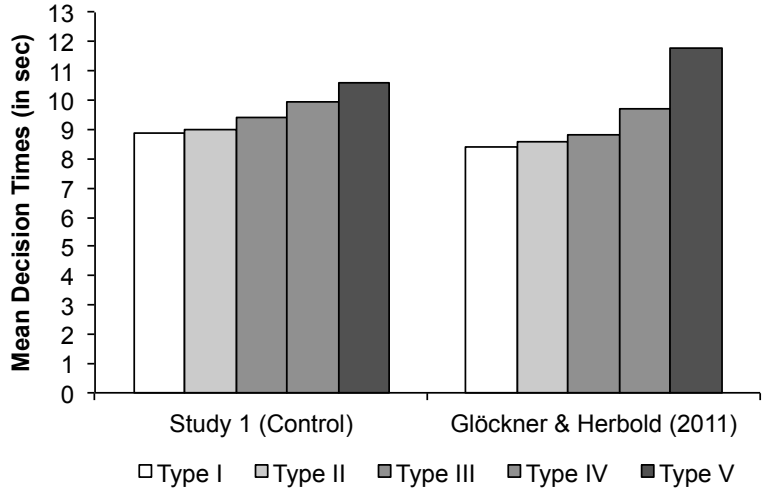

Figure 6.3. Comparison of decision times in the control condition in Study 1 and in Glöckner & Herbold (2011, p. 83). Extreme decision time outliers were excluded (+/− 3SD).

Moreover, decision times increased in relation to the level of difficulty and were closely linked to the number of fixations. Mindsets had an effect on both, decision times and fixations, as indicated by two mixed-design ANOVAs with mindset as a between factor and level of difficulty as a within factor.

The first 3 (between; mindset: control vs. implemental vs. deliberative) × 5 (within; level of difficulty: Type I vs. Type II vs. Type III vs. Type IV vs. Type V) mixed-design ANOVA was conducted on the median of the decision times.[9]
As displayed in Figure 6.4, decision times increased in relation to the level of difficulty of the lottery, $F(3.24, 272.50) = 22.88$, $p < .001$, $MSE = 4.16$, $\eta^2 = .21$, with a strong linear trend, $F(1, 84) = 60.28$, $p < .001$, $MSE = 4.90$, $\eta^2 = .42$.[10] Moreover, the interaction between mindsets and level of difficulty was significant on the 10% level with $F(6.49, 272.50) = 1.96$, $p = .066$, $MSE = 4.16$, $\eta^2 = .04$. Mindsets did not have a main effect ($p = .226$).
To further analyze the mindset × difficulty interaction, separate ANOVAs for each condition were computed as well as t-tests comparing decision times at each level of difficulty between mindsets. The linear trend of increasing decision times along with difficulty was significant for all conditions (all $p < .002$). However, t-tests showed that deliberative participants were faster than participants in the control condition at the simplest level of difficulty Type I on a 10% level, $t(57) = 1.86$, $p = .068$, $d = 0.49$ ($M_d = 6.99$, $SD = 2.33$ and $M_c = 8.53$, $SD = 3.87$). Also, deliberative participants were faster than

[9] Using the Greenhouse-Geisser Correction.
[10] The median was used to account for the non-normal response time distribution, see for instance Achtziger, Alós-Ferrer, Hügelschäfer, and Steinhauser (2014).

Figure 6.4.: Decision Times by Mindset

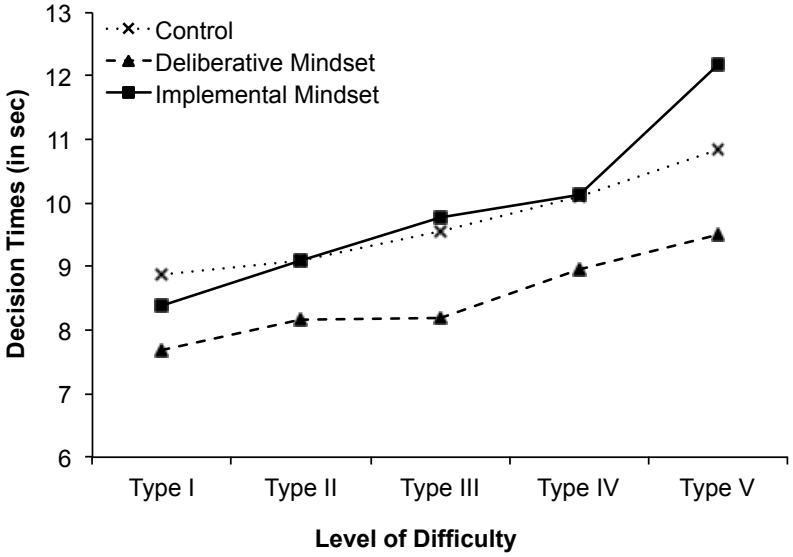

Figure 6.4. Decision times by level of difficulty and mindset.

implemental participants at Type III and Type V lotteries, with $t(58) = 1.92$, $p = .060$, $d = 0.50$, ($M_d = 7.64$, $SD = 2.93$ and $M_i = 9.35$, $SD = 3.91$) and $t(53.18) = 2.48$, $p = .016$, $d = 0.64$ ($M_d = 8.83, SD = 3.88$ and $M_i = 11.80$, $SD = 5.29$), respectively.

The same pattern was found in the second 3 (mindsets: control vs. implemental vs. deliberative) $\times$ 5 (level of difficulty: Type I vs. Type II vs. Type III vs. Type IV vs. Type V) mixed-design ANOVA for the number of fixations, see Figure 6.5.
Again, the level of difficulty of the lotteries was a significant factor, $F(2.68, 232.99) = 35.10$, $p < .001$, $MSE = 165.87$, $\eta^2 = .27$. A significant linear trend showed that more difficult decisions increased the number of fixations before the decision was made, $F(2, 87) = 78.89$, $p < .001$, $MSE = 182.14$, $\eta^2 = .48$. While there was no main effect of mindset ($p = .132$), the interaction between mindset and level of difficulty was also significant, $F(5.36, 232.99) = 2.79$, $p = .016$, $MSE = 165.87$, $\eta^2 = .04$.
Separate ANOVAs showed again that the pattern was significant for all conditions. Then, t-tests for the number of fixations at each level of difficulty indicated no differences between the control group and mindsets (control vs. implemental mindset, all $p > .104$; control vs. deliberative mindset, all $p > .278$). However, the implemental mindset had significantly more fixations than the deliberative mindset in Type III and Type V lotteries, with $t(58) = 2.19$, $p = .033$, $d = 0.56$ ($M_i = 54.94$, $SD = 28.06$, $M_d = 41.63$, $SD = 17.99$) and $t(45.18) = 2.39$, $p = .021$, $d = 0.62$ ($M_i = 69.10$, $SD = 39.98$, $M_d = 49.13$, $SD = 22.08$), respectively.

Figure 6.5.: Number of Fixations by Mindset

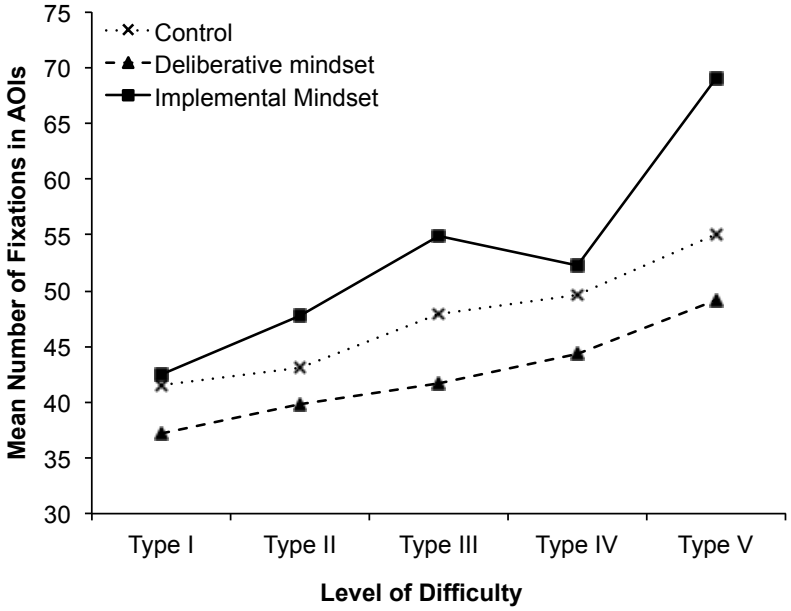

Figure 6.5. Mean number of fixations within AOIs by level of difficulty and mindset.

Content Search

Regarding the content of the information searched during the decision process, a 3 (between; mindset: control vs. implemental vs. deliberative) × 8 (within; AOIs: AOI 1 vs. AOI 2 vs. AOI 3 vs. AOI 4 vs. AOI 5 vs. AOI 6 vs. AOI 7 vs. AOI 8) mixed-design ANOVA was conducted.[11] Thus, the percentages of fixations on each piece of information between the conditions could be compared, see Figure 6.6.

Fixations were not evenly distributed over all AOIs, $F(7, 609) = 91.05$, $p < .001$, $MSE = 0.001$, $\eta^2 = .51$. In descending order, fixations concentrated on the upper outcome of Gamble A (16%, $SD = 2.5$), the upper probability of Gamble A (15%, $SD = 3$), the upper outcome of Gamble B (13%, $SD = 2.1$), the lower outcome of Gamble B (12%, $SD = 2.0$), the lower outcome of Gamble A (12%, $SD = 1.8$), the upper probability of Gamble B (12%, $SD = 1.9$), the lower probability of Gamble B (10%, $SD = 2.0$), and the lower probability of Gamble B (10%, $SD = 1.8$). Mindsets did not interact with the distribution of fixations over the eigth AOIs ($p = .566$). The effect of the between factor was not tested, because percentages added up to 100% in all conditions.

Moreover, information search was rather balanced between desirability and feasibility information, with 54% ($SD = 4.2$) of all fixations on payoff information in all groups ($p = .850$).
The stimulus was divided into four quadrants (Quadrant 1 on the upper left, Quadrant

[11] Using the Greenhouse-Geisser Correction.

Figure 6.6.: Distribution of Fixations Across AOIs

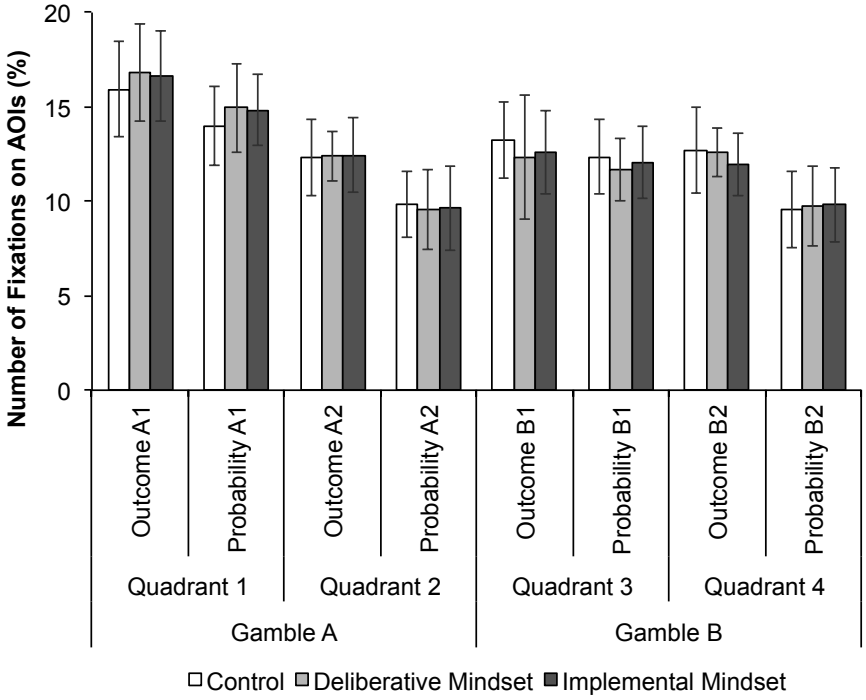

Figure 6.6. Number of fixations on AOIs, error bars indicate $+/-1SD$. On the x-axis, 1 signifies the upper and 2 the lower gambling-alternative on each side.

2 on the lower left, Quadrant 3 on the upper right, Quadrant 4 on the lower right, see Figure 6.7). Rather than content, the position of the information on the screen was a decisive factor for attracting attention. A repeated 3 (between; mindset: control vs. implemental vs. deliberative) $\times$ 4 (within; quadrants: Quadrant 1 vs. Quadrant 2 vs. Quadrant 3 vs. Quadrant 4) mixed-design ANOVA indicated that the upper quadrants attracted the most fixations (Q1: $M = .31$, $SD = .04$, Q3: $M = .25$, $SD = .03$, vs. Q2: $M = .22$, $SD = .02$, Q4: $M = .22$, $SD = .03$). Moreover, Gamble A attracted slightly more fixations than Gamble B ($M = .53, SD = .04$). Mindsets did not interact with quadrants or gambles. Moreover, an overall of 92% ($SD = 2.7$) of all saccades were recorded within gambles, again with no significant differences between mindsets ($p = .515$). Also, not all AOIs were always fixated in all trials. Overall, an average of 7.72 AOIs ($SD = 0.33$) was fixated per trial, with no significant differences between mindsets ($p = .273$).

Commitment

As expected, all participants fixated significantly more on the chosen than the non-chosen alternatives throughout the game, as indicated by a paired t-test, $t(89) = 9.43$, $p < .001$, $d = 1.98$ ($M_{chosen} = 0.53$, $SD = 0.03$, $M_{non-chosen} = 0.47$, $SD = 0.03$).

