Moderators of Automatic and Controlled Processes in Economic Decision Making

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Declaration

I herewith declare that I have compiled the presented paper without any illegal third-party assistance and without the use of any tools other than those mentioned. Any data and concepts from other sources directly or indirectly incorporated are labelled by quoting the source. The paper has never been submitted in identical or similar format to any other examination board either locally or abroad in the past.

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Abstract

According to dual-process models, human behavior is the result of an interaction between automatic processes and controlled processes. Although automatic processes often lead to positive results, they can also lead to severely negative consequences. The current dissertation investigated the effect of self-control depletion, mindsets, framing, and preference for consistency on the usage of automatic processes in decision tasks where heuristics (e.g., reinforcement heuristic) can either conflict or be aligned with Bayesian updating.

In particular, Study 1 hypothesized that when a reinforcement heuristic opposed Bayesian updating, ego-depletion would influence the reliance on automatic processes. Three sub-studies (Studies 1a to 1c) were conducted using different depletion manipulations plus controls. Although the manipulation checks indicated successful ego-depletion induction, only Study 1a found the predicted effect. It seems that the ego depletion effects in complex decision-making tasks are less robust than previously reported in the literature.

Study 2 tested the hypothesis that deliberative versus implemental mindsets would affect participants' use of the reinforcement heuristic differently. In order to examine whether the changes of performance are caused by the deliberative mindset, the implemental mindset, or by both, a neutral mindset condition and a baseline condition were included. Study 2 showed that the neutral mindset manipulation decreased participants' dependence on the reinforcement heuristic. It was argued that the performance enhancement might be caused by a boost in self-efficacy. Differences concerning the effects of the deliberative and the implemental mindsets on decision performance were not observed.

Study 3 aimed to investigate whether the reinforcement heuristic could be experimentally manipulated given its highly automaticity. Study 3 framed the goal of the probability-

updating task differently, thus tested the effect of win/loss framing on individuals' use of the reinforcement heuristic. It was found that a loss frame strengthened the tendency to shift away from an unsuccessful option, if this option was chosen freely before.

Study 4 focused on decision inertia, the tendency to repeat previous choices independently of the outcome, in the context of the Bayesian-updating tasks. Studies 4a and 4b proved the existence of decision inertia as a third process apart from the reinforcement heuristic and Bayesian updating. Additionally, both studies showed that the tendency to rely on decision inertia was positively associated with preference for consistency.

To summarize, although the results regarding ego-depletion effect were not systematic, the present dissertation found the moderating effects of self-efficacy, framing, and preference for consistency on automatic decision processes.

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Chapter 1

General Introduction

Recent work in psychology and economics poses that human decisions do not always result from rational deliberations. Rather, these decisions are argued to be driven by low-level cognitive processes such as heuristics and behavioral rules from a psychological and economics or game theory perspective, respectively (see review by Hastie, 2001). Within the framework of dual-process models, human behavior is understood to be the result of an interaction between two distinct processes: automatic processes corresponding to bounded rationality and controlled processes corresponding to rational considerations. The studies presented in this dissertation investigate possible moderators that influence the usage of both automatic and controlled processes underlying decision behavior by conducting a series of behavioral experiments in a laboratory setting. In particular, the current research examined whether variables such as self-control depletion, mindsets, or framing moderate decision makers' dependence on the "boundedly rational" heuristics or the fully rational strategies in the context of probability updating tasks, where participants are faced with situations where rational reasoning can either conflict with or be aligned with heuristics. Furthermore, the conflict between intuitive heuristics and Bayesian rationality was addressed in the belief updating tasks.

The present chapter is structured as follows. Firstly, Bayesian updating and a reinforcement heuristic on which the present research mainly focuses will be introduced, as an illustration of controlled and automatic processes in decision making. The second part will discuss possible variables that affect automatic or controlled decisions. After that, a probability updating paradigm which the current dissertation adopts will be elaborated.

1.1 Automatic and Controlled Processes in Judgment and Decision Making

Human decisions are frequently influenced by competing decision rules. On the one hand, fully rational considerations give specific behavioral prescriptions for a specific task. On the other hand, low-level cognitive processes, such as heuristics, prescribe behavioral patterns competing with rational behavior. Human behaviors are considered to be the result of a competition between these different processes, where one can be described as capturing rational strategies, and the other correspond to "boundedly rational" behavioral rules or heuristics.

Theories that explicitly discuss such a competition are the dual-process models (see reviews by Evans, 2008; Weber and Johnson, 2009), which postulate that human decisions are the result of the interplay of two broad types of processes. The first type, commonly called as automatic processes, are assumed to be fast, immediate, effortless, and unconscious. They are involved in intuitive decisions without requiring effort, resources, or conscious control. The second type, commonly known as controlled processes, are considered to be slower, not immediate, heavily demanding cognitive resources, and partly conscious. The controlled processes in decision making are often referred to as rationality, or analytical thinking. Regarding the mechamism of how these processes interact, most theories postulate a parallel-competitive structure where several processes influence a decision simultaneously, each of them either conflicting with or cooperating with the other ones (e.g., Epstein, 1994; Sloman, 1996). From this perspective, conflicts between analytical considerations and heuristics are noticed by the decision makers. Reasoning errors occur because the analytical process does not always manage to inhibit the intuitive heuristics in case of conflict (De Neys and Glumicic, 2008; De Neys et al., 2008). A different class of theories assume a default-interventionist account where automatic and controlled processes interact in a sequential way. Automatic processes operate by default and, more controlled processes intervene at a later stage only if decision makers detect the need to override the automatic responses (e.g., Evans, 2011; Glöckner et al., 2008). Then, if the impulse created by the automatic processes is detected to be wrong, the controlled processes deliberatively correct that response tendecy. According to this view, reasoning errors occur because the controlled processes sometimes are ineffective in conflict detection.

Although automatic processes do not always conflict with controlled processes and often lead to positive results or even outperform rational strategies (e.g., Glöckner and Betsch, 2008; Klein, 1993), they can also lead to severely negative consequences and systematic errors (Gilovich et al., 2002). For instance, when a reinforcement heuristic conflicts with Bayesian updating, decisions based on the heuristic lead to systematic errors (Charness and Levin, 2005). Furthermore, because automatic processes are characterized by being fast and unconscious, automatic decisions are difficult to manipulate. The present research aims to investigate variables that affect the use of controlled vs. automatic processes in decision making under uncertainty.

1.1.1 Bayesian Updating

Decision making under uncertainty or risk requires the integration of different pieces of information on the possible outcomes in order to obtain appropriate probability judgments (beliefs). From a normative point of view, the correct combination of previous (prior) beliefs on the probability of an uncertain event and additional information is described by Bayes' rule (Bayes and Price, 1763). Given this rule, posterior probabilities can be stated as:

$$P(A|B) = \frac{P(B|A)P(A)}{P(B|A)P(A) + P(B|\neg A)P(\neg A)} \tag{1.1}$$

where A represents the event for which the decision makers want to compute the probability, and B stands for a new piece of information. $P(A)$ denotes the prior probability that event A occurs. $P(A|B)$ is the posterior probability of event A after receiving the new piece of information, B. $\neg A$ is the negation of event A. $P(B|A)$ and $P(B|\neg A)$ are two conditional probabilities indicating how likely the information B is depending on whether event A is true or false.