Figure 6.7.: Attention Patterns Across Quadrants

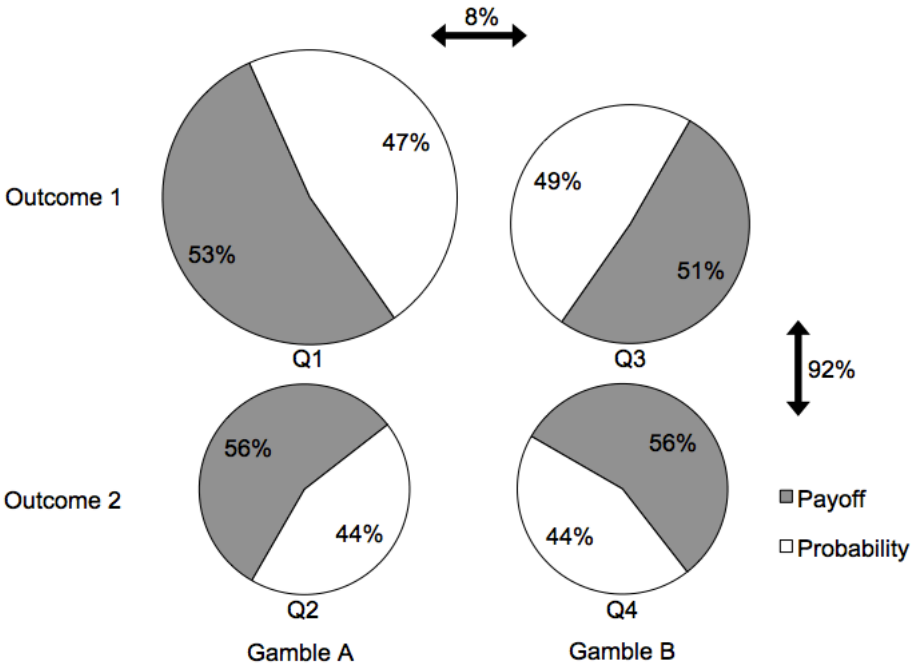

Figure 6.7. Overall proportions of fixations on payoffs and probabilities in the four quadrants of the stimulus material (Q = Quadrant). The size of the bubbles indicates the amount of fixations on each quadrant and the darker and lighter parts indicate the proportion of fixations on payoffs and probabilities within each quadrant. Arrows indicate percentages of within-gamble and between-gamble saccades.

To test the predictive power of only the last fixation, a 3 (mindsets: control vs. implemental vs. deliberative) × 5 (level of difficulty: Type I vs. Type II vs. Type III vs. Type IV vs. Type V) mixed-design ANOVA was conducted. The level of difficulty of the lotteries was a significant factor, $F(4, 348) = 2.60$, $p = .036$, $MSE = 0.03$, $\eta^2 = .03$, qualified by a mindset × difficulty interaction that was significant on the 10% level, $F(8, 348) = 1.83$, $p = .071$, $MSE = 0.03$, $\eta^2 = .04$.
Separate ANOVAs for each condition then revealed that the level of difficulty was only a significant factor in the mindset conditions, not in the control group ($p = .389$). In the implemental mindset, the level of difficulty was a significant factor on the 10% level, $F(4, 116) = 2.17$, $p = .077$, $MSE = 0.02$, $\eta^2 = .07$. The predictive power of the last fixation was lowest at the most difficult level (Type V), and significantly (10%) so compared to Type I ($p = .060$), Type III ($p = .002$) and Type IV ($p = .090$) lotteries.
Similarly, the level of difficulty was a significant factor in the deliberative mindset, $F(4, 116) = 3.06$, $p = .020$, $MSE = 0.03$, $\eta^2 = .10$, with a significant quadratic trend, $F(1, 29) = 6.78$, $p = .014$, $MSE = 0.02$, $\eta^2 = .19$. Comparing the different levels, the last fixation was a significantly better predictor of choice in Type III lotteries than in all other types (all $p < .05$), see Table 6.2.

Table 6.2.: Predictive Power of the Last Fixation

	Control	Deliberative Mindset	Implemental Mindset
Type I	.72	.70	.79
Type II	.70	.72	.75
Type III	.69	.80	.80
Type IV	.77	.69	.76
Type V	.70	.67	.71
Total	.72	.72	.76

Note. Percentages of correct predictions of choices by the last fixation in the different mindsets.

Finally, mindsets made a significant difference for the predictive power of the last fixation at the medium level of difficulty (Type III). A t-test showed that the last fixation was a better predictor in both the implemental and the deliberative mindset than in the control group, $t(58) = 2.41$, $p = .019$, $d = 0.62$ and $t(58) = 2.35$, $p = .022$, $d = 0.61$, respectively. At Type IV, the opposite was true and the last fixation a significantly (10%) better predictor in the control group than in the deliberative mindset, $t(53.43) = 1.98$, $p = .053$, $d = .51$. Also at the 10% level, the last fixation was a better predictor in the implemental than in the deliberative mindset in Type I lotteries, $t(58) = 1.69$, $p = .096$, $d = .44$.

Choices

Regarding choice proportions, mindsets had no effect (all $F < 1$). The previously observed pattern was robust with the clearest preferences at the easiest level, see Figure 6.8. For a comparison of choice proportions between the present experiment and the results published by Glöckner and Herbold (2011), see Appendix B.3.

6.6.4. Exploratory Analysis

In an exploratory analysis of the data, the decay of mindset effects over time and some qualitative indicators of strategies used during the lottery game were examined.
First, due to the randomization of trials with different levels of difficulty, the setup of this study was not ideal for analyzing the temporal decline of mindset effects. For instance, the eight trials making up the most difficult lotteries (the level were implemental participants took significantly longer to make decisions than deliberative participants) were spread rather unevenly over the 40 trials (trial numbers 2, 6, 7, 8, 9, 18, 26, 34). Still, in an exploratory approach, it was examined whether the effect of mindsets declined over time, or whether it was stable for the whole experiment. A decay of mindset effects

Figure 6.8.: Choices by Mindset

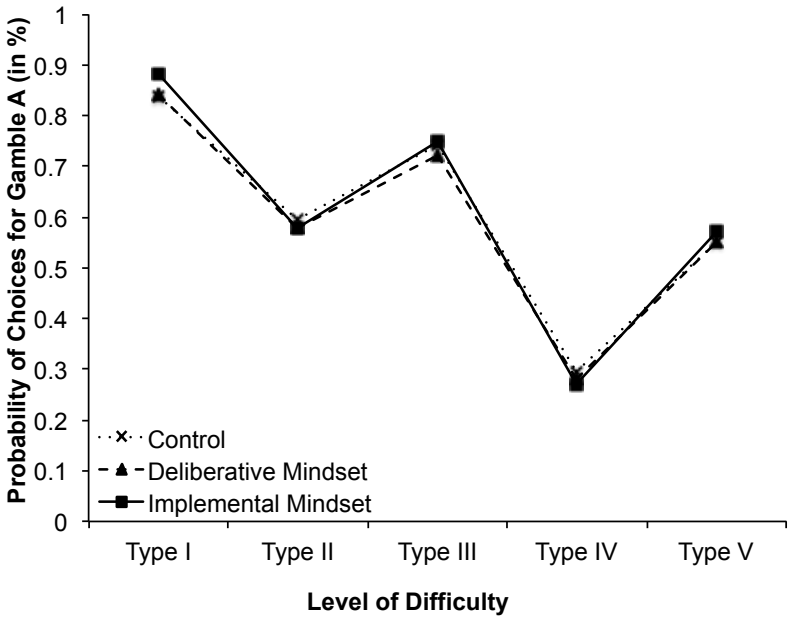

Figure 6.8. Probability of choices for Gamble A by level of difficulty and mindset.

would be indicated by an interaction between mindset and the number of trial. Due to the distribution of the trials (5 in the first 10 trials, 3 in the rest), decision times of the first five trials and the last three trials were compared in an ANOVA (within: Part 1 vs. Part 2), with mindsets as between factors (control vs. implemental vs. deliberative). Neither part, nor the interaction between mindset and part were significant ($p = .173$ and $p = .707$, respectively).

Second, participants' descriptions of their strategies for playing the game were analyzed. Uncued and in retrospect, participants could explain as much or as little as they wanted about how they had approached the task. The experimenter and a student aid with no connection to the experiment rated the answers to this open question independently, without knowledge of the experimental condition, and defined four categories of strategies:

Risk Avoidance: Strategies minimizing risk, e. g., *I wanted to take small risks, avoid 0€ outcomes.*

Intuition: Strategies based on intuition, e. g., *I followed my gut feeling, intuition.*

Rationality: Strategies emphasizing a rational approach e. g., *I estimated expected values, I weighted outcomes and probabilities.*

Risk: Strategies targeting the highest outcome or emphasizing the fun of gambling, e. g.,

No risk no fun, I had nothing to lose.

Answers were coded nominally according to the four categories (see Table 6.3).

Table 6.3.: Strategies Used in the Lottery Task

	Control	Deliberative Mindset	Implemental Mindset
Risk Avoidance (RA)	23	24	25
Intuition (I)	4	6	4
Rationailty (Rat)	4	9	6
Risk (Ri)	4	0	2
RA + I	3	3	2
RA + Rat	2	5	4
RA + Ri	2	0	2
I + Rat	1	4	1
I + Ri	1	0	0
Rat + Ri	1	0	0
RA + I + Rat	1	1	0
RA + I + Ris	1	0	0
RA + Rat + Ris	0	0	0
I + Rat + Ris	0	0	0
RA + I + Rat + Ri	0	0	0

Note. Uncued strategies as mentioned by participants, categories are non-exclusive.

Participants mentioned an average of 1.23 ($SD = 0.64$) strategies in their answers with no difference between the mindsets ($p = .724$). Also, theory would suggest deliberative participants to be most risk-avoiding. However, a Chi-square test showed that overall, 80% of all participants indicated that risk avoidance was a major factor in their decision-making process, with no difference between the conditions ($p = .812$); furthermore, 16% mentioned intuition as a strategy ($p = .713$), 21% referred to rationality ($p = .282$), and only 7% said they consciously took on risks or wanted to have fun ($p = .117$).[12] Although not significant, it is interesting that none of the latter belonged to the deliberative mindset.

[12] 50% of all cells had expected frequencies smaller than 5 in the Chi-square test on risk as a strategy.

6.6.5. Overview Results

The following table summarizes the results obtained from the first experiment, including the exploratory analysis. The above data was interpreted in terms of supporting, partly supporting, not supporting, or rejecting the tested hypotheses.

Table 6.4.: Overview of Results in Experiment 1

		Hypothesis	Result
$H1_1$	Intensity of information search	The more difficult a choice, the more intense the search for information.	supported
$H1_2$		More intense information search in the implemental mindset than in the deliberative mindset.	partly supported
$H1_3$		More intense information search in the deliberative mindset than in the control condition.	not supported[a] partly rejected[b]
$H1_4$		Interaction of level of difficulty and mindset: more intense information search in the implemental mindset.	supported
$H2_1$	Content of information search	All information is equally important in the deliberative mindset.	not supported
$H2_2$		Feasibility information is more important than desirability information in the implemental mindset.	not supported
H3	Commitment	More commitment to the choices made in the implemental mindset than in the other conditions.	partly supported
$H4_1$	Choices	Better outcomes in an implemental mindset than in a deliberative mindset.	not supported
$H4_2$		Better outcomes in a deliberative mindset than in the control group.	not supported
		Exploratory Analysis	
H_{E1}	Durability	Mindset effects decrease during experiments.	not supported
H_{E2}	Strategy	Most risk avoidance in deliberative mindset.	not supported

Note. [a]Number of fixations; [b] decision times.

6.7. Discussion

The increase of the level of difficulty from Type I to Type V lotteries was confirmed by increasing decision times as well as an increasing number of fixations. The more similar the options, the more difficult the choice.
Also, the interaction between the level of difficulty and the experimental condition provided evidence that difficulty affected implemental participants in particular. They took significantly longer and had more fixations than deliberative mindset participants at Type III and V lotteries. This contradicts previous findings that deliberative participants have longer decision times, especially at intermediate levels of difficulty (Puca, 2001). Rather, it suggests that individuals in an implemental mindset might put more effort in economic decision processes than deliberating individuals, especially when facing a difficult task. Such behavior could indicate an increased level of achievement motivation in the implemental mindset in difficult tasks. This idea is supported by classic research on the achievement motive by McClelland et al. (1953) who found that the achievement motive "develops out of growing expectations" (p. 63). Only tasks with a medium to high degree of complexity have the potential to challenge individuals sufficiently to exhibit achievement motivation. When tasks are difficult, but still achievable if skills and luck are on the decision-maker's side, the individual can have expectations of success without having them confirmed immediately. In other words, a reasonable remainder of uncertainty regarding success or failure in a task is necessary to stimulate individuals to give their best. In comparison, very easy tasks are likely to lead to a foreseeable series of events, and might thus cause boredom and avoidance. Also, tasks too difficult to allow success do not provide any opportunity for an individual to confirm their mastery of that challenge, but will more likely provoke frustration and avoidance.
The results of the present study indicated that participants in different mindsets had different perceptions regarding the level of difficulty. While deliberating participants made fast decisions, implemental individuals put effort into the task, probably striving to perform well. For implemental participants to invest this amount of time and effort in the decision-making process, they probably believed there was a chance to make better-than-average decisions and tried to achieve this goal.
The idea of higher achievement motivation in the implemental mindset is further supported by findings on emotional effects in previous studies. Researchers found higher levels of self-esteem and more positive evaluations of mood (Taylor & Gollwitzer, 1995) and higher levels of overconfidence (Hügelschäfer & Achtziger, 2014) in individuals in an implemental mindset. These factors were also found to correlate positively with achievement motivation (Awan, Noureen, & Naz, 2011; Heaven, 1990; Pekrun, Elliot, & Maier, 2009).
An alternative explanation for the smaller number of fixations in the deliberative mindset points at differences in memory recall between the experimental conditions. Heckhausen and Gollwitzer (1987) showed that participants in a deliberative mindset had a greater short-term memory span for lists of nouns than implemental participants. Moreover, Fujita et al. (2007) found that deliberation also increased recognition memory of stimulus information involving word lists. Overall, a better memory recall could decrease

the need for re-fixations during the decision process and make deliberative participants faster. However, while participants in the deliberative mindset might demonstrate a better integration of information into their working memory, this explanation falls short in two aspects. First, processing numbers is different from words in terms of encoding information into working memory and retrieving it (Conway et al., 2005). This is especially important in the experimental task given in this study. In the stimulus setup, the presented numbers only gained significance in pairs (outcomes together with their according probabilities). Thus the relationship between two numbers made up chunks of information (Simon, 1974), and a simple recall of separate pieces of information would not be sufficient for good decision making.
Second, since the information presented on the screen during the experiment consisted of outcome-relevant information only, in fact, all information in the experiment was implementation-related. This makes an important difference, because Gollwitzer and Kinney (1989) also found a better memory recall of implementation-related information in participants in an implemental mindset, compared to participants in a deliberative mindset. Thus, differences in memory recall are unlikely to explain the observed results. Still, it should be noted that there is a lack of research examining the exact nature of mindset effects regarding the processing of different kind of information, such as numbers as opposed to words.

Surprisingly, mindsets did not affect the content searched during the decision process. All participants fixated almost equally on payoffs and probabilities, while concentrating more on information in the upper than in the lower quadrants. Thus, the position on the screen was a more decisive factor than content. And while this is in line with eye-tracking studies, finding a fixation bias towards the center of the screen (central fixation bias, Mannan, Ruddock, & Wooding, 1996; Tatler, 2007; Clarke & Tatler, 2014), mindset theory would have suggested a different result. Gollwitzer et al. (1990) explained that the deliberative mindset would increase thoughts related to expected value, thus the combination of outcomes and probabilities. Meanwhile, the implemental mindset should gear individuals towards feasibility-relevant information only, thus probabilities. Finding that mindsets did not influence the content of information search is thus unexpected. One reason for this observation could again relate to the stimulus material presenting chunks of information rather than individual pieces that are independent from each other. The overwhelming amount of within-gamble saccades supports this point. It suggest that individuals tried to evaluate each gamble as a whole, separately rather than contrasting individual pieces of information, and only then compared both gambles. This strategy might have altered the importance of fixating on desirability-related information, that is, payoffs, in the implemental mindset.
Yet, such a strategy does not explain why participants in a deliberative mindset did not evenly distribute their fixations over all four quadrants. Many studies have found evidence that the deliberative mindset contributes to impartial and open-minded information processing (e. g., Beckmann & Gollwitzer, 1987; Fujita et al., 2007; E. Harmon-Jones & Harmon-Jones, 2002), reinforcing the equal consideration of all information in a decision task. Yet, all individuals disregarded information on the bottom of the screen,

as compared to the middle or the top. Looking at the stimulus, this means that the probabilities of the second and fourth quadrant attracted the least amount of fixations. Because probabilities in each gamble always added up to 100%, it can be argued that fixations on one probability per gamble were sufficient to get all the information necessary to make a decision. Then, the positioning on the upper half of the screen - which is more attractive to viewers - made probabilities in the first and third quadrant more likely to provide all necessary information. Still, also the distribution of fixations over the other AOIs remained unequal and the deliberative mindset did not have the expected effect. Another explanation for this observation relates to preferences. Researchers have found that, in choice scenarios, preferred options attract more fixations than the less attractive option (Glaholt, Wu, & Reingold, 2009). For instance, Shimojo, Simion, Shimojo, and Scheier (2003) found a gaze bias towards the chosen alternative in their studies, which was especially strong in the last second before the decision. They argued that in decisions between two alternatives, there is an initial preference for one option, which then attracts more fixations. This initiates a mere exposure effect, which in turn reinforces the preference for that option. In short, participants tend to look longer at the option they prefer, which in turn strengthens their preference for that option. Thus, building preferences for one of the gambles and one specific outcome could interfere with the even distribution of attention. However, as choice patterns indicated, preferences switched between Gamble A and B, so the fixation pattern still seems primarily biased by the positioning on the screen. Other experimental setups should follow up on this finding to examine the impact of the geometrical setup and the use of number chunks as information input.

The predictive power of the last fixation was rather high, in general. For the implemental mindset, it was higher at the easier than at the higher levels of difficulty. This finding should not be over-interpreted, but it might indicate a higher commitment to those easier choices as opposed to the most difficult ones. For both mindset conditions, the highest level of commitment was observed at the medium level of difficulty, while the predictive power was rather stable in the control group. A higher commitment to the task in the mindsets can be related to emotional mindset effects. Optimism and a higher level of achievement motivation in the implemental mindset and a high risk avoidance in the deliberative mindset could both increase the effort and commitment put into the decision process.
Despite the indicators of different motivations (achievement vs. risk avoidance), choice proportions were very robust towards mindset manipulations. Replicating Glöckner and Herbold (2011) not only with the control group, but across all participants, outcomes were not affected by deliberation or implementation processes.
Thus, despite a more intense information search process in the implemental mindset, indicated by longer decision times and more fixations, performance outcomes did not differ between the experimental conditions. While this is somewhat sobering, the finding also highlights the importance of the results on information processing. Individuals ended up making the same choices, whether or not their mindsets had been manipulated, but they arrived at that decision on different routes. The additional effort participants in

the implemental mindset put into their choices did not transfer into better choices. On the contrary, participants in the deliberative mindset seemed to demonstrate the most efficient decision-making process throughout all levels of difficulty.
The functionality of the deliberative mindset might be a reason for this finding. Mindsets occur naturally to fulfill a specific purpose, deliberation has the goal of choosing a goal and the implementation phase serves to plan out an already chosen goal. In this economic decision task, it might have been an advantage to be induced the deliberative mindset, because it tuned participants to weight information. Still, it cannot be ignored that deliberation usually evokes a higher feeling of vulnerability towards risks, lowered performance expectations and more negative self-concepts (Taylor & Gollwitzer, 1995). Also, it should be remembered that deliberative individuals were only faster than the control group at the simplest level of difficulty. Rather than declaring them being overall very fast, it is more accurate to assume that implemental participants were particularly slow.

The exploratory analysis on self-reported strategies used by participants indicated that risk aversion was the overall dominating factor in all conditions. However, the observation that no deliberative individual mentioned risk taking as a fun factor, while not significant, should be followed up on. Future research should try using cued strategy inquiries to see if risk avoidance actually was the only strategy used by most participants, or if it was just the most salient.
Regarding the decay of mindset effects, it was observed that mindset effects persisted over the whole experiment. Given a mean task-completion time of about 8 minutes, this could have been expected, but is still reassuring. Usually, no time frames are reported on the duration of the measurements of dependent variables in mindset research. The time span encountered in this first experiment does not seem excessive. Other studies should follow and report task-completion times, so the durability or strength of inductions can further be researched. Moreover, future studies on economic risk taking should use other experimental setups and try to replicate the present results. For instance, it is suggested to use new experimental paradigms with more variance in the expected values. This could create less robust choice patterns and increase the impact of mindsets on outcomes. Also, a different visual setup would provide valuable insights. For instance, E. Brandstätter and Körner (2014) have varied horizontal and vertical presentations of decision tasks to decrease the impact of the positioning on the screen of single pieces of information. Furthermore, not only was there no task-irrelevant information presented on the screen, the equal importance of all pieces of information was made highly salient. Results on information search intensity, content search, and outcomes might differ if more effort is required to identify relevant information in the first place. Lastly, incentivizing performance rather than providing flat payments could impact information processing as well as behavior immensely. Providing a financial reason for everyone to invest effort would put the hypothesis of more effortful behavior in the implemental mindset to a serious test.

For now, however, it can be subsumed that decision processes tend to be susceptible

to mindset manipulations. While choice preferences were robust, longer decision times in the implemental mindset could not be explained by the functional advantage of the deliberative mindset in the given task. Rather, it is suggested that a higher level of achievement motivation led to a more intense and effortful information search in the implemental mindset.

7. Experiment 2: Mindset Effects in a Ring Toss Game

7.1. Summary

In a second experiment, mindset effects on economic risk-taking behavior with a focus on achievement motivation were examined in a repeated ring toss game. Participants could freely choose distances to play from and received performance-based incentives as payment for success. Results showed a dynamic risk-taking pattern in the implemental mindset, but not in the other conditions. Also, implemental participants out-earned deliberative and control participants. The effect of monetary incentives and different levels of achievement motivation in the three conditions are discussed as reasons for these observations.

7.2. Introduction

The second experiment was set up to follow up on the finding that participants in an implemental mindset seemed to invest more effort into the decision-making process than other participants in the first experiment. Moreover, using a risk-taking task including performance-based incentives, another new aspect of economic risk-taking was investigated.

An increase in achievement motivation in the implemental mindset has already been suggested by V. Brandstätter et al. (2015) and was supported by findings in Experiment 1. Yet, the hypothesis has not yet been explicitly tested. To address the question, Atkinson's (1957) model of risk taking provides a useful background. According to the model, goal selection depends on individual levels of achievement motivation, subjective expectancies, and the value of incentives. Furthermore, it assumes that highly achievement motivated individuals prefer goal standards with a probability of success of .5, which pushes them most in their performance (see also Festinger, 1954). However, only few studies confirmed this assumption (e. g., Hashiguchi, 1982), while most others did not (e. g., Ray, 1982). These contradictory findings inspired a discussion on whether individuals with high levels of achievement motivation preferred choice options with a 50% chance of success (McClelland, 1961). Indeed, numbers on success preferences varied, as Heckhausen (1967, p. 99f.) indicated in an overview presenting preferred probabilities of success for highly achievement motivated individuals ranging between .23 and .50. Yet, Atkinson's reasoning prevailed: Highly achievement-motivated individuals tend to set high, but still attainable goal standards (Schneider, 1978). Thus, the ring toss game (Atkinson & Litwin, 1960) provided a fitting paradigm for the present research, as it combined both, risk-taking measurements and a valid indicator of achievement motivation. Including monetary incentives for good performance, the task was ideal to further explore mindset effects on economic risk-taking behavior.

7.3. Present Research

Experiment 1 provided some indicators that implemental participants put more effort into economic risk taking tasks. To explore this claim further, a version of Atkinson and Litwin's (1960) ring toss game was adopted. This paradigm with the goal of hitting a peg with a ring was chosen because risk-taking levels as well as success/failure feedback are very salient and research has shown that highly achievement-motivated individuals tend to choose distances of moderate difficulty. Also, it was easy to incentivize risk taking by providing performance-based monetary rewards. Offering small incentives for small risks and high incentives for high risks, participants efforts throughout the 10 rounds of the game should be maximized. Earlier mindset research and most studies on achievement performance neglected the idea that, in order to strongly motivate individuals to strive for goal success, monetary incentives should be based on task performance (Achtziger, Alós-Ferrer, & Wagner, 2015). Also, as discussed in Chapter 4, money is an external source of motivation that is likely to interact with mindsets, which then is a crucial

aspect in studying mindset effects on economic risk taking.

Thus, the following hypotheses were set for Experiment 2: Based on the prolonged decision process in the implemental mindset in the first experiment, a higher level of achievement motivation was expected for participants in the implemental mindset. According to McClelland et al. (1953), this should reflect in moderate levels of risk taking in the present task.
Due to increased feelings of vulnerability to risks and a lower self concept (Taylor & Gollwitzer, 1995), deliberative participants should have a particularly high level of risk avoidance. This should translate into very low risk preferences in the task. For the control group, it was predicted that they would take higher risks than the deliberative mindset group. However, there was no prediction regarding the relation to the implemental mindset, as individuals trait-specific levels of achievement motivation should dominate and produce a variety of results in the control group.

Hypothesis 1: Risk Taking

$H1_1$: Risk taking is at a moderate level in the implemental mindset.

$H1_2$: Risk taking is lowest in the deliberative mindset.

While the level of risk taking determined the value of the possible reward, success or failure in hitting the peg determined whether the reward was disbursed. Thus, hit rates were a second crucial indicator of performance. Results by Armor and Taylor (2003) suggested that participants in an implemental mindset would outperform the control group and deliberative participants. Moreover, deliberative participants should have lower hit rates than the control group, as they tend to underperform (V. Brandstätter & Frank, 2002).

Hypothesis 2: Hit Rates

$H2_1$: Individuals in an implemental mindset have higher hit rates than individuals in the other conditions.

$H2_2$: Individuals in a deliberative mindset have lower hit rates than individuals in the other conditions.

The integration of feedback into behavior was measured by immediate reactions to success or failure. After hitting or missing, participants could either stay were they were, take fewer risks and decrease the distance, or take higher risks and increase the distance from the peg. Through the feedback, participants could approach their optimal level of risk taking. Yet, according to the risk taking model (Atkinson, 1957), the optimal level does not equal a series of success. As discussed above, individuals with high levels of achievement motivation seek moderate chances of success. Thus, implemental mindset

participants should not reflexively decrease risks after missing the peg once in a while. On the other hand, deliberative mindset participants should avoid risks altogether and thus would immediately decrease risks after missing, but not necessarily increase risks after hitting. Hence, different win-stay and loose-stay feedback patterns were expected between deliberative and implemental participants.

Hypothesis 3: Feedback

$H3_1$: Individuals in an implemental mindset stay at the same distance after a miss more often than individuals in a deliberative mindset.

$H3_2$: Individuals in a deliberative mindset stay at the same distance after a hit more often than individuals in an implemental mindset.

An important addition to the second experiment were performance-based incentives. Thus, while mindset effects on risk taking, hit rates, and feedback integration gave further insights into mindset processes, a major point of interest were outcomes. One question left unasnwered in Experiment 1 was whether an increased achievement motivation in the implemental mindset would actually pay off in a different setting. The profits participants could make in the second experiment were determined by a combination of risk taking and success. Thus, smart risk takers would be monetarily rewarded; smart risks were those that resulted in the highest profits which in this task represented choices at the limit of an individual's capabilities. In other words, participants would profit most if they chose distances that had some probability - but no certainty - of success. Mindsets should affect outcomes in that individuals in an implemental mindset should outperform participants in a deliberative mindset and control participants. Also, due to lower risk taking and lower hit rates, deliberating participants should have lower profits than the control group.