However, experimental evidence suggests that human decision makers often deviate from the Bayesian updating model, as reflected in the conservatism heuristic (Edwards, 1968), the representativeness heuristic (Grether, 1980; Kahneman and Tversky, 1972; Tversky and Kahneman, 1971), or the conjunction fallacy (Zizzo et al., 2000). Systematic failures in decisions involving Bayesian updating are frequently observed. Some studies have tried to analyse and interpret the failures of Bayesian rationality. For example, Ouwersloot et al. (1998) examined decision makers' performance in a Bayesian updating task where participants were asked to estimate a posterior of a quantity with an unknown value, with a given prior distribution (i.e., mean) of the unknown value together with messages regarding the unknown value. They found that participants deviated significantly from Bayesian updating and that the deviations were affected by the precision, reliability, relevance, and timeliness of the messages. Zizzo et al. (2000) also showed that participants violated the Bayes' rule. However, the participants did not perform randomly with "zero rationality". In fact the participants' performance could be improved by simplifying the decision tasks (i.e., providing hints to solve the tasks). As a result, Zizzo et al. (2000) suggested a bounded rationality assumption to interpret the deviations from rationality. This view was supported by Charness and Levin (2005) who observed the same failure of Bayesian rationality in a task where optimal decisions require Bayesian updating of beliefs. In this task, an intuitive reinforcement-based heuristic, which depends on the outcomes of previous decisions, could either conflict with or align with Bayesian updating. Participants made frequent errors when reinforcement conflicted with Bayesian updating. Interestingly, the error rates were significantly reduced when these two processes aligned. It seems that, building on the analogy of dual-process models, both the more controlled Bayesian updating and the more intuitive reinforcement heuristic play a role in the decision process. Indeed, the participants' decision performance is strongly influenced by the interaction of these two processes. The present dissertation will focus on the interaction between intuitive reinforcement and Bayesian updating in decision processes.

1.1.2 Reinforcement Heuristic

Charness and Levin (2005) introduced the reinforcement heuristic as a decision rule where decisions which led to success in the past are repeated, and decisions that led to failure are avoided. This simple "win-stay, lose-shift" principle corresponds to Thorndike's (1911) Law of Effect, which states that actions that produce satisfaction are more likely to occur again in the future, whereas actions that generate negative outcomes are less likely to reoccur.

This reinforcement heuristic, which might be an effective shortcut in simple settings, can conflict with the normative rule (i.e., prescribe a different response than Bayesian updating) in more complex settings, however. Previous studies (Achtziger and Alós-Ferrer, 2014; Charness and Levin, 2005) showed that, under such a conflict, individuals frequently rely on the faulty heuristic, neglecting information on underlying uncertain events, and hence committing many decision errors. Research on response times (Achtziger and Alós-Ferrer, 2014) has shown that the reinforcement errors are made faster than correct responses, providing evidence for the automaticity of reinforcement. This automaticity is also in line with psychophysiological evidence suggesting that reinforcement processes are related to extremely fast and unconscious brain responses (Holroyd and Coles, 2002). More specifically, a recent EEG study (Achtziger et al., 2015a) found that the reinforcement process is evident in the feedback-related negativity, an event-related component of the EEG, already 250 ms after win/lose feedback is presented. This implies that the reinforcement heuristic corresponds to a very quick, highly automatic process which requires early conflict detection and process inhibition in order to be stopped.

Through the analysis of response times, Achtziger and Alós-Ferrer (2014) found that when Bayesian rationality opposed reinforcement heuristic, the erroneous fast decisions were significantly more frequent than the erroneous slow decisions. When both processes were aligned, the opposite pattern was shown, consistent with the assumption that more controlled Bayesian updating interacts with the more automatic reinforcement heuristic. Considering the characteristics of being fast and unconscious, is it possible to control the automatic processes in decision making? This dissertation will investigate whether variables, such as self-control depletion, deliberative vs. implemental mindsets, as well as framing can change decision makers' use of intuitive heuristics and biases in situations in which they are detrimental to decision performance. Furthermore, this dissertation will explore whether a third process, decision intertia, exists in the context of Bayesian updating. In addition, possbile moderators on decision interia will be investigated.

1.2 Moderators of Automatic vs. Controlled Processes in Decision Making

Decision makers' reliance on automatic or controlled processes can be influenced by situational factors. Decision makers for instance, tend to rely on a more controlled process when given unlimited time, whereas they are more likely to depend on an automatic process if under time pressure (Ariely and Zakay, 2001; Friese et al., 2006; Goodie and Crooks, 2004). Similarly, individuals are more susceptible to intuitive reasoning when they are depleted of self-control resources (Masicampo and Baumeister, 2008; Pohl et al., 2013), under cognitive load (Friese et al., 2008; Gibson, 2008), or in a positive mood (De Vries et al., 2008; Ruder and Bless, 2003). Information processing style has been found to play a role in the reliance on non-deliberation processes as well. For example, Hügelschäfer and Achtziger (2014) showed that decision makers with an induced implemental mindset are more likely to be influenced by decision biases. Additionally, since reinforcement heuristic is the focus of this dissertation, factors that might influence reinforcement learning or the use of reinforcement-based heuristic will be considered. For simple reinforcement learning paradigms, there is some evidence that loss frames are more motivating than gain frames (Niznikiewicz and Delgado, 2011), indicating that loss versus gain frames might distinctly affect the use of a reinforcement heuristic.

Moreover, the dependence on automatic or controlled processes in decision making can be affected by individual differences, which might lead to stable preferences for a certain decision strategy. Epstein et al. (1996) found individual differences concerning the engagement in one's own intuition (faith in intuition) versus the engagement in cognitive activity (need for cognition). Therefore, individuals who rely on their intuition might be more likely to adopt heuristics in decision processes. Through using the Faith in Intuition Scale (Epstein et al., 1996), Alós-Ferrer and Hügelschäfer (2012) measured participants' reliance on intuitive decision making, and showed that more intuitive participants relied more frequent on heuristics.

In addition to the effects of situational factors and individual differences on non-deliberative processes, studies have examined some methods to reduce heuristics or to debias. For example, interventions like providing hints for decision tasks (Zizzo et al., 2000), training on statistics (Fong et al., 1986) or on heuristics and biases (Mumma and Wilson, 1995), providing justification of decisions (Simon et al., 2004) have been shown to affect the use of heuristics in decision making. However, research testing these methods yielded inconsistent results. For instance, training on statistics mostly failed to show an effect (Kahneman and Tversky, 1973; Ouwersloot et al., 1998), although in some studies the training interventions were successful (e.g., Fong et al., 1986).

Given the above inconsistent evidence of these methods, further research is needed to identify methods of altering the reliance on automatic or intuitive decision strategies in situations where they are detrimental to decision performance. The current dissertation will focus on the effects of self-control depletion, deliberative and implemental mindsets, and framing on decision makers' reliance on reinforcement heuristic versus Bayesian rationality, and will further explore whether another decision heuristic, decision inertia, plays a role in intuitive decision making. Moreover, certain variables which might moderate the use of decision inertia will be investigated.