Hypothesis 4: Profits

$H4_1$: Individuals in an implemental mindset have the highest profits.

$H4_2$: Individuals in a deliberative mindset have the lowest profits.

In risk-taking tasks, gender is an important control variable. With this task, this is especially true, since McClelland et al. (1953) reported that most findings related to the ring toss game were based on male-only experiments. They found that results for females could often not be replicated and were unreliable.[13] Yet, both, male and female students were included in this experiment. In accordance with earlier research on overconfidence (e. g., Barber & Odean, 2001), it was expected for gender that males would show overconfidence in the ring toss task as compared to females, taking higher risks

[13]See Alper (1974) for a review on female achievement motivation.

but not making higher profits.

Hypothesis 5: Overconfidence

$H5_1$: Men take greater risks than women.

$H5_2$: Men have similar outcomes as women.

Finally, the durability and mutability of mindsets was tested. While the first experiment suggested a constant mindset effect, Gagné and Lydon (2001a, 2001b) found that the more time elapses between induction and task performance, the less pronounced mindset effects were. Thus, the question remained, whether this attenuation of mindset effects held true for tasks with repeated trials that presented unambiguous success/failure feedback. Similarly, it was unclear whether mindset effects attenuated when a task offered monetary incentives for goal attainment to keep achievement motivation high throughout the task.

Hypothesis 6: Durability

H6: Mindset effects decrease over time.

Testing these hypotheses would provide further insights into mindset effects on economic risk taking. The experiment was designed to support findings from the first experiment, while also expanding mindset research to include monetary incentives. Moreover, the experiment used a different induction method for mindset manipulations, as explained in the next section.

7.4. Method

7.4.1. Participants

One hundred one participants were recruited on the campus of Zeppelin University, Friedrichshafen. Ten persons were excluded from later analysis for the following reasons: failed mindset inductions (8), interruption of the experiment (1), non-native German speaker (1). The final sample included 29 participants in each the implemental and deliberative mindset, and 33 in the control condition ($N = 91$, female: 48.4%). Age ranged from 19 to 47 ($M = 23.59$, $SD = 3.43$). Participants were paid according to their performance in the game at the end of the experiment; additionally, a 50€ gift certificate was raffled off among all participants.

7.4.2. Design

The study followed a mixed between-within design, specifically a 3 (between; mindset: control vs. implemental vs. deliberative) × 9 (within; number of toss: 2 vs. 3 vs. 4 vs. 5 vs. 6 vs. 7 vs. 8 vs. 9 vs. 10) design, with gender as an additional between factor (female vs. male). The first toss was excluded from the repeated analysis as a test toss.[14] Participants were randomly assigned to the experimental conditions. As dependent variables risk taking (choice of distances), hit rates (success/failure), the integration of feedback, and profits were measured, while controlling for task enjoyment and physical activity.

7.4.3. Procedure

Participants were greeted and the experiment was introduced as a two-part study. First, participants (except for the control group) completed a questionnaire inducing one of the two mindsets on a computer. Therefore, the bicycle induction method was used (see Chapter 3). In short, participants were asked to rate the strength of arguments in favor of and against a law that would require cyclists to wear protective helmets on a 7-point scale (1 = *weak argument* to 7 = *strong argument*). Having participants deliberate about advantages and disadvantages of different options (e. g., when choosing test materials or conversation partners, or thinking about positive and negative consequences of a personal goal) is common practice to induce mindsets (Gollwitzer & Kinney, 1989; Taylor & Gollwitzer, 1995; Hügelschäfer & Achtziger, 2014). Four arguments for and against the helmet law were rated, thereby having participants deliberate about both sides of the problem. In the deliberative condition, participants were then asked to write down the most convincing arguments for and against the law. To induce the implemental mindset, participants were asked to make a decision for or against the law, after rating the arguments, by clicking on a thumbs-up or thumbs-down icon. Additionally, they were asked to write down the most important reasons for their decision to further their commitment to their choice. The manipulation check included questions asking for their opinion for or against the helmet law, the strength of participants deliberation process, the strength of their commitment to their own position, and their determination to defend their position in front of others.

After the induction (or as the first task for the control group), the experimenter introduced participants to the ring toss game (see Figure C.1 in Appendix C). Based on an experiment by Atkinson and Litwin (1960), the ring toss game represents a well-known paradigm in measuring risk-taking behavior and achievement motivation. The goal of the game is to repeatedly toss a ring around a peg. According to the original description of the task, a peg with a diameter of 4.8 cm and a height of 36.2 cm was constructed. The ring, made of a flexible tube, had a diameter of 26 cm. Distances from the peg were marked on the floor in 1-foot intervals (1 to 15 ft).[15] Participants played 10 rounds

[14] Including the first toss did not change results on a significant level.
[15] 1 foot = 30.48 cm.

and could choose each time to toss from any of the 15 lines. Furthermore, participants received monetary rewards for scoring. For a hit from the 1-foot line, participants received 10 Cents, and 10 Cents were added to the payoff at each line (i.e., 20 Cents for a hit from the second line, 30 Cents from the third, etc.), thus the maximal winning amount per toss was 1.50€ from the 15-foot line. Winnings of all rounds were added up to calculate participants final profits (maximum 15€). The 5-, 10-, and 15-foot lines were marked according to the winnings participants would receive if they scored (i.e. payoffs were written next to the lines). Hence the valence of each toss was made highly salient.
After the game, participants could choose to play an additional, not incentivized toss and rated task enjoyment on a 101-point scale (left = *no fun at all* to right = *very much fun*). Finally, they completed the manipulation check, answered control questions (cycling and driving behavior, possession and use of a helmet), and gave some demographic information.

7.5. Results

7.5.1. Mindset Manipulation Check and Data Quality

Participants rated arguments in favor of wearing helmets more strongly than arguments against, as indicated by a paired t-test, $t(57) = 15.11$, $p < .001$, $d = 2.74$ (Pro: $M = 5.06$, $SD = 0.80$ and Con: $M = 2.86$, $SD = 0.81$). Regardless, with 97% using their bicycle regularly, only 13% reported owning a helmet and always wearing it. This reflected the results from the pretests and strongly suggested a personal relevance of the issue.
In the mindset manipulation and quality check, the control group (without having deliberated or decided upon the helmet law in the first phase) was included. Without presenting them any arguments, they were asked for their opinion on a bicycle helmet law, whereas participants in the mindset conditions were reminded of the first phase of the experiment and then asked the same question. With a large variance in their opinions (101-point scale, left = *against the law* to right = *for the law*, overall $M = 43.84$, $SD = 32.65$), medians were reported for each group. Control and deliberative participants seemed more opposed to the introduction of a helmet law than implemental participants ($Mdn_c = 31$, $Mdn_i = 58$, $Mdn_d = 29$), yet differences were not significant ($p = .941$).[16]
Furthermore, deliberative participants indicated the highest level of deliberation on the issue (scale 1 = *not at all* to 9 = *very much*), but again, no significant differences were recorded, with $M_c = 5.06$, $SD = 2.06$, $M_i = 5.69$, $SD = 2.07$, $M_d = 6.10$, $SD = 2.19$ ($p = .151$). Regarding commitment to their decision, participants in an implemental mindset were most prepared to defend their position on the issue in front of others on the same 9-point scale, with $M_c = 6.91$, $SD = 1.55$, $M_i = 7.10$, $SD = 1.21$, $M_d = 6.31$, $SD = 2.06$ ($p = .161$). Thus, while differences were not significant, all means went in the expected direction.

[16] Using a Kruskal-Wallis Test.

In relation to control variables, the three conditions did not differ significantly in the possession of a helmet, the frequency of cycling, or the usage of cars (all $p > .350$). Similarly, participants did not differ regarding physical activities (playing basketball, Frisbee®, handball), or general physical activities that could have provided an advantage in the ring toss game (5-point scales, 1 = *daily* to 5 = *never*, all $p > .480$).
Participants took an average of 1.47 m ($SD = 0.29$) to complete the game, with no significant differences between the groups ($p = .830$). After the game, the experimenter offered all participants a non-incentivized extra toss to see if mindset effects still occurred after the main task. All but seven persons (six women) played the additional toss, with no differences between conditions ($p = .304$). Overall, task enjoyment was rated fairly high, with $M = 72.49$ ($SD = 21.53$), but no significant differences between the three conditions ($p = .741$).

7.5.2. Risk Taking

Depending on the mindset condition, risk taking developed differently throughout the game. And while gender played a role in the choice of distances, it did not interact with mindsets. A 3 (between; mindset: control vs. implemental vs. deliberative) × 2 (between; gender: female vs. male) × 9 (within; number of toss: 2 vs. 3 vs. 4 vs. 5 vs. 6 vs. 7 vs. 8 vs. 9 vs. 10) mixed-design ANOVA revealed these two major findings. First, the ANOVA showed a highly significant effect of number of toss and a significant interaction between mindset and number of toss, see Figure 7.1. Second, results indicated a highly significant gender effect, qualified by a highly significant interaction between gender and number of toss, see Figure 7.2.

The main effect of the number of the toss during the game derived from the sharp increase in distance at the last toss, $F(4.72, 400.91) = 7.18$, $MSE = 6.24$, $p < .001$, $\eta^2 = .07$.[17] Pairwise comparisons of the mean distances in each round showed that at the final 10th toss, the chosen risk was significantly higher than during the rest of the game (all $p < .02$).
There was no main effect of mindsets ($p = .248$), but the interaction between mindset and the number of toss demonstrated that different game dynamics developed across mindsets during the game, $F(9.43, 400.91) = 2.08$, $MSE = 6.24$, $p = .028$, $\eta^2 = .04$. The number of toss was a highly significant factor in the implemental mindset, $F(3.36, 93.97) = 7.68$, $MSE = 7.88$, $p < .001$, $\eta^2 = .22$, with a linear trend to increase risks over the course of the game, $F(1, 28) = 13.43$, $MSE = 11.70$, $p = .001$, $\eta^2 = .32$. This trend remained significant even when the highly risky last toss was excluded.
Similar results were found in the control condition. The number of toss was a significant factor, $F(5.00, 159.85) = 4.04$, $MSE = 6.27$, $p = .002$, $\eta^2 = .11$, but the linear trend disappeared when excluding the 10th toss. Meanwhile, the number of toss was not a significant factor in risk taking for participants in the deliberative mindset ($p = .376$).
This finding of increasing risks only in the implemental mindset was further supported by a planned contrast analysis. Individual analyses for each toss clearly showed an in-

[17] Using the Greenhouse-Geisser Correction.

Figure 7.1.: Risk Taking by Mindset

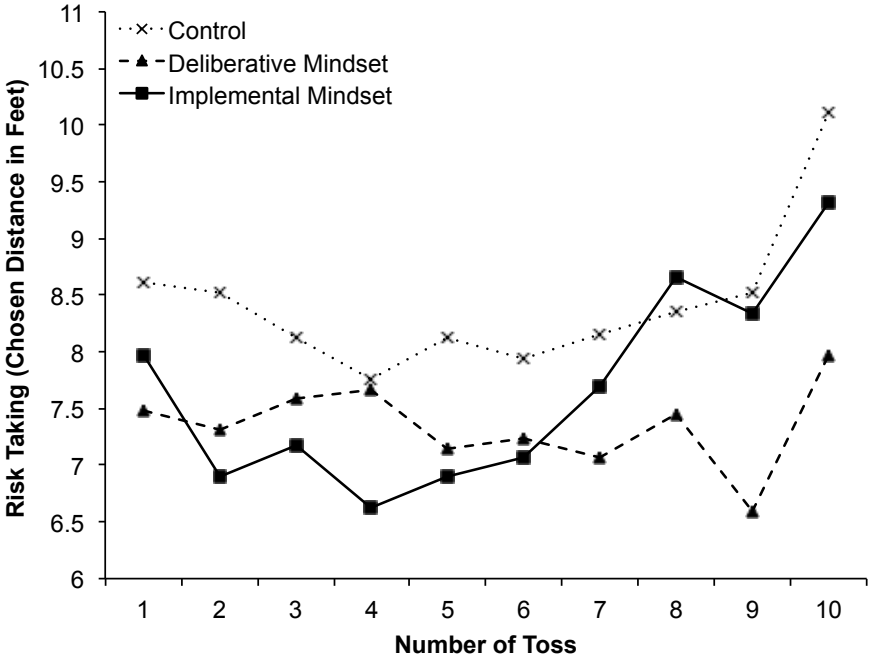

Figure 7.1. Risk-taking behavior over the course of the game by mindset.

crease of risk taking in the implemental mindset versus the other conditions (see Table 7.1). It was observed that at the beginning of the game, participants in the implemental mindset took smaller risks than participants in the other two conditions (negative contrast value). This changed over the course of the game and starting with the seventh toss, implemental mindset participants took higher risks than the other two conditions (positive contrast value).

Secondly, the main effect of gender was also highly significant in the ANOVA, $F(1, 85) = 18.16$, $MSE = 32.41$, $p < .001$, $\eta^2 = .17$. Means revealed a lower risk-taking tendency in female than in male participants ($M_f = 6.90$, $SE = 0.29$ vs. $M_m = 8.62$, $SE = 0.28$). The highly significant interaction of gender and number of toss qualified this effect, $F(4.72, 400.91) = 4.94$, $MSE = 6.24$, $p < .001$, $\eta^2 = .05$. Separate analyses by gender revealed that the number of toss was not a significant factor for females ($p = .526$) who had a rather constant low risk preference. However, male participants increased their level of risk taking over the course of the game, $F(4.18, 183.94) = 9.45$, $MSE = 82.55$, $p < .001$, $\eta^2 = .17$, see Figure 7.2. Their tossing pattern followed a linear trend, $F(1, 44) = 16.69$, $MSE = 214.33$, $p < .001$, $\eta^2 = .27$, a robust result, as it remained significant even when the last toss was excluded. There was no significant three-way interaction between mindset, gender, and number ($p = .918$).