1.3 Bayesian Updating Task

The present studies used a two-draw decision paradigm where the rational strategy to derive optimal decisions corresponds to Bayesian updating (Achtziger and Alós-Ferrer, 2014; Charness and Levin, 2005). There are two urns, the Left Urn and the Right Urn, each containing 6 balls, which can be black or white. The urns are presented on computer screen, with masked colors for the balls. Participants are asked to choose which urn a ball should be extracted from (with replacement) by pressing one of two keys on the keyboard, and are paid for drawing balls of a predefined color, say black (the winning ball color is counterbalanced across participants). After observing the result of the first draw, participants are asked to choose an urn a second time, a ball is again randomly extracted, and they are paid again if the newly extracted ball is of the appropriate color. The payment per winning ball in our implementation was 18 Euro cents.

The urn composition (i.e., number of black and white balls) in the present study is given in Table 1.1. As shown in the table, in the Up state, there are six black balls in the Right Urn, and four black balls and two white balls in the Left Urn. On the other hand, in the Down state, six white balls are in the Right urn, and 2 black balls and 4 white balls in the left urn. The essence of the design is that the composition varies according to the "state of the world", Up or Down, which is not revealed to participants. However, participants are informed that the prior probability of each state is 1/2. The state of the world is constant within the two-draw decision, but is randomized according to the prior for each new round. This means that the first draw is uninformed, but by observing the first ball's color the decision maker can update his or her beliefs on the most likely state of the world. Thus for a second draw, an optimizer should choose the urn with the highest expected payoff, given the posterior probability of the state of the world updated through Bayes' rule.

Given the urn composition, choosing the Right Urn in the first draw reveals the state of the world and the decision for the second draw is straightforward. Note that after a first draw from Right, optimizing behavior is fully aligned with behavior prescribed by an intuitive reinforcement rule (win-stay, lose-shift). Those situations correspond to an alignment of decision processes. In contrast, choosing the Left Urn in the first draw leads to a different situation. Given the posterior probability updated through Bayes' rule, it is easy to see that Bayesian updating prescribes to stay after a loss and to switch after a win (win-shift, lose-stay), which is opposed to the prescriptions of reinforcement. That is, those situations correspond to a conflict among decision processes. For example, if a black ball is extracted from the Left Urn, the updated probability of being in the state "up" is $(1/2)(4/6)/((1/2)(4/6)+(1/2)(2/6)) = 2/3$, hence choosing the Left Urn again delivers an expected payoff of $(2/3)(4/6)+(1/3)(2/6)=5/9$, while switching to the Right Urn delivers a higher expected payoff of $(2/3)(1)+(1/3)(0)=2/3$.

Table 1.1 Studies 1-3, 4b. Urn composition in the Bayesian updating task

State (Prob)	Left Urn	Right Urn
Up (1/2)	● ● ● ● ○ ○	● ● ● ● ● ●
Down (1/2)	● ● ○ ○ ○ ○	○ ○ ○ ○ ○ ○

Participants repeated the two-draw decision 60 times. Following Charness and Levin (2005) and Achtziger and Alós-Ferrer (2014), the current dissertation studies included both forced first draws (where the choice is dictated to the participant) and free first draws. To avoid confounding forced choices and learning effects, participants made forced draws and free draws alternately.

In this paradigm, Charness and Levin (2005) observed that participants often follow the reinforcement heuristic, resulting in a high rate of errors after starting with the Left Urn. Furthermore, Achtziger and Alós-Ferrer (2014) has proven the automaticity of reinforcement in the same paradigm. Following these studies, the current dissertation studies adopt this Bayesian updating paradigm to investigate possible moderating effects on the reinforcement heuristic vs. Bayesian updating. Studies 1 to 3 focus on the moderating effects of ego-depletion, mindsets, and framing, respectively. Study 4 explores whether a third decision process, decision inertia, exists in this paradigm apart from the reinforcement and Bayesian rationality, and whether certain variable, such as preference for consistency, moderates that process.

Chapter 2

Experimental Studies

The experimental studies presented in Chapter 2 consist of 4 studies on different research topics. Studies 1 to 3 investigated whether ego-depletion, mindsets, and framing play a role in the dependence on a reinforcement heuristic. Study 4 focused on a third decision process, decision inertia. All these studies were conducted at Cologne Laboratory for Experimental Research (CLER) using z-Tree (Fischbacher, 2007). Participants were recruited via ORSEE (Greiner, 2004) among the student population of the University of Cologne, and no participant took part in more than one study. In total 477 participants participated in the dissertation studies.

2.1 Study 1: Ego-Depletion and Bayesian Updating

2.1.1 Overview

The limited-resource model of self-control is based on an enticingly simple assumption. Self-control is viewed as a limited resource which enables individuals to inhibit unwanted responses. After an initial exertion of self-control, any subsequent self-control performance is impaired. According to the model, in the resulting state of depleted regulatory resources, individuals tend to rely on their automatic inclinations and act more impulsively than under normal circumstances (Baumeister et al., 1998; Muraven and Baumeister, 2000). This is known as the ego-depletion effect. The purpose of Study 1 is to investigate the relevance of this effect for decision making, especially for intuitive reasoning.

Support for the limited-resource model includes numerous studies relying on a sequential task paradigm involving two consecutive tasks. In the first task, the manipulation, self-control resources are depleted. For example, participants might be instructed to inhibit automatic, habitual responses, e.g. resisting impulses and temptations (Baumeister et al., 2007). In the second task, subsequent attempts at self-control are measured. Hence, participants in an ego-depletion condition work on two consecutive difficult tasks requiring self-control. For participants in the control condition, the first task is replaced by a less-depleting version, that is, an easy task requiring little or no self-control. Hagger et al. (2010) carried out a meta-analysis of 83 studies following this structure and reported a medium effect size of the ego-depletion manipulations.

The limited-resource model of self-control, however, has been recently challenged. Although the ego-depletion effect has been and still is frequently replicated, a rapidly-growing number of studies show that the effects of depletion on self-control might be more complex than initially assumed. First, the nature of the resource at the basis of the model is unclear. Some studies pointed out that consumption of glucose serves to replenish depleted self-control resources (Gailliot and Baumeister, 2007; Gailliot et al., 2007; Vohs et al., 2008), leading to the hypothesis that brain blood glucose might be the actual self-control resource being exhausted. Later studies, however, have shown that a placebo is equally effective (Molden et al., 2012; Sanders et al., 2012). Second, a number of motivational factors have been shown to counteract ego-depletion, buffer its effects, or replenish the self-control resource. Those include positive mood induction (Tice et al., 2007), explicit feedback on task performance (Wan and Sternthal, 2008), motivational incentives (Muraven et al., 2006; Muraven and Slessareva, 2003), the belief that willpower is unlimited (Job et al., 2010), personal prayer (Friese and Wänke, 2014), and feelings of autonomy support (Muraven, 2008). Integrating these insights, Inzlicht and Schmeichel (2012) recently proposed the process model of ego depletion and argued that subsequent self-control failure is caused by shifts in motivation and attention instead of limited resources.

Most of the evidence for the ego-depletion effect comes from the sequential task paradigm described above. Generally, both of the involved tasks are simple and belong to different domains, that is, they involve different control processes. For instance, the manipulation task might consist of incongruent trials of a Stroop task, while the second task refers to the moral domain. A further challenge to the limited-resource model has been posed by studies relying on a variant of this basic paradigm. Specifically, it has been shown that when the two tasks require similar control processes, the previous use of self-control can even enhance the subsequent self-control performance (Dewitte et al., 2009). Furthermore, when the first self-control task is performed long enough for individuals to adapt to it, the subsequent self-control performance is again not impaired. Ego-depletion effects were only observed when the initial task was performed for a short time (Dang et al., 2013). The fact that such small changes to the basic paradigm can yield outcomes that are inconsistent with the classic ego-depletion phenomenon represents a serious challenge for the limited resource model.

In addition, other researchers are now questioning the magnitude of the ego-depletion effect. Carter and McCullough (2013) suggest that the effect size of ego depletion might have been overestimated due to publication bias, and the actual effect size might be small or even zero. These authors showed that many tests of the ego-depletion effect were underpowered, indicating that the likelihood of finding such a large number of significant effects in the literature is low (see, however, Hagger and Chatzisarantis, 2014).

The Present Research

Given the current state of the literature, the present study aimed to investigate whether the ego-depletion effect is relevant for judgment and decision making. According to the literature, ego depletion has an effect on behavior requiring cognitive control, including decision making. For instance, it has been shown that participants' logical thinking was diminished under ego-depletion (Schmeichel et al., 2003), that depleted consumers were more vulnerable to affective product features (Bruyneel et al., 2006), and that depleted decision makers were more likely to rely on heuristics (Masicampo and Baumeister, 2008; Pohl et al., 2013). These results are consistent with the assumption that ego-depletion selectively strengthens behavior resulting from automatic processes (Hofmann et al., 2009; Vohs, 2006). Thus the current study hypothesized that ego-depleted individuals would be less likely to make rational decisions when a simple, highly automatic heuristic was available.

The decision-making paradigm taken from the economics literature (Achtziger and Alós-Ferrer, 2014; Charness and Levin, 2005) was used to measure (self-control) performance. All the experimental settings of the decision task used in the present research were exactly the same as described in Chapter 1 (see Chapter 1.3). In contrast, this study varied the first, depleting task used to manipulate self-control resources. The reason was twofold. On the one hand, the current study wanted to make sure that the effects of ego depletion were robust, and not dependent of the particular manipulation. On the other hand, it was possible for this study to compare the effects across manipulation tasks.

As presented in Chapter 1, the task of interest was a Bayesian updating task in which decision makers are repeatedly confronted with situations where rational reasoning (i.e., Bayesian updating) might conflict with a heuristic based on automatic reinforcement learning. This task is perfect for testing ego depletion effect, since the heuristic process was clearly identified and is known to have an automatic (impulsive) character. Following the literature, this study hypothesized that ego depletion would lead to more errors in situations where the reinforcement heuristic conflicts with Bayesian updating (after a first draw from Left). As ego depletion can result in a loss of self-control capacity, this study assumed that this would make it difficult for participants to suppress the highly automatic reinforcement process and follow the normative rule instead. The present study did not expect detrimental effects of ego-depletion on error rates in case of alignment of the two decision rules (after a first draw from Right) because in this case, the automatic process points to the optimal solution and error rates are generally very low. To test the robustness of ego-depletion effects, this study adopted three different ego-depletion manipulation tasks that have been used in previous research.

2.1.2 Experimental studies (Studies 1a – 1c)

The current study conducted three sub-studies with different ego-depletion manipulations. A session lasted about 1.5 hours. In exchange for participation, participants received a payment based on the outcomes of their decisions in the Bayesian updating task plus a show-up fee of 7.5 Euros. In total 189 participants participated in the three studies.

Studies 1a – 1c followed the same procedure, implementing the ego-depletion manipulation prior to the decision task (always accompanied by a control condition). Before the start of the experiment, participants read through the instructions of the decision task (see Appendix A.2) and answered several control questions (see Appendix A.3) to ensure they understood the rules of the decision task properly. Then they proceeded with the manipulation task (depletion vs. control). Subsequently, participants answered a manipulation check item regarding how exhausting they had perceived conducting the manipulation task. Then participants continued with the decision task, which lasted around 10 minutes. Afterwards, participants filled in questionnaires.

All sub-studies used the same decision task (see Achtziger and Alós-Ferrer, 2014; Charness and Levin, 2005) and questionnaires including the State Self-Control Capacity Scale (Ciarocco et al., 2007), a mood scale consisting of 8 adjectives (Taylor and Gollwitzer, 1995), the Trait Self-Control Scale (Tangney et al., 2004), and demographic questions, including two items on self-evaluated knowledge in statistic/stochastics (see Appendix A.4).

Study 1a

To induce ego-depletion, Study 1a followed Sripada et al.'s (2014) modified version of the letter-*e* task of Baumeister et al. (1998). The original paper-and-pencil version of this task is considered one of the most effective depletion-induction tasks (Hagger et al., 2010) and has been used in many studies, e.g. Achtziger et al. (2015b). The computerized version has been proven to manipulate ego-depletion successfully as well (Sripada et al., 2014).

Methods

Manipulation task. The task was implemented as in Sripada et al. (2014). Words are shown on the computer screen. Participants in the control condition are asked to press a key whenever a word with the letter *e* is shown, and to withhold the response when the word does not contain an *e*. Participants in the ego-depletion condition are additionally instructed to inhibit the response if the *e* is followed by another vowel, or if it is one extra letter away from another vowel in either direction. For instance, participants in this condition should respond to the German word "*alles*", but they should withhold the response to "*breit*". Participants in the control condition should respond to both words. 100 emotionally neutral German words were pre-selected for this study. During the task, word stimuli randomly appeared on the screen and participants had 3 s to respond. The next trial started immediately after the 3 s response period was over. The task consisted of 100 trials and lasted exactly 5 mins.

Procedural details. 64 participants were randomly assigned to two experimental conditions (ego-depletion vs. control) and two counterbalance conditions (winning ball color). One participant was excluded from data analysis due to failure to properly understand the instructions (For Studies 1a – 1c, results remain qualitatively unchanged when no participants are excluded). Following the criteria of Sripada et al. (2014), two further participants were excluded because their error rates in the *e* task were larger than or equal to 20% (both values were also larger than or equal to the upper adjacent value). Thus 61 participants (35 female, age range $18-39$, $M = 23.89$, *SD* 3.57) were considered for data analysis, 29 in the ego-depletion condition and 32 in the control condition.

Participants first read the instructions for the decision task, and then answered the corresponding control questions. After that, they proceeded with the letter-*e* task. After completion, participants answered a manipulation check item regarding how exhausting they had perceived conducting the letter-*e* task. Then they continued with the decision task and finally filled in the questionnaires. Average earnings in Study 1a were 19.51 Euros (*SD* 0.71) including the show-up fee.