Table 7.1.: Planned Contrast Analysis

Number of Toss	Contrast Value	$t(88)$	p
1	-0.08	-0.11	.458
2	-1.02	-1.60	.057
3	-0.68	-1.15	.128
4	-1.09	-1.92	.029
5	-0.73	-1.28	.103
6	-0.52	-0.96	.169
7	0.08	0.14	.446
8	0.75	1.18	.121
9	0.79	1.27	.105
10	0.27	0.33	.371

Note. Contrast values on risk taking comparing control and deliberative vs. implemental mindset.

Figure 7.2.: Risk Taking by Gender

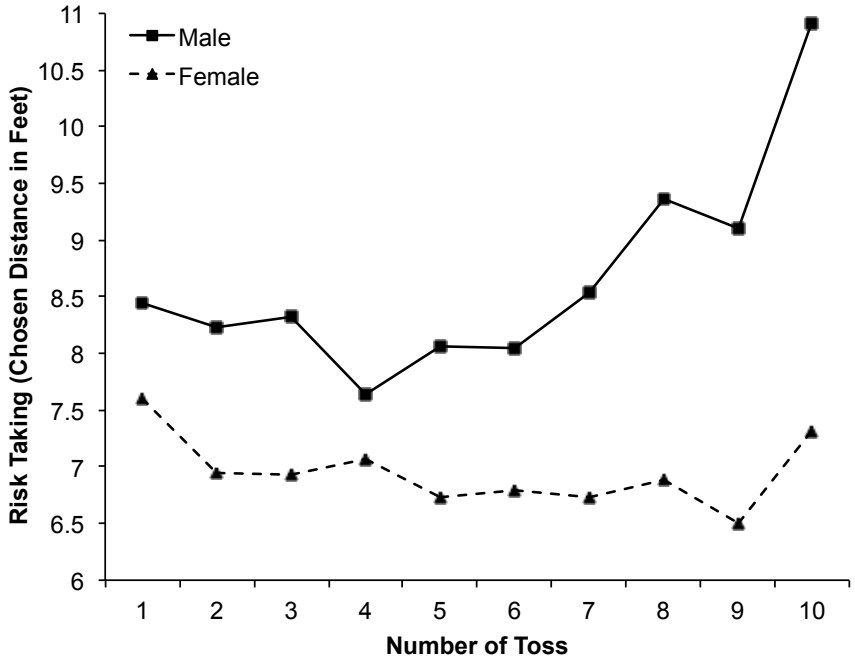

Figure 7.2. Risk-taking behavior over the course of the game by gender.

Figure 7.3.: Hit Rates by Mindset

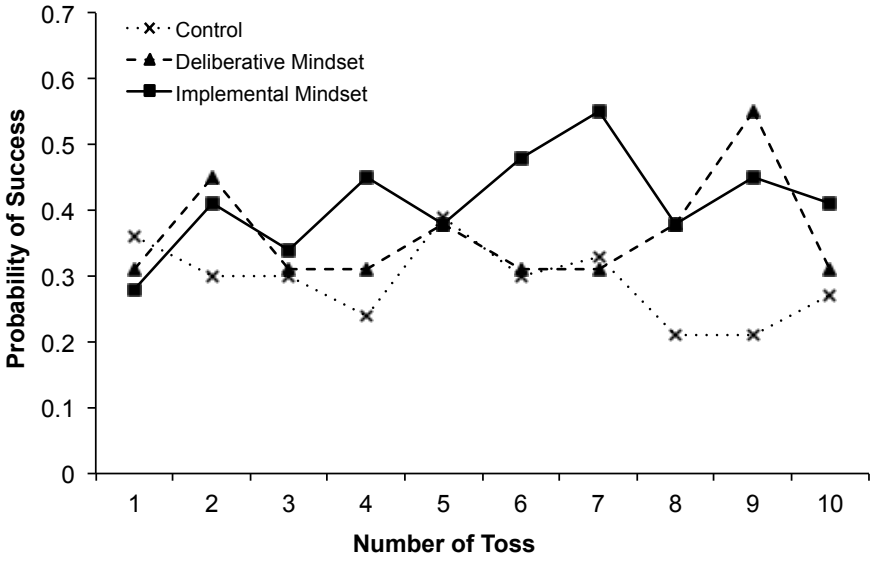

Figure 7.3. Success/Failure proportions over the course of the game by mindset.

7.5.3. Hit Rates

To evaluate success and failure, a hit rate score was computed by totaling the number of hits. This score ranged from 1 to 9, indicating the number of hits for the tosses 2 to 10. A 3 (between; mindset: control vs. implemental vs. deliberative) × 2 (between; gender: female vs. male) × 9 (within; number of toss: 2 vs. 3 vs. 4 vs. 5 vs. 6 vs. 7 vs. 8 vs. 9 vs. 10) mixed-design ANOVA revealed only a significant main effect of mindsets, $F(2, 85) = 4.11$, $MSE = 2.92$, $p = .020$, $\eta^2 = .09$ (all other $p > .133$), see Figure 7.3. Participants in the implemental mindset achieved the highest hit rate ($M = 3.86$, $SD = 1.79$), followed by participants in the deliberative mindset ($M = 3.31$, $SD = 1.97$), and participants in the control condition ($M = 2.58$, $SD = 1.30$). T-tests showed that participants in both mindset conditions were significantly more successful than those in the control condition, (control vs. implemental: $t(60) = 3.27$, $p = .001$, $d = 0.82$; control vs. deliberative: $t(60) = 1.76$, $p = .042$, $d = 0.44$).[18] Meanwhile, the difference between the implemental and deliberative mindset was not significant ($p = .134$). Gender had no effect on hit rates ($p = .281$).

7.5.4. Integration of Feedback

To analyze participants reactions to success and failure feedback, the increases and decreases in risk taking after hitting and missing the peg were calculated. Also, the tendency to stay at the same distance after a miss or a hit was analyzed. Thus, six

[18] One-sided tests.

Figure 7.4.: Mean Winnings per Distance

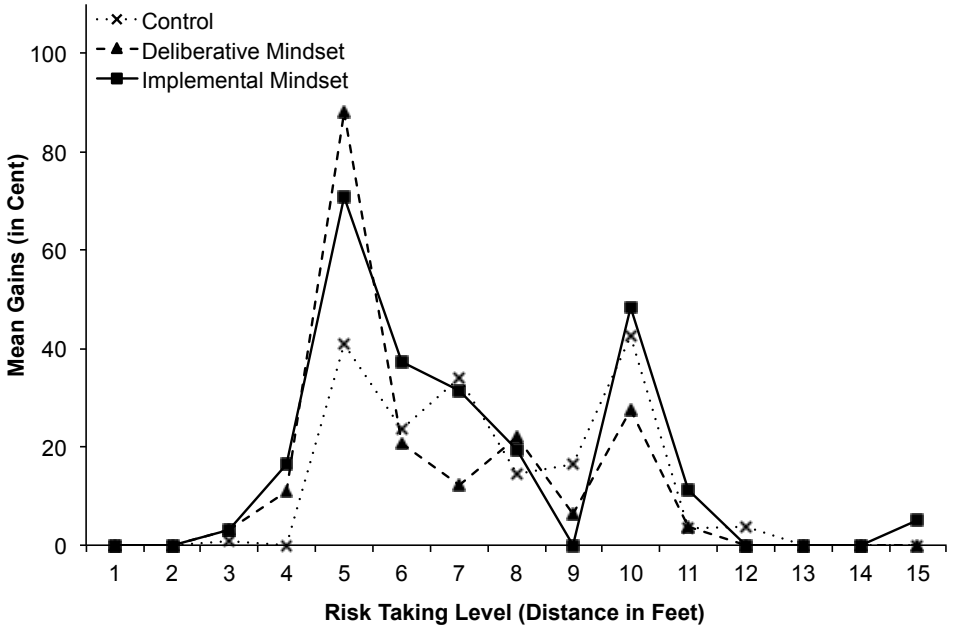

Figure 7.4. Mean winnings by risk-taking levels (distances) and mindset.

parameters indicated feedback integration in the game: (1) increases and (2) decreases in risk taking after success; (3) increases and (4) decreases in risk taking after failure; and (5) keeping the same distance after success or (6) failure.

One-way ANOVAs for mindsets showed that the win-stay strategy tended to be more prominent in both mindset conditions than in the control group, $F(2, 88) = 2.81$, $p = .066$, $MSE = 2.08$, $\eta^2 = .06$, with $M_c = 1.70$ ($SD = 1.51$), $M_i = 2.62$ ($SD = 1.78$), and $M_d = 2.59$ ($SD = 1.97$). Pairwise comparisons indicated that the difference was significant for control vs. implemental participants ($p = .0.42$) and marginally significant for control vs. deliberative participants ($p = .050$); all other behavioral indicators showed no significant differences between the groups (all $p > .183$).

Also, gender differences in feedback integration were significant. First, t-tests indicated a significant difference in the increase in risk taking after misses. After missing, male more than female decision makers tended to take an even higher risk in the subsequent toss, $t(68.62) = 1.84$, $p = .035$, $d = 0.39$, with $M_f = 1.09$ ($SD = 1.68$) vs. $M_m = 2.11$ ($SD = 3.36$). Second, males were more likely to try again from the same distance after missing the peg, $t(89) = 2.56$, $p = .012$, $d = 0.54$, with $M_f = 2.68$ ($SD = 1.76$) vs. $M_m = 3.70$ ($SD = 2.02$). Other indicators showed no gender effect (all $p > .352$).

Figure 7.5.: Profits by Mindset

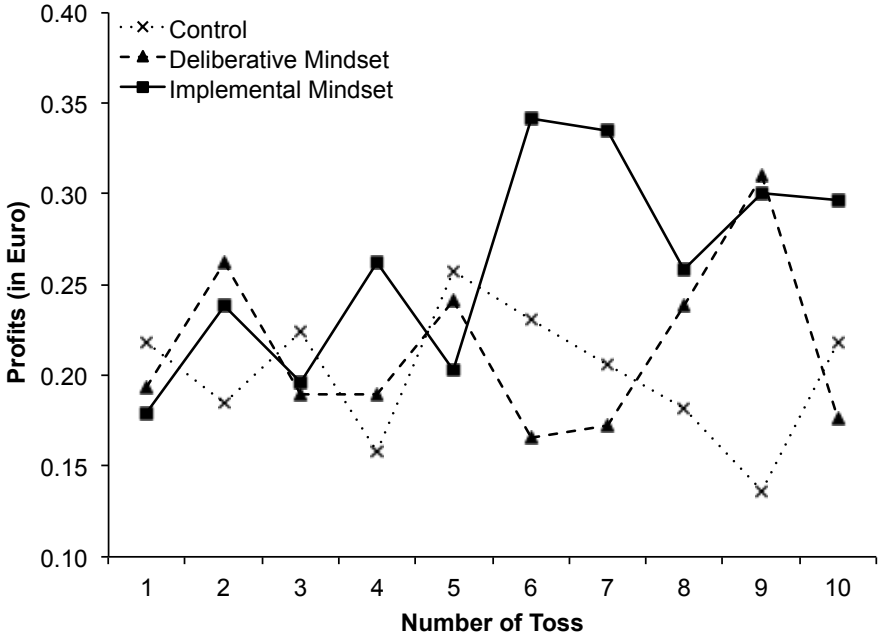

Figure 7.5. Profits over the course of the game by mindset.

7.5.5. Profits

Participants profits – the sum of incentives won over the course of the game – ranged from 0€ to 4.70€ ($M = 2.24$, $SD = 1.05$). Most winnings were achieved from the 5- and 10-foot risk-taking level, see Figure 7.4. This is little surprising, as most tosses were attempted from these distances. Note that these intervals were marked according to the winnings at that level (see Figure C.1 (right) in Appendix C; also see Figure C.2 in Appendix C for the expected values at each risk-taking level).
Implemental participants had significantly higher profits than participants in the deliberative mindset and in the control condition, as indicated by a 3 (between; mindset: control vs. implemental vs. deliberative) × 2 (between; gender: female vs. male) × 9 (within; number of toss: 2 vs. 3 vs. 4 vs. 5 vs. 6 vs. 7 vs. 8 vs. 9 vs. 10) mixed-design ANOVA. The ANOVA showed a significant main effect of mindsets, $F(2, 85) = 3.47$, $MSE = 1086.63$, $p = .036$, $\eta^2 = .08$, see Figure 7.5. Neither gender nor number of toss had a significant effect. Furthermore, there were no significant two-way or three-way interactions between mindset, gender, and number of toss (all $p > .475$).

Participants in the implemental mindset earned an average of 2.43€ ($SD = 0.88$) in tosses 2 to 10, followed by participants in the deliberative mindset with 1.94€ ($SD = 1.14$), and participants in the control condition with only 1.80€ ($SD = 0.89$). According to t-tests, implemental participants' profits were significantly higher than profits in the control group, $t(60) = 2.80$, $p = .004$, $d = 0.71$, and in the deliberative mindset

$t(56) = 1.81$, $p = .038$, $d = 0.48$.[19] There was no significant difference between the deliberative mindset and the control condition ($p = .326$).
To control for the impact physical fitness (task-specific: "Do you play basketball, handball, or Frisbee?", general: "Do you exercise?"), and task-enjoyment ("How much fun did you have playing the game?"), a hierarchical regressions with implemental and deliberative mindset dummies was calculated on profit, see Table 7.2. Results indicated that the findings on higher profits in the implemental mindset were quite robust, since the predictor remained significant even when task enjoyment was included into the regression, which itself showed a positive impact on profits.

Table 7.2.: Hierarchical Regression on Profits

	Variable	B	$SE(B)$	β	ΔR^2
Step 1					.074*
	Dummy IM[a]	.634	.248	.297*	
	Dummy DM[b]	.148	.248	.069	
Step 2					.006
	Dummy IM	.653	.250	.305*	
	Dummy DM	.172	.251	.080	
	Gender[c]	−.150	.207	−.075	
Step 3					.005
	Dummy IM	.628	.256	.294*	
	Dummy DM	.177	.253	.083	
	Gender	−.145	.212	−.073	
	Task specific sports[d]	.012	.105	−.075	
	General sports[e]	−.118	.172	.013	
Step 4					.125*
	Dummy IM	.555	.240	.259*	
	Dummy DM	.135	.237	.063	
	Gender	−.055	.200	−.028	
	Task specific sports	.033	.098	−.031	
	General sports	−.048	.162	.035	
	Task enjoyment[f]	.017	.005	.362**	

Note. Hierarchical regression on profits in tosses 2 to 10. Total $F(6, 84)$ for Step 4 $= 3.70^*, N = 91$, adjusted $R^2 = .15$. Significance levels $^*p < .05, ^{**}p < .001$.
[a]Dummy IM: Implemental Mindset = 1. [b]Dummy DM: Deliberative Mindset = 1. [c]Gender: Female = 1. [d]Task-specific sports: 1 = *daily* to 5 = *never*; [e]General sports: 1 = *daily* to 5 = *never*; [f]Task enjoyment: 1 = *no fun* to 101 = *very much fun.*

[19]One-sided test.

7.5.6. Overview Results

The results of the second experiment are summarized in the following table, indicating support, part-support, or no support for the tested hypotheses.

Table 7.3.: Overview of Results in Experiment 2

		Hypothesis	Result
$H1_1$	Risk Taking	Medium level of risk taking in the implemental mindset.	partly supported
$H1_2$		Lowest level of risk taking in the deliberative mindset.	not supported
$H2_1$	Hit Rates	Highest hit rate in the implemental mindset.	partly supported
$H2_2$		Lowest hit rate in the deliberative mindset.	not supported
$H3_1$	Integration of Feedback	Same distance after a miss more probable in the implemental than the deliberative mindset.	not supported
$H3_2$		Same distance after a hit more probable in the deliberative than the implemental mindset.	partly supported
$H4_1$	Profits	Highest profits in the implemental mindset.	supported
$H4_2$		Lowest profits in the deliberative mindset.	not supported
$H5_1$	Overconfidence	Higher risk taking by men than women.	supported
$H5_2$		Similar winnings by men and women.	supported
H6	Durability	Mindset effects decrease over time.	partly supported

7.6. Discussion

Mindsets had a direct impact on profits by influencing both risk taking and hit rates in the ring toss game. A simple decision versus deliberation task on a completely unrelated topic strongly influenced participants' behavior and consequently, their payoffs.
Only participants in an implemental mindset adapted their level of risk taking during the game. While the control condition displayed a constantly high level of risk taking and deliberative participants remained at a lower level (approximately half of the maximum distance), implemental participants started low, but strongly increased risk taking during the second half of the game. This pattern suggests that implemental participants preferred to first gain some experience with the task and to test their skills. Once suc-

cessful at a lower level, however, they were comfortable to set higher standards. While the last toss provoked increased risk-taking behavior in all groups, this upward trend in risk-taking in the implemental mindset was not only driven by a risk-all mentality at the last toss. Also, it cannot be solely contributed to good feedback, as individuals in both mindset conditions received similar feedback (better than the control group). Thus, it seemed that implemental participants interpreted the feedback differently than deliberative participants and used it to optimize their game. Using success/failure feedback to improve performance, that is, reinforcement learning (Sutton & Barto, 1998), is an important quality to maximize profits. And while considering negative feedback can be unpleasant, lowering one's self-esteem (Crocker, Karpinski, Quinn, & Chase, 2003), and sometimes even threatening a persons social identity (Reinhard, Schindler, & Stahlberg, 2014), the right state of mind seemed to facilitate this task (see also Gollwitzer, 1990; Kluger & DeNisi, 1996; Krenn, Würth, & Hergovich, 2013). Specifically, the implemental mindset facilitated the development of a dynamic pattern by which individuals could figure out their optimal risk-taking level. This again supported a higher level of achievement motivation in implemental than in deliberative and control participants, as McClelland et al. (1953) and Heckhausen (1991) observed that searching for the optimal level of risk – a balance between difficulty and feasibility – is the main indicator of high achievement motivation. Meanwhile, deliberative mindset participants preferred to continue on the risk level set in the beginning of the game, despite good feedback.
Interestingly, both mindset conditions were more likely to stay at the same risk-taking level after a hit than the control group. The win-stay strategy is consistent with a deliberative mindset in which risks are avoided (Puca, 2001; Hügelschäfer & Achtziger, 2014). In the implemental mindset, it could be interpreted as part of a learning process. Testing one's abilities could include repetitive actions, to confirm that success did not depend on luck. This also refers back to McClelland et al. (1953) who discussed the issue of certainty in relation to achievement motivation. Only if success and failure are not certain, the chosen risk level can provide an achievement-motivated feeling of success. Thus, the win-stay strategy in the implemental mindset could be part of the learning curve to find one's limits. However, there was no equal effect in the opposite direction, indicating that implemental individuals also kept trying after miss. Summing up, this suggested a training effect in the implemental mindset - getting better and increasing risks - with a high sensibility towards negative feedback and quick adjustments.

Profits indicated participants overall performance, reflecting how well participants actually figured out their optimal level of risk taking in the game. Risks had to be high (to earn more money), but still promising (attainable) to make the highest profits. As predicted, the highest profits were recorded for participants in an implemental mindset (20% and 26% more than in the deliberative and control condition, respectively). Thus, the learning curve displayed by implemental participants paid off financially and their strategy was the most successful. This is consistent with high levels of achievement motivation, as Atkinson and Litwin (1960) argued that those individuals preferred calculated risks.
Contrary to the initial hypothesis, however, profits did not differ between the deliberative

and the control condition. It was expected that deliberation would impair participants performance, based on previous research linking the deliberative mindset to lowered expectancies of success and optimism (Taylor & Gollwitzer, 1995; Armor & Taylor, 2003), resulting in lower performance (Armor & Taylor, 2003). While still finding some support for these expectations, such as the overall cautiousness displayed by deliberative participants (constant low level of risk taking), they simultaneously achieved higher hit rates than the control group. This resulted in similar profits in both conditions. Monetary incentives, a new factor in mindset research, might be responsible for this result. Those incentives offered as rewards for task performance might have compensated the negative influence of low expectancies of success and hence augmented deliberating individuals performance to the same level as the control group. This idea is also in line with research arguing that achievement motivation is a result of both, the expectancy to succeed and incentives (Atkinson, 1957; Atkinson & Feather, 1966). Given low expectancies of success in the deliberative mindset, monetary rewards could thus have increased achievement motivation to a sufficient level to support goal attainment at an equal level as in the control condition. This effect of monetary incentives on task performance (compensating lowered expectancies of success) is a novel finding and future research should follow up on this observation. For instance, it could be expected that the impact of monetary incentives also depends on the size of the reward.

While gender did not interact with mindsets, female and male participants behaved differently throughout the game. Females stayed at a constant, moderate level of risk taking, as opposed to males who were more prone to risk taking in general, and particularly so over the last couple of tosses. This higher, and upward-trending risk behavior for males is quite common in economic contexts (e. g., Barber & Odean, 2001). Also, as with mindsets, the upwards trend in risk taking might indicate a learning curve and higher achievement motivation for males. Note that – while not significant – six out of seven participants who did not want to play a non-incentivized additional toss after the game were female. This could be related to the physical nature of the ring toss task. Related to sports, the task might have reinforced gender stereotypes, which would also explain why male participants kept or even increased their risk-taking level after missing the peg. Reinhard et al. (2014) found that risky behavior after negative feedback was driven by stronger ingroup-prototypical behavior in men than in women. Overall, however, while taking higher risks, males did not earn higher profits. In line with gender stereotypes, this display of overconfidence could thus well be a dealing mechanism to protect gender identity.

Finally, the experiment provided some evidence on the durability of mindsets. While no decay of mindset effects was observed, implemental participants seemed to shift from an exploring phase into an action phase at around the sixth toss, (see Figure 7.5). They started to earn more money than in the first phase, and more than deliberating and control participants. It could be speculated that the first part, used to optimize behavior, corresponded a planning phase in the rubicon model of action phases. Endowed with a strategy, participants then entered an action mindset in the second phase, exhibiting a

sudden outburst of performance, which strongly increased task performance and profits, even hinting at a flow experience (Csikszentmihalyi, 1988). The other conditions did not show any comparable dynamics. Ultimately, with no differences in the choice proportions of an additional, non-incentivized toss at the end of the experiment, it is suggested that the mindset effects disappeared as soon as the main task had officially finished.

To sum up, the second experiment provided two novel findings: First, an effort to optimize risk taking was observed in implemental participants, resulting in a dynamic learning curve and ultimately in higher profits than in the other two conditions. Second, the positive effect of monetary incentives on the deliberative mindset seemed to outplay the usually low expectancies of success. Participants overcame this self-impairing hurdle, achieving the same profits as participants in the control group. Overall, these results support the idea of increased levels of achievement motivation in both mindsets, especially in the implemental mindset.

8. General Discussion

8.1. Mindset Effects on Economic Risk Taking

The effect of mindsets on individuals' economic risk taking was examined in two experiments. Specifically, three questions stood in the center of this research: The nature of mindset effects in economic risk taking; their added value to the decision-making process and to outcomes; and the dynamics of mindset effects in repeated measurements of risk taking.

A number of studies would suggest different, and somewhat contradictory mindset effects on individuals' behavior in economic risk-taking tasks. Torn between cognitive and affective dimensions of mindset effects, risk taking could either benefit from rationality-increasing features of the deliberative mindset (e. g., Gollwitzer, 1990), or suffer from increased levels of risk avoidance (e. g., Hügelschäfer & Achtziger, 2014). The opposite could be expected for the implemental mindset. Thus, the nature of mindset effects on risk taking was the first point of interest in this work. The two experiments presented provided some evidence of a primarily affective response to economic risk taking in both mindsets which then seemed to trigger different behavioral strategies.
The first experiment provided eye-tracking data from a repeated lottery task. After a classic mindset induction, prolonged decision times and a higher number of fixations in more difficult tasks was recorded for participants in an implemental mindset, compared to participants in a deliberative mindset. This is an indicator of the perception of a task as a challenge in the implemental mindset, as Frings, Rycroft, Allen, and Fenn (2014) observed that participants had more fixations when playing a lottery framed as a challenge as opposed to a threat. The perception of facing a challenge in the implemental mindset also correlates with other characteristics of the mindset, such as higher self esteem (Taylor & Gollwitzer, 1995) and optimistic performance expectations (Armor & Taylor, 2003). Longer decision times and more fixations depended on the level of difficulty, so this applied specifically to difficult decision tasks. There, the implemental mindset then caused an increase in efforts which is strongly believed to be related to increased levels of achievement motivation (Atkinson, 1957). Yet, the questions remained: what did individuals do in the additional time and with the additional fixations they used to make a decision? The analysis of contents searched and Stewart et al. (2015) suggested that it is more of the same behavior as observed before: Participants use "more of the same type of eye movements for harder choices" (Stewart et al., 2015, p. 13). If participants in an implemental mindset found the choices harder to make because their standards were higher, this would reflect in the exact observed pattern.

Furthermore, Shimojo et al. (2003) found evidence that fixations indicate preferences in choice-scenarios, specifically towards the end of the decision process. In the first experiment, the last fixation tended to be the best predictor for choices in the implemental mindset (overall 76% vs. 72% in the other conditions, and an especially good predictor at easy and medium levels of difficulty). Without over-interpreting this partially significant observation, it could be speculated that participants in an implemental mindset actually were more committed to their choices than participants in the other conditions. Meanwhile, participants in the deliberative mindset did not seem to interpret the task as an opportunity to show off their skills. Their decision process was faster than in the other conditions, yet very close to the control group. Their fast responses might indicate a perception of the task as a threat scenario in these groups, tryring to avoid the task (since all lotteries depicted gain scenarios, results would likely be different in loss scenarios) (Frings et al., 2014). Overall, it is suggested that in both mindsets, an affective response took effect, leading to different categorizations of the task: a challenge in the implemental and a threat in the deliberative mindset.
This idea was supported by findings in the second experiment. Only participants in an implemental mindset displayed a learning curve, starting with low risks, and increasing the risk-taking level over the course of the game. Both, participants in the deliberative and in the control condition remained at their defined standards with very little variation from the beginning until the end of the game, and with deliberation provoking very cautious behavior. Although both mindset groups received similar feedback in terms of hit rates, this only encouraged implemental participants to slowly increase risks. This again supports the hypothesis of increased achievement motivation in the implemental mindset. However, a case can also be made for individuals in a deliberative mindset being achievement motivated, but setting a different focus. As Higgins et al. (2001) argued, depending on the focus, achievement motivation can inflict different strategies. Priming participants in a prevention or promotion focus, they found different strategic orientations, namely a prevention pride and a promotion pride regulating achievement-driven behavior.

> "Promotion pride is oriented toward eagerness means of success whereas prevention pride is oriented toward vigilance means of success. This strategic difference within the motive to succeed has received insufficient attention in the achievement literature." (Higgins et al., 2001, p.21)

Thus, facing the challenge and exhibiting cautiousness can be two sides of the same phenomenon: achievement motivation. This also fits the observation that both mindset conditions were very sensitive to negative feedback, underlining risk aversion in the deliberative mindset, but also high achievement standards in the implemental mindset. It is important to note that – contrary to the control group – participants in the implemental mindset also did not get overconfident. Instead of taking blind risks, implemental participants corrected their behavior in case of overreaching, and effectively figured out the best risk-taking level.
Overall, regarding the question of which kind of mindset effects apply in economic risk taking, findings suggest a dominance of the automatic, emotional responses that then get

filtered through mindsets and initiate different behavioral strategies. While Hügelschäfer and Achtziger (2014) applied a similar dual-process explanation to their findings on anchoring effects, they actually argued that the deliberative mindset tuned individuals to use the slower, cognitive route, and the implemental mindset was linked to the faster, emotional path (Epstein, 1994; Evans, 2008). However, there seems to be a different process involved in economic risk taking. Also, the present findings are based on process data as well as outcomes, which provides an additional, novel perspective. All in all, that data suggested that affective, fast responses dominated in both mindsets, which then had different behavioral consequences for deliberation- and implementation-tuned individuals.