Results

Manipulation checks. The letter-*e* task was more difficult for participants in the ego-depletion condition than in the control condition. This can be seen in the error rates (including false alarms and misses), which were significantly higher in the ego-depletion condition (M 7.17%, Mdn 6.00%, *SD* 3.96%) than in the control condition (M 0.56%, Mdn 0%, *SD*

0.72%), $z = 6.36$, $p = .000$ (two-tailed Rank-Sum test). Similarly, response times for correct responses were significantly longer in the ego-depletion condition (*M* 1642 ms, *Mdn* 1631 ms, *SD* 239 ms) than in the control condition (*M* 661 ms, *Mdn* 650 ms, *SD* 72 ms), $z = 6.70$, $p = .000$ (two-tailed Rank-Sum test). Further, the answers to the manipulation-check item showed that participants in the ego-depletion condition (*M* 4.09, *SD* 2.34) evaluated the task as more exhausting than participants in the control condition (*M* 2.65, *SD* 2.67), $t(59) = 2.24$, $p = .029$. No differences were found in mood, trait self-control, and self-evaluations of knowledge in statistics among the two groups, with *p*-values above .206.

Error rates. To compare error rates between the ego-depletion condition and the control condition, Study 1a relies on non-parametric, two-tailed Rank-Sum tests. Average error rates are presented in Figure 2.1. As expected for the case of conflict, errors in the ego-depletion condition ($N = 29$, *M* 45.88%, *Mdn* 46.67%, *SD* 32.33%) were significantly more frequent than in the control condition ($N = 32$, *M* 29.22%, *Mdn* 26.60%, *SD* 25.28%) (two-tailed Rank-Sum test: $z = 2.01$, $p = .045$).

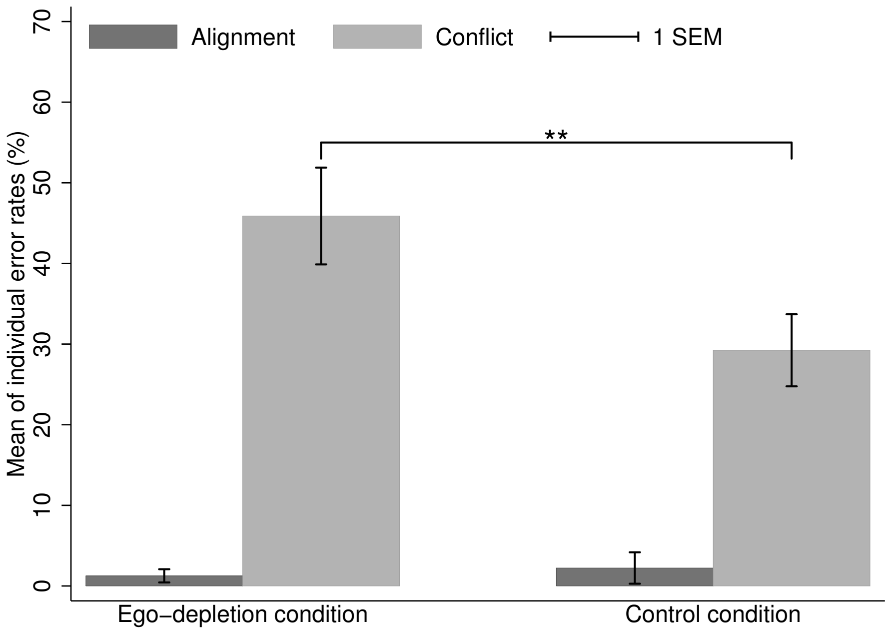

Fig. 2.1 Study 1a. Means of the individual average error rates in case of alignment and conflict.

*Note: * p <.10, ** p <.05, *** p <.01*

In case of alignment, there were no significant differences of the error rates between the ego-depletion condition ($N = 29$, M 1.26%, Mdn 0%, SD 4.42%) and the control condition ($N = 32$, M 2.23%, Mdn 0%, SD 11.02%) (two-tailed Rank-Sum test: $z = 0.25$, $p = .805$).

Discussion

The results of Study 1a showed that in case of conflict between reinforcement and Bayesian updating, errors were more frequent under ego-depletion compared to a control condition. This is consistent with the interpretation of reinforcement as an automatic process which needs to be inhibited (Achtziger and Alós-Ferrer, 2014). The results of several manipulation checks indicate that ego-depletion was induced successfully. Since there were no differences in mood, trait self-control, and proficiency in statistics among the two conditions, Study 1a can exclude possible impacts of these variables on the observed results.

The current study found that the manipulation had no effects on error rates in case of alignment between reinforcement and Bayesian updating. This result is not surprising because error rates are extremely low, hence accuracy will typically show ceiling effects.

Study 1b

Study 1b was conceptually identical to Study 1a. The only difference was that a different task was used to manipulate self-control resources. The present study chose the Stroop task (Stroop, 1935), which has been frequently used in the past to induce ego-depletion (Hagger et al., 2010; Mead et al., 2009).

Methods

Manipulation task. In the implementation of the task, in each trial a German word denoting *red*, *blue*, *green*, or *yellow* in one of the four font colors was shown on the screen. Participants were asked to indicate the font color of the word as quickly as possible by mouse-clicking the appropriate button on the screen (buttons were labeled with the color names). A very similar implementation of the Stroop task was used in a study by Linnman et al. (2006).

Participants in the ego-depletion condition encountered only incongruent trials, in which the semantic meaning of a word does not match its font color (e.g., *green* written in blue color).

To give the correct response, these participants had to inhibit the meaning of the word which is automatically identified when looking at the word. Participants in the control condition encountered only congruent trials, in which the semantic meaning of a word matches the font color. A word stimulus was shown on the screen until participants responded, with a response time limit of 2.5 s. There was a fixed intertrial interval of 1.5 s. The task went on for 60 trials or 3 mins, whichever came first. This implementation ensured that all participants finished the task at around the same time and prevented fast participants from having to wait for slower people in the session, which might have caused ego-depletion effects to vanish before the main task.

Procedural details. 64 participants were randomly assigned to two experimental conditions (ego-depletion vs. control) and two counterbalance conditions (winning ball color). One participant had to be excluded from data analysis because his answers in the final questionnaire revealed a color vision deficiency. Three additional participants were excluded due to high error rates in the Stroop task (over 10%, which was above the upper adjacent value). Hence 60 participants (37 female, age range $18-31$, $M = 23.97$, *SD* 2.85) were included for data analysis, 29 in the ego-depletion condition and 31 in the control condition. The experimental procedure was as in Study 1a, with the addition of a color vision test at the end of experiment. Average earnings were 19.37 Euros (*SD* 0.75) including the show-up fee.

Results

Manipulation checks. The Stroop task was more difficult for participants in the ego-depletion task than for those in the control condition. This could be seen in the response times of correct responses, which were significantly longer in the ego-depletion condition (*M* 1138 ms, *Mdn* 1103 ms, *SD* 150 ms) compared to the control condition (*M* 1039 ms, *Mdn* 1003 ms, *SD* 138 ms), $z = 2.70$, $p = .007$ (two-tailed Rank-Sum test). There were, however, no differences in error rates in this simple task (ego-depletion condition, *M* 2.16%, *Mdn* 1.67%, *SD* 2.50%; control condition, *M* 1.65%, *Mdn* 1.67%, *SD* 1.83%; two-tailed Rank-Sum test, $z = 0.58$, $p = .564$). The differences in perceived difficulty measured through the single-item manipulation check missed significance (ego-depletion condition, *M* 3.74, *SD* 2.75; control, *M* 2.69, *SD* 2.25; $t(58) = 1.64$, $p = .107$). Again, there were no differences regarding mood, trait self-control, and self-evaluations of knowledge in statistics among the two conditions, with p-values above .124.