The second question addressed the question whether mindsets were beneficial to the outcomes of economic risk taking. As outlined above, the decision-making process was affected in both experiments, yet only advantageous in the second study. While outcomes were the same in the lottery task, participants in an implemental mindset earned significantly more money than participants in the deliberative and the control condition in the ring toss game.
There are several reasons why the intensified effort and the increase in achievement motivation in the implemental mindset did not pay off in the first task. First, the material used in the experiment prompted choices between rather similar expected values. Thus, even with a lot of effort, it was not easy to figure out the best lottery in 40 tasks. Making the best choice over the whole course of the game was in fact an excessive cognitive demand. As a consequence, a higher willingness to invest efforts was probably not enough to achieve a better result. Second, Glöckner and Herbold (2011) who used the material to examine economic decision strategies, concluded that individuals confronted with the lotteries employed automatic processes rather than deliberative calculations to make a decision. Indeed, examining the role of deliberation and intuition in similar decision processes, Hortsmann, Ahlgrimm, and Glöckner (2009) found that "automatic processes build the basis of every decision and are only supplemented by deliberate processes if necessary" (p.2). Thus, even if implemental participants experienced a desire to achieve higher goals, the mindset-implicit impediment in rational deliberations (e. g., Taylor & Gollwitzer, 1995), as well as the material used, created hurdles that were very difficult to overcome. Overall, the implemental mindset is known to make individuals more susceptible to biases (e. g., Gollwitzer & Kinney, 1989), so despite their increased efforts, they did not profit from the mindset. On the contrary, it seemed that by following their automatic responses, deliberative participants benefitted from their mindset, as they saved time and effort and arrived at the same conclusions.

However, the second experiment provided a more nuanced picture. In the ring toss game, implemental participants actually finished the game with more money in their hands. In this setting, rather than calculating expected values, participants needed to figure out their capabilities and resist excessive risk avoidance as well as misleading overconfidence. Again, the perception of the task as a challenge rather than a threat might have contributed to this outcome. Individuals in an implemental mindset achieved

the balance between restraint and exaggeration best by applying a dynamic risk-taking pattern.
At the same time, outcomes in the deliberative mindset were better than expected. Following up on the idea of increased achievement motivation evoking prevention pride (Higgins et al., 2001), Ayduk, May, Downey, and Higgins (2003) found that

> "(p)revention pride develops from a subjective history of success in preventing negative outcomes through vigilance, leading to a strategic avoidance of errors of commission" (Ayduk et al., 2003, p. 2).

In a game with performance-based monetary payoffs – a game that only rewards success and thus indirectly punishes bad performance – this focus on vigilance would explain the very cautious behavior in the deliberative mindset.
Thus, depending on the context, the implemental mindset can provide an advantage in economic risk taking. However, the deliberative mindset, which emphasized cautiousness and tuned the perception of risk tasks towards threats, did not impair individuals as could have been expected. Indeed, in cognitively demanding tasks, it was even more efficient. Still, allowing participants to set their own risk-standards, the implemental mindset provided a clear and financially measurable advantage.

More than the outcomes, decision-making processes revealed the characteristics of mindsets in economic risk taking. Repeated measurements and varying risk-taking levels were key elements in identifying and interpreting the behavior of individuals in both mindset conditions. Therefore, the importance of mindset dynamics constituted the third key question in the dissertation.
In the first experiment, the level of difficulty in lotteries was a factor determining the impact of mindsets. In the second experiment, temporal dynamics outlined the different strategies used in the ring toss game by the three experimental groups. Neither experiment provided explicit evidence for declining mindset effects over time. However, the performance-curve in the second experiment could initiate speculations about the implemental mindset actually making room for an actional mindset. As risk-taking behavior got bolder and success justified the chosen strategy, it is possible that individuals were no longer influenced by any non-actional thoughts (i.e., the implemental mindset). Unfortunately, very little research has been done on the actional mindset, and there has not yet been an attempt to measure the deliberative and implemental mindset continuously, which could clarify this issue. Interestingly though, EEG (e. g., Schweiger Gallo, Keil, McCulloch, Rockstroh, & Gollwitzer, 2009) and fMRI (e. g., Gilbert, Gollwitzer, Cohen, Oettingen, & Burgess, 2009) data has been used to investigate implementation intentions, finding support for a successful automation of responses in the implemental mindset. Also, in a related field, Schroder, Moran, Donnellan, and Moser (2014) found different activation patterns in EEG measurements when tracking the impact of growth- and fixed-mindsets, relating to the assumptions that intelligence was either a malleable or an immutable condition. Such methods could be adapted to further investigate dynamics in action mindsets, as the present research has demonstrated their importance

in decision-making processes.

On a side note, the role of individual differences should always be considered in mindset research. Historically, in risk-taking research and in relation to achievement motivation, an important factor to consider is gender (McClelland et al., 1953; Alper, 1974). While eye movements did not reveal any gender differences, the second experiment showcased the well-known effect that females were more risk-averse than male individuals, but that overconfidence prevented men from gaining higher profits. While no interaction with mindsets was recorded in this work, Hügelschäfer and Achtziger (2014) found interactions in similar contexts regarding cognitive biases in decision making. Thus, gender should always be considered as a possible moderator or mediator of mindset effects. Furthermore, age and the student status of most participants could be intervening factors, and as previous research has shown, socio-economic differences might also interact with mindset effects (Dennehy et al., 2014). The latter could be particularly relevant in economic risk-taking, especially if the size of monetary rewards varies.

8.2. Limitations

While this work shed light on different aspects of mindset effects on economic risk taking and contributed novel findings to the field, it also contains some limitations to the scope of these findings.
First, a newly developed mindset induction method (bicycle induction) was used in the second experiment. Thoroughly developed, it produced results that were in line with those measured after the classic induction method used in the first experiment. Nonetheless, it remains possible that different mindset inductions could produce mindsets of different strengths. The induction process followed the logic of shortened induction methods used before (e. g., Puca, 2001; Armor & Taylor, 2003; Fujita et al., 2007), which also contained varying degrees of personal involvement (e. g., V. Brandstätter et al., 2015). Still, there is a lack of studies comparing induction methods. Such research could provide information about the strengths of mindsets induced through different processes and further explain the present findings.
Second, results of the eye-tracking experiment are limited by some technological features. Participants were rather conscious of the measurement procedure due to the head-mounted eye tracker. Also, a number of participants had to be excluded before starting the experiment due to device-specific restrictions regarding glasses or hard contact lenses. Thus, the subject pool, already confined to students, was further reduced and rendered less representative. Nonetheless, results indicated a high-quality replication of many results also reported by Glöckner and Herbold (2011), and while technological improvements would benefit future studies, they should not change the overall findings.
Furthermore, out of the wide range of risk-taking tasks, two specific categories were chosen: one that examined mindset effects in a cognitively-challenging setup and another requiring participants to optimize their behavior over time. Further aspects in economic risk-taking include a variety of biases that can distort rational behavior, such as fram-

ing (Kahneman & Tversky, 1979) or the endowment effect (Thaler, 1980). With some differences observed regarding the benefit of either mindset in relation to outcomes in the two experiments presented, generalizations of those findings must be handled with great care. Thus, while it should be expected that the same basic effects of increased achievement motivation (promoting either prevention or promotion pride) are found, the benefit of those strategies could vary.

Finally, performance-based, monetary incentives were only used in the second experiment. This resulted in some of the most interesting findings in both the implemental and deliberative mindset. However, while asking participants to imagine real payoffs is not an uncommon approach, outcomes remain hypothetical and thus more distant (Trope & Liberman, 2010). A replication of the first experiment including financial rewards for good performance could cause results to differ significantly from findings reported by Glöckner and Herbold (2011) and disrupt those very robust choice patterns.

9. Conclusion and Future Prospects

"All that an obstacle does with brave men is, not to frighten them, but to challenge them."
— Woodrow Wilson

To sum up, inducing an implemental or a deliberative mindset had consequences for economic risk-taking behavior. Strong evidence was found, suggesting that emotional rather than cognitive mindset effects dominated in economic risk-taking scenarios. Specifically, both mindsets seemed to increase achievement motivation, yet initiating different behavioral strategies. Higher levels of achievement motivation led implemental individuals to approach risks as challenges and put more effort into the decision-making process, trying to achieve the best possible outcomes. Meanwhile, there is evidence suggesting that deliberative participants perceived risk-taking tasks as threats, possibly endangering their self-concept. This perception reinforced risk-avoiding strategies and emphasized cautiousness in the process of goal pursuit. While higher levels of motivation in the implemental mindset have also been suggested by V. Brandstätter et al. (2015), they were not specified as higher levels of achievement motivation. Moreover, the causal connection between achievement motivation in mindsets and different decision-making strategies is a new discussion in mindset research, in which the deliberative-mindset perspective is particularly intriguing.

The second novel finding presented in this work relates to outcomes. Asking which mindset offered individuals an advantage in economic risk-taking tasks, the results of the studies provoked some recommendations. If effort is a decisive factor, the implemental mindset significantly contributes to better outcomes. In the second experiment, implemental individuals took home more money than any other group. However, if challenges are very difficult on a cognitive level, decision-making is not improved by an implemental state of mind. In fact, implemental participants in the first experiment invested – and seemingly wasted – more time and cognitive resources than participants in a deliberative mindset or the control group. Overall, the implemental mindset did not damage any outcomes, but decision making always required more effort.

Third, mindset effects had a great impact on decision-making processes. Observed through repeated measurements, mindset effects exhibited a formerly unknown dynamic dimension which revealed the different strategies used in the game and thus big parts of the nature of mindsets in economic risk taking. Interacting with the level of difficulty and showing adaptive patterns over time, mindsets influenced individuals very differently over the course of the experiments.

Also, it was shown that monetary incentives provided a valuable addition to mindset research. They improved performance in both mindset conditions, although different strategies prevailed. As external motivational factors, monetary incentives are important features in economic risk-taking research and were successfully introduced to mindset research in the present work, providing some fascinating, new insights.

Future research should continue on the path of this work, examining mindset effects on economic risk taking, and take specifically the following points into consideration.
Conducting more eye-tracking studies would be highly beneficial; this would extend investigations into differences in content searches in risk taking and mindsets. By varying the stimulus materials and using different geometrical setups, the dominance of the positioning of information on the screen (e. g., most fixations on the first quadrant) could be reduced. Also, it would be interesting to examine eye movements when information is not given in numbers, especially chunks of numbers, but in the form of texts or pictures. That way, desirability- and feasibility-related information could be separated more clearly, and additional and task-irrelevant information could also be easily incorporated in the task.
Moreover, regarding mindset inductions and manipulation checks, finding a method to continuingly measure the impact of mindset manipulations would provide very valuable new addition to mindset research. Intensity as well as durability of mindsets could be examined in more detail, and EEG measurements or fMRI studies could be appropriate tools to advance research in that direction.
Also, studies comparing the strength of different induction methods and their limitations (e. g., cultural contexts) would provide interesting and much needed information. Especially if mindset research is conducted online and international samples are included, it is necessary to know more about the applicability of different induction approaches.
Furthermore, research would benefit from the incorporation of more and different sized performance-based rewards into mindset experiments. Since research in this area is still in its early stages, the impact of monetary incentives on mindset effects is still almost unknown. It can be argued that larger incentives would trigger threat-scenarios in all, rather than only deliberative individuals, and that behavior in the implemental mindset would significantly change with bigger monetary rewards. Also, loss-scenarios are likely to evoke different mindset effects than observed in the present experiments. More data is needed to investigate these lines of thought.
Finally, this work only indirectly touched upon the topic of participants' self reports on strategies used during task performance. Including cued memory recall would provide a more comprehensive understanding of participants justifications for their actions. In addition, a combination of process-tracing techniques and self reports would allow further insights into the conscious and unconscious nature of mindset effects.

All in all, the present dissertation provides novel findings on decision-making dynamics in different states of mind. Specifically, mindset-specific consequences of increased levels of achievement motivation and monetary incentives were outlined. This constitutes

a solid groundwork to understand mindset effects in economic risk-taking situations. Further directions for research in this area are proposed. At last, while additional benefits cannot be guaranteed, an implemental mindset is generally recommended to face gain-framed challenges, to at least try to achieve the best possible outcomes.