Error rates. Average error rates are presented in Figure 2.2. In the ego-depletion condition, the average error rate was 39.72% ($N = 29$, *Mdn* 45.45%, *SD* 29.14%); in the control condition, it was 45.56% ($N = 31$, *Mdn* 48.00%, *SD* 25.27%). The difference goes in the opposite direction as the expected one, but is not significant according to a two-tailed Rank-Sum test ($z = -0.65$, $p = .515$).

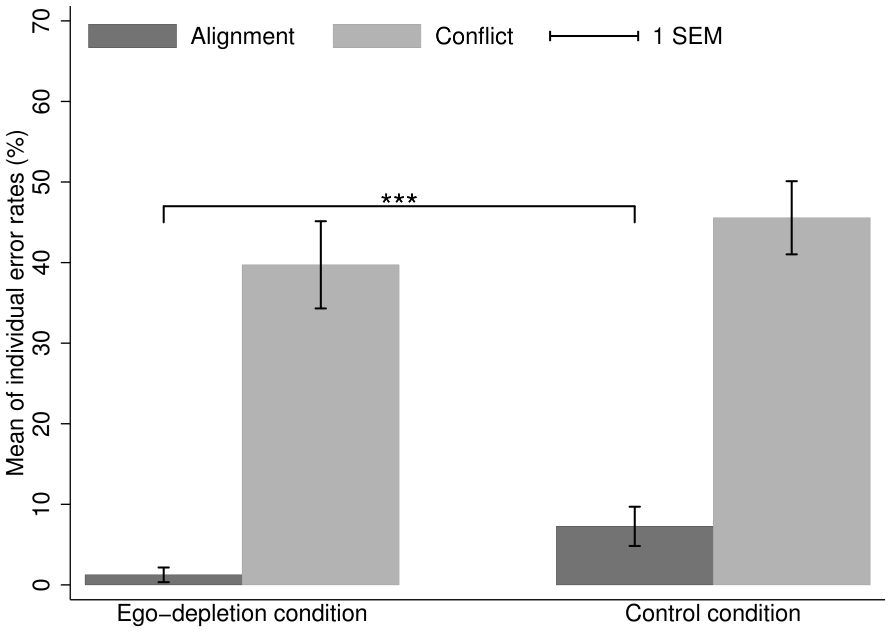

Fig. 2.2 Study 1b. Means of the individual average error rates in case of alignment and conflict

*Note: * p <.10, ** p <.05, *** p <.01*

In case of alignment, there were significantly fewer errors in the ego-depletion condition ($N = 29$, M 1.25%, *Mdn* 0%, *SD* 4.91%) than in the control condition ($N = 31$, M 7.27%, *Mdn* 0%, *SD* 13.56%) (two-tailed Rank-Sum test: $z = -2.69$, $p = .007$).

Discussion

Study 1b adopted the classic Stroop task to deplete participants' self-control resources. The results of manipulation checks, such as longer response times for depleted individuals and higher ratings of exhaustion, implied that working on the incongruent trials was actually more effortful than working on congruent trials. The two conditions did not differ in the percentage of errors in the Stroop task, but this might be due to the low difficulty of the task. As the equivalence of the conditions concerning several control variables could not be rejected, any differences in error rates cannot be explained by differences in mood, trait self-control etc.

In case of conflict, there were no differences in error rates between the ego-depletion condition and the control condition. This is inconsistent both with the results of Study 1a and with the predictions derived from the limited-resource model of self-control. In case of alignment, errors were reduced in the ego-depletion condition, compared to the control condition. Although this study had no experimental hypotheses in this case, this is not difficult to interpret. As argued by Achtziger and Alós-Ferrer (2014), in case of alignment most errors arise from controlled processes rather than from automatic ones. This is because automatic processes are swifter and deviate from the prescribed response (which in this case is correct) less often. Hence, if ego-depletion caused an increased reliance on automatic processes, this might have helped participants in the ego-depletion condition to avoid mistakes by following the automatic tendency.

Study 1c

The study 1c was conceptually identical to Studies 1a and 1b. The only difference was that again a different task was used to manipulate self-control resources. In this case, Study 1c relied on the retyping task first used in Muraven et al. (2006), which has also been successfully used to deplete individuals in Muraven (2008) and DeBono et al. (2011).

Methods

Manipulation task. Participants were instructed to retype a short paragraph shown on the computer screen. This paragraph was part of a physics textbook and consisted of 645 characters, including 100 *e*s and 83 spaces. The paragraph was taken from Achtziger et al.'s (2015b) experimental materials.

In the control condition, participants were asked to retype the paragraph as it appeared on the screen as quickly as possible. Participants in the ego-depletion condition were instructed to retype the paragraph leaving out all letters *e* and all spaces. This requires participants to override their natural tendency to type every letter and separate words by means of spaces. To prevent participants from correcting any typos, the present study blocked the mouse and several keys (e.g., the “backwards” and “delete” keys).

Procedural details. 61 participants were randomly assigned to two experimental conditions (ego-depletion vs. control) and two counterbalance conditions (winning ball color). Two participants were excluded because the analysis of their typing output showed that they used the forbidden keys more than 30 times, which was above the upper adjacent value. Hence 59 participants (26 female, age range $18-45$, $M = 24.00$, *SD* 3.88) were considered for data analysis, 29 in the ego-depletion condition and 30 in the control condition. Average earnings in Study 1c were 19.67 Euros (*SD* 0.74) including the show-up fee.

Results

Manipulation checks. The task in the ego-depletion condition was more taxing than the one in the control. This could be seen in the response times, which showed that depleted participants needed significantly longer (*M* 236.41 s, *Mdn* 219.00 s, *SD* 49.65 s) to retype the paragraph than controls (*M* 157.33 s, *Mdn* 153.5 s, *SD* 40.62 s), $z = 5.43$, $p = .000$. Further, the answers to the manipulation-check item showed that participants in the ego-depletion condition (*M* 6.62, *SD* 2.43) evaluated the task as more exhausting than participants in the control condition (*M* 5.00, *SD* 2.25), $t(57) = 2.66$, $p = .010$. Again, the two conditions did not differ concerning mood, trait self-control, and self-evaluations of statistics knowledge, with *p*-values above .339.

Error rates. Average error rates are presented in Figure 2.3. In the ego-depletion condition, the average error rate was 38.53% ($N = 29$, *Mdn* 46.67%, *SD* 27.66%); in the control condition, it was 40.67% ($N = 30$, *Mdn* 36.11%, *SD* 32.07%). The difference is not significant according to a two-tailed Rank-Sum test ($z = -0.14$, $p = .885$).

In case of alignment, there were no significant differences in errors between the ego-depletion condition ($N = 29$, M 2.61%, Mdn 0%, SD 10.30%) and the control condition ($N = 30$, M3.51%, Mdn 0%, SD 9.26%) (two-tailed Rank-Sum test: $z = -1.46$, $p = .144$).

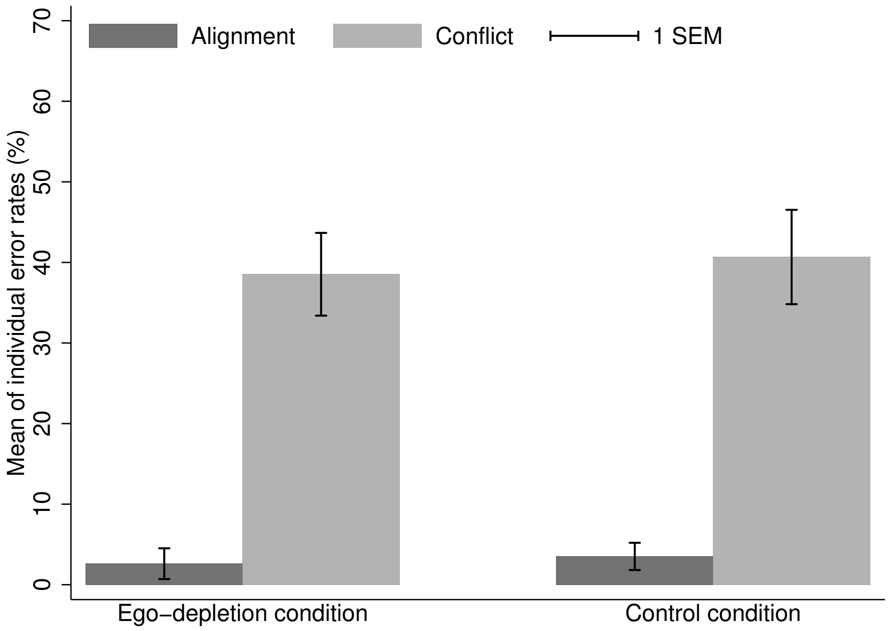

Fig. 2.3 Study 1c. Means of the individual average error rates in case of alignment and conflict

*Note: * p <.10, ** p <.05, *** p <.01*

Discussion

Study 1c adopted a retyping task to manipulate self-control resources. The manipulation checks showed that participants in the ego-depletion condition needed more time to complete the task and evaluated it as more exhausting, indicating a successful ego-depletion induction. Again, results cannot be explained by differences in any of the measured control variables.

Error rates in case of conflict did not differ across ego-depletion and control conditions. This agrees with the results of Study 1b but is not consistent with the predictions derived from the limited-resource model of self-control. In case of alignment, ego-depletion had no influence of the error rates.

2.1.3 Individual Differences

It is natural to speculate whether effects would depend on the effectiveness of the ego-depletion manipulation at the individual level. This would require a reliable state measure of self-control resources. To explore this possibility, in addition to trait self-control measures, the German version of the State Self-Control Capacity Scale was added to each study (Bertrams et al., 2011; Ciarocco et al., 2007). For each of the three studies, the differences on the scores in this scale were tested between the ego-depletion condition and the control condition. No significant differences were found in any of the studies. For Study 1a, the mean values were 6.45 for depleted participants (*SD* 1.61) and 6.47 for controls (*SD* 1.76), $t(59) = -0.04$, $p = .965$. For Study 1b, they were 6.62 (*SD* 2.08) and 6.72 (*SD* 1.94), respectively, $t(58) = -0.19$, $p = .853$. For Study 1c, they were 6.68 (*SD* 1.81) and 6.35 (*SD* 1.93), respectively, $t(57) = 0.67$, $p = .503$.

The limitation of this scale is that, being relatively long (25 questions), measuring it before the task might have given time for the participants to recover from the manipulation. It might also have made the purpose of the experiment too obvious and induced experimenter demand effects. Hence, the scale needed to be measured at the end of the experiment, when ego-depletion effects might already have faded out or participants might have become depleted by the decision-making task itself. Hence, this present study included it in an exploratory way only.

The current study also included a single-item check after the depletion task but before the Bayesian updating task. This item asked for a subjective evaluation of how strenuous the manipulation task had been ($0-10$, with higher values indicating a more strenuous task). Spearman's correlations were computed between error rates and the manipulation check, $N = 180$ (note that a linear correlation would make little sense with error rates).

The correlation between the manipulation check and error rates in case of alignment was not significant, $\rho = -.09$, $p = .235$. The correlation between the manipulation check and error rates in case of conflict was not significant either, $\rho = -.08$, $p = .284$. Correlations with the State Self-Control Capacity Scale were both $\rho < .01$, $p > .906$. This study ran a number of non-linear regressions adding other controls (trait self-control, gender, etc.) and found these observations to be robust.

2.1.4 General Discussion

The present study investigated the effects of ego depletion on decision making under risk. Contrary to the bulk of ego-depletion studies, Study 1 targeted a relatively complex task where optimal behavior involves Bayesian updating of beliefs. The task was taken from the literature and selected because it has been shown that an automatic process based on reinforcement influences decisions. When this process conflicts with Bayesian updating, error rates are very high. When Bayesian updating and reinforcement are aligned, error rates are very low. Within the domain of decision making, this paradigm should be an example of ideal conditions to elicit ego-depletion effects. According to the limited-resource model of self-control, depletion manipulations should lead to an increased reliance on the automatic process (the impulse is inhibited less often), in particular leading to increased error rates in case of conflict.

Study 1 consisted of three studies with classical ego-depletion manipulations. The present research found no systematic tendency towards increased error rates in case of conflict. Only one of the three studies found any differences in this case, implying that the effect is not robust. Hence, the present study cannot draw the general conclusion that ego-depletion has a detrimental effect on Bayesian updating when there is response conflict through a simple reinforcement strategy. This finding is in line with Dickinson and Drummond (2008), who showed that sleep deprivation, which is thought to have effects similar to ego depletion, did not influence performance in a Bayesian updating task.

Study 1 had no hypotheses for errors in case of alignment because error rates in this case are very low and ceiling effects on accuracy were to be expected. However, Study 1b showed that depleted participants exhibited lower error rates compared to the control condition. This has an interpretation in the terms advanced by Achtziger and Alós-Ferrer (2014). Automatic processes are swift and have a higher probability of leading to their favored response (see also Alós-Ferrer, 2015), independently of whether this is an error or a correct response. In case of alignment, the favored prescription of the automatic process is actually correct. Hence, if depletion led to an increased reliance on automatic processes, errors should indeed decrease in case of alignment. If this interpretation is correct, however, it is unclear why such a strengthening of automatic processes only happened under alignment, and not under conflict. Although the mechanism is still not clear, it has to be remarked that a somewhat related finding has been reported by Dickinson et al. (2014) who investigated the effect of glucose administration on Bayesian versus heuristic-based decision making. Using a Bayesian updating task very similar to the current study, they found that glucose administration significantly increased response times (and thereby indirectly affected decision errors) under alignment, but not under conflict.