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A. Appendix Induction Methods

Table A.1.: List of Arguments in the Pretests

Category	Label	M	SD
Con 1	Wearing a helmet is uncomfortable.	2.95	1.40
Con 2	Wearing a helmet makes you sweat.	2.24	1.51
Con 3	Wearing a helmet ruins your hairstyle.	2.95	2.09
Con 4	I look stupid with a helmet.	3.10	2.05
Con 5	Wearing a helmet is a pessimistic take on life.	1.52	0.87
Con 6	A good helmet costs too much.	2.52	1.83
Con 7	A study shows that the relative number of head injuries (number per 100 cyclists) even increased after the introduction of a helmet law.	3.67	1.98
Con 8	A study shows that the number of cyclists decreased after the introduction of a helmet law.	2.81	1.81
Con 9	Cars are involved in 73% of all bicycle accidents. We should look at the causes and not ask additional security measures from the weaker party.	3.10	1.45
Con 10	Wearing a helmet increases risk taking in cyclists and suggests a false feeling of safety. People who responsibly participate in traffic without a helmet take more time to analyze traffic and are more likely to recognize dangers.	2.86	1.71
Con 11	Wearing a helmet can increase the danger of colliding with cars, buses, or trucks. In a study with hidden cameras and distance meters, traffic psychologists found that cars keep less distance (8.5cm on average) from cyclists with helmets than from those without.	3.14	1.59
Pro 1	Wearing a helmet shows responsibility for oneself and others.	4.81	1.75

Table A.1.: (continued)

Category	Label	*M*	*SD*
Pro 2	A study shows that the absolute number of head injuries strongly decreased after the introduction of a helmet law.	5.43	1.25
Pro 3	Helmets significantly reduce the severity of injuries through accidents. Experts think that helmets could help in about 80% of severe head injuries.	6.43	0.68
Pro 4	20% of all bicycle accidents happen without any outside interference thus cyclists should always wear helmets!	5.00	1.61
Pro 5	A study states that helmets can decrease severe head injuries up to 67%.	6.24	0.83
Pro 6	A helmet law would devaluate excuses like helmets look stupid or helmets ruin my hairstyle.	4.10	1.55
Pro 7	Electronic bicycles allow everyone to reach a speed comparable to mopeds on a bicycle, thus cyclists should also have to wear helmets.	5.38	1.32
Pro 8	A helmet law would particularly protect children and adolescents in traffic.	5.86	1.32
Pro 9	A helmet law would increase the supply of affordable, high quality helmets.	5.24	1.26
Pro 10	A helmet law would boost inventions like the airbag-helmet, a helmet that is worn like a scarf around the neck and only inflates in case of an accident. The law would support the development of more alternatives to the traditional, very functional helmet.	5.10	1.14
Pro 11	Often, people don't wear helmets, although they think it would be sensible. A helmet law would reinforce people in their own convictions.	4.43	1.86

Note. Arguments rated on a 7-point scale (1 = *weak argument* to 7 = *strong argument*), $N = 21$.

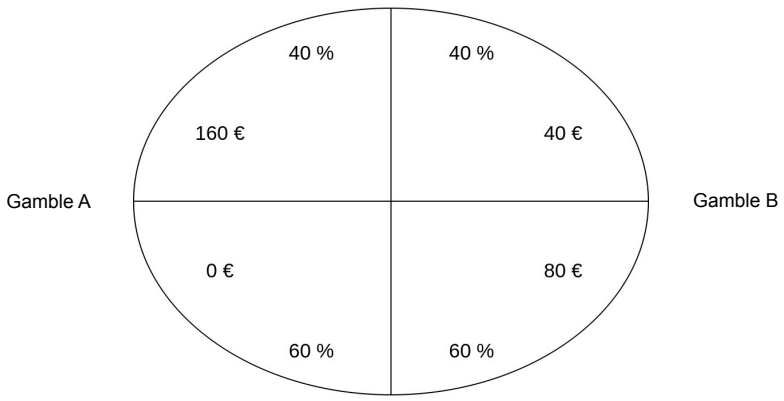
B. Appendix Experiment 1

B.1. Instructions

You are about to see 40 decision tasks on the screen in front of you. They will be presented to you one after the other. In each decision task, you will choose between two gambles and indicate your personal preference for one of them. All winnings are virtual, yet we ask you to think of them as real. Between the trials, you will see your progress on a progress bar.

The gambles will be presented in an ellipse, with Gamble A left to the center and Gamble B right to the center. Every gamble has two possible outcomes (in Euro) that will occur with an indicated probability. It is your task to choose one of the gambles.

Example:



In the example you have the following choice:

Decision for Gamble A (left) You will win 160€ with a probability of 40% or win 0€ with a probability of 60%.

Decision for Gamble B (right) You will win 40€ with a probability of 40% or win 80€ with a probability of 60%

Please decide as fast as possible, but also try to make the best decision. Which gamble do you prefer? Look at the example and let the experimenter know your decision. If

you have any questions, please ask now.

Note: Your participation in this study is voluntary and you can quit the experiment at any time without giving any reason. All data is anonymous and confidential.

B.2. Material

The following table (Table B.1) provides an overview of the content of the stimulus material. Lottery types are arranged according to their level of difficulty. Each level of difficulty consists of eight lotteries and each gamble has two possible outcomes (Out 1 and Out 2).

Table B.1.: Stimulus Material

	Type I				Type II				Type III				Type IV				Type V			
	Gamble A		Gamble B		Gamble A		Gamble B		Gamble A		Gamble B		Gamble A		Gamble B		Gamble A		Gamble B	
Out 1	€ 40	.40	€ 0	.60	€ 55	.90	€ 0	.01	€ 146	.98	€ 67	.85	€ 0	.40	€ 10	.60	€ 50	.60	€ 40	.50
Out 2	€ 80	.60	€ 160	.40	€ 500	.10	€ 100	.99	€ 160	.02	€ 600	.15	€ 160	.60	€ 225	.40	€ 60	.40	€ 69	.50
Out 1	€ 30	.50	€ 0	.30	€ 67	.85	€ 0	.02	€ 83	.98	€ 38	.85	€ 0	.30	€ 5	.50	€ 30	.70	€ 20	.60
Out 2	€ 40	.50	€ 50	.70	€ 600	.15	€ 150	.98	€ 100	.02	€ 340	.15	€ 90	.70	€ 120	.50	€ 40	.30	€ 54	.40
Out 1	€ 10	.45	€ 0	.40	€ 27	.90	€ 0	.01	€ 150	.98	€ 72	.85	€ 0	.40	€ 8	.55	€ 60	.55	€ 76	.40
Out 2	€ 40	.55	€ 44	.60	€ 250	.10	€ 50	.99	€ 200	.02	€ 600	.15	€ 100	.60	€ 125	.45	€ 100	.45	€ 80	.60
Out 1	€ 40	.30	€ 0	.20	€ 217	.92	€ 0	.02	€ 55	.99	€ 28	.80	€ 0	.20	€ 6	.30	€ 40	.25	€ 60	.50
Out 2	€ 100	.70	€ 103	.80	€ 1.800	.08	€ 350	.98	€ 100	.01	€ 165	.20	€ 103	.80	€ 115	.70	€ 80	.75	€ 80	.50
Out 1	€ 40	.50	€ 0	.25	€ 35	.85	€ 0	.02	€ 215	.98	€ 50	.85	€ 0	.25	€ 6	.50	€ 75	.50	€ 50	.35
Out 2	€ 70	.50	€ 73	.75	€ 340	.15	€ 83	.98	€ 230	.02	€ 1.150	.15	€ 90	.75	€ 130	.50	€ 89	.50	€ 100	.65
Out 1	€ 30	.40	€ 0	.30	€ 67	.85	€ 5	.02	€ 300	.99	€ 50	.85	€ 0	.30	€ 4	.60	€ 50	.50	€ 40	.65
Out 2	€ 50	.60	€ 60	.70	€ 600	.15	€ 150	.98	€ 320	.01	€ 1.720	.15	€ 45	.70	€ 72	.40	€ 100	.50	€ 140	.35
Out 1	€ 20	.65	€ 0	.50	€ 28	.90	€ 2	.01	€ 460	.99	€ 60	.80	€ 0	.50	€ 7	.65	€ 30	.70	€ 20	.60
Out 2	€ 70	.35	€ 75	.50	€ 250	.10	€ 50	.99	€ 500	.01	€ 2.060	.20	€ 80	.50	€ 100	.35	€ 40	.30	€ 54	.40
Out 1	€ 45	.60	€ 0	.33	€ 111	.90	€ 0	.02	€ 750	.99	€ 90	.80	€ 0	.33	€ 5	.60	€ 10	.50	€ 5	.60
Out 2	€ 65	.40	€ 80	.67	€ 1.100	.10	€ 215	.98	€ 800	.01	€ 3.390	.20	€ 90	.67	€ 145	.40	€ 33	.50	€ 47	.40

Note. Complete stimulus material used in Experiment 1.

B.3. Replication Data

To compare choice proportions of Gamble A in the initial (Glöckner & Herbold, 2011) and the present study, a back calculation of the material was computed, due to the previously conducted randomization. Note the difference in the denomination of the lottery types according to the original material. Because no numbers relating to choice proportions in the different types were provided in the paper by Glöckner and Herbold, only a visual comparison is possible. This, however, is very compelling and an extremely similar choice pattern can be observed. Error bars indicate .95 confidence intervals.

Figure B.1.: Comparison: Probability of Choice for Gamble A

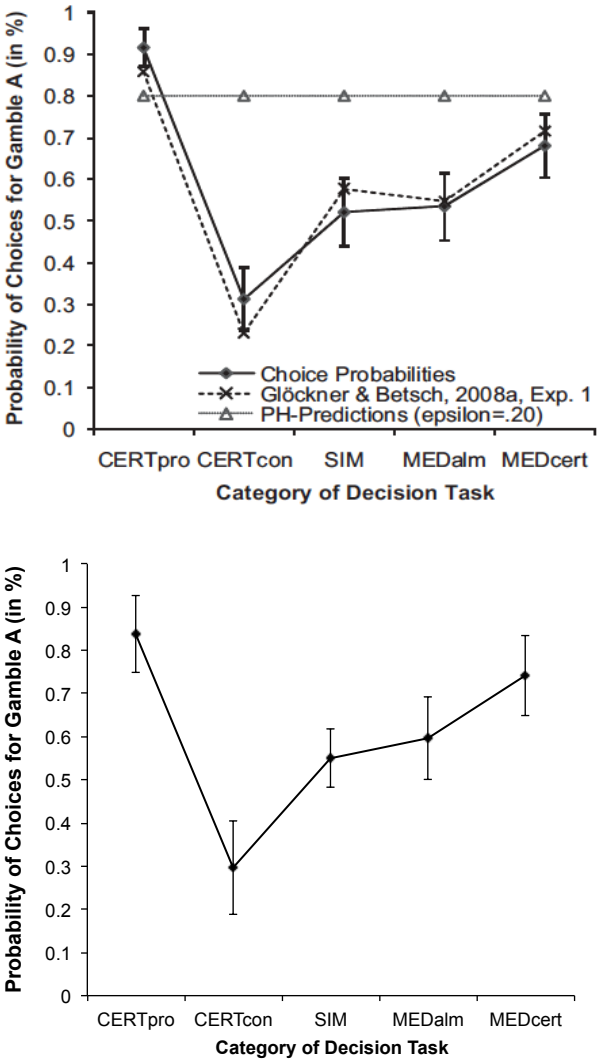


Figure B.1. Above: Probability of choice for Gamble A in the original study by Glöckner and Herbold (2011, p. 82). Below: Probability of choice for Gamble A in Experiment 1.

C. Appendix Experiment 2

C.1. Setup and Instructions

Figure C.1.: Setup Experiment 2

Figure C.1. Experimental setup. Left: Ring and peg. Right: Risk-taking levels.

Verbal instructions:

This is the ring toss game. Your goal is to toss the ring around the peg. You will play 10 rounds and you can choose freely among these 15 lines the distance from where you want to toss the ring. If you hit the peg, you win money. You get 10 Cents for a hit from the first line, 20 Cents for a hit from the second line, and so on, up to 1.50 Euro from the last line. We marked the 5th, 10th, and 15th line, so you have clear indications for your winnings.

C.2. Additional Results

Table C.1.: Risk Frequencies and Probabilities of Success

Risk	Frequency	Probability of Success
1	0%	n/a
2	0%	n/a
3	1%	.75
4	3%	.85
5	25%	.58
6	10%	.43
7	12%	.38
8	10%	.23
9	5%	.17
10	23%	.19
11	1%	.42
12	2%	.06
13	0%	n/a
14	0%	n/a
15	7%	.02

Note. Risk-taking level frequencies and probabilities of success of all tosses.

The probability of success from the 11-foot line (see Table C.1 and Figure C.2) is striking and demands some further explanation. Overall, only a low number of attempts with an improbably high success rate was responsible for this anomaly. Six participants threw a total of eleven times from the 11-foot line. Three participants in the control condition chose this distance (two individuals trying once, one individual trying four times), two participants in the implemental mindset (one trying once, one trying three times), and one participant in the deliberative mindset condition (trying once). Out of the 11 attempts, 5 were successful (3 hits by two participants in the implemental mindset vs. 1 hit in each the control and deliberative mindset). Excluding these participants from the overall analysis did not change the significance of any results.

Figure C.2.: Expected Value per Distance

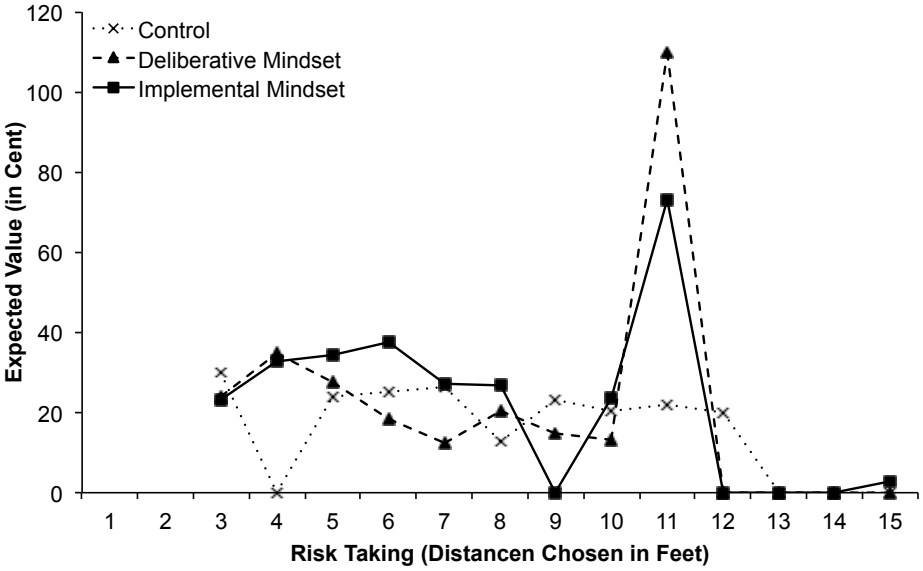


Figure C.2. Expected values at the risk-taking levels by mindset.