It must be remarked that the current study relied on an incentivized decision-making task, in which wins and losses where reflected in monetary gains and lack thereof. It could be argued that such situations, by virtue of providing both explicit feedback and motivational rewards to participants, counteract the effects of ego depletion. This would be in line with results by Muraven and Slessareva (2003), who showed that monetary incentives in tasks following the depletion stage can mitigate ego depletion, and Boucher and Kofos (2012), who showed that priming the concept of money can already buffer ego-depletion effects. However, other experiments, e.g. in the realm of social preferences have found depletion effects in incentivized tasks (Achtziger et al., 2014, 2015b). This research considers this explanation unlikely for two reasons. First, Achtziger and Alós-Ferrer (2014) showed that increased monetary incentives did not reduce errors in the Bayesian updating task the current study employed, hence it is unlikely that monetary incentives were able to improve self-control capacity in this context. Second, to test whether the accumulated effects of rewards gradually counteracted the effects of ego depletion, the present study repeated the whole analysis considering only the first 30 trials of each participant. The results were qualitatively the same. In spite of these arguments, it is important to explore this alternative explanation in further research. If small monetary incentives counteract the effects of depletion, this study would have to conclude that the ego-depletion phenomenon is of limited relevance for (economic) decision making.

Study 1 selected three different, well-established manipulations from the literature. It might be the case that depletion is better modeled as a continuum, rather than an on-off state. Different manipulations could have different effects, and it might be the case that alternative manipulations not considered here induce the hypothesized effect. However, if the predictions of the limited-resource model for decision making depended on the fine-tuning of manipulations, the theory in its current form would effectively deliver few testable hypotheses and the current study would have to evaluate its applicability to this domain rather critically.

Overall, the current research did not find consistent results in line with the classic ego-depletion effect. Based on the present results, evidence from other studies (e.g. Dewitte et al., 2009), and recent analysis of possible publication bias (Carter and McCullough, 2013), this study cautiously concludes that the ego-depletion effect might not be as robust as previously assumed. The results of the present research point out that for complex decision-making tasks in which several cognitive processes are involved, the effects of ego depletion might be weaker or not as stable as for the simple tasks traditionally used in the ego-depletion literature (e.g. Masicampo and Baumeister, 2008; Pohl et al., 2013). Further research is needed to determine under which conditions ego depletion impairs (or improves) decision making.

2.2 Study 2: Mindsets and Bayesian Updating

2.2.1 Overview

The present study aimed to investigate whether decision makers' reliance on a reinforcement heuristic as opposed to Bayes' rule in a belief-updating task depends on their style of information processing (mindset; Gollwitzer, 1990). This study assumed that certain mindsets reduced the use of intuitive heuristics and biases in situations in which they are detrimental to judgment and decision making. The effects of the deliberative and the implemental mindsets on the decision performance in a probability-updating task was investigated.

Deliberative and Implemental Mindsets

Over the last decades, research has shown that deliberating a choice ("Should I change my field of study or not?") versus thinking about an object in the context of a plan ("How should I change my field of study?") can influence individuals' cognitions and actions (see reviews, Achtziger and Gollwitzer, 2008; Gollwitzer, 1990, 2012). These phenomena have been described and interpreted in mindset theory (Gollwitzer, 1990; Gollwitzer and Bayer, 1999). Mindset theory proposes that the process of goal pursuit is characterized by different action phases, each of which is associated with a specific task, for instance, the task of choosing between potential action goals or the task of promoting the implementation of a chosen goal. When individuals are involved in these tasks, different cognitive orientations (deliberative and implemental mindsets) appear to affect cognitions and behaviors.

Specifically speaking, when individuals are in a pre-decisional phase, they face the task of deliberating, to choose wishes and desires they want to realize based on the feasibility and desirability of the wishes and desires at issue. In order to turn those desires into binding goals which are realizable and attractive, individuals should process feasibility-related information realistically, and weigh the pros and cons (desirability) impartially. Because at this point of goal pursuit it is still unclear which decision the individual will take, any pieces of information might be relevant to assess the desirability and feasibility of a particular end-state. Accordingly, individuals tend to remain unbiased in their information processing (Gollwitzer, 1987; Taylor and Gollwitzer, 1995). For instance, individuals in a deliberative mindset tend to show open-mindedness, such as a high openness to incidental information. In a study by Fujita et al. (2007), participants conducted a primary task, at the same time, random incidental, unavoidable words were shown as distractions to participants' performance in the main task. A subsequent unexpected recognition memory test measured to which extent these incidental words had been processed. The study evidenced that participants in the deliberative mindset condition performed faster or had a higher accuracy in the recognition memory test, implying a higher openness to this incidental information. By adding a neutral mindset condition, the researchers further demonstrated that the changes in selective information processing was caused because that the incidental information was processed less selectively in the deliberative mindset, on the other hand, the incidental information was filtered more selectively in the implemental mindset. In addition to the increased open-mindeness, individuals in a deliberative mindset are characterized by realistic expectancy-value considerations and realistic evaluation of their own skills. Research has shown that the deliberative mindset reduces optimistic-biased thought contents (Puca and Schmalt, 2001) and positive illusions about participants' future performance (Puca, 2001), and leads to accurate evaluations of individuals' own skills (Taylor and Gollwitzer, 1995).

Once the individual has decided for a specific goal, s/he meets the task of planning the steps of goal pursuit, to promote the initiation of goal-directed actions. This requires committing oneself to the goal decision, since the implementation might fail if individuals are in doubt of themselves or their goal (Armor and Taylor, 2003). Therefore, individuals involved in tasks of planning tend to exhibit selective and biased information processing, to support and protect their dominant goal. For instance, the implemental mindset goes along with a closed-mindedness. Fujita et al. (2007) found that participants with an implemental mindset tended to ignore incidental information, which in turn led to a worse performance in the recognition task. Moreover, cognitions in an implemental mindset are characterized by optimism and exaggerated expectancy considerations. Previous research showed that implemental participants are overly optimistic regarding the future of their current romantic relationship (Gagné and Lydon, 2001) and regarding future task performance (Puca, 2001), and that an implemental mindset tends to increase self-confidence of decision makers and leads to risky decisions for male participants (Hügelschäfer and Achtziger, 2014).

The Present Research

According to the mindset literature, deliberative and implemental mindsets affect information processing and accordingly behavior differently. This seems highly relevant for decision making under uncertainty, where in many cases there is a conflict between different decision strategies or processes that are based on different kinds of information. The current study investigates the effects of deliberative and implemental mindsets on the reliance on the reinforcement heuristic vs. Bayes' rule in the probability updating task presented in Chapter 1 (see Chapter 1.3).

This study hypothesized that the deliberative and implemental mindset would differentially affect error rates in situations where the reinforcement heuristic conflicts with Bayesian updating (after a first draw from Left). As the deliberative mindset is typically associated with an unbiased information processing, the current research expected that this mindset would make participants more likely to incorporate all relevant information (prior probabilities and decision outcomes) and to make choices based on the normative rule (updating prior probabilities according to Bayes' Rule). This should be reflected in lower error rates in the deliberative mindset condition in conflict situations. In contrast, individuals in an implemental mindset typically exhibit a biased information processing. Due to their strong focus on the feasibility of a goal, they should be highly focused on information related to the goal to draw as many winning balls as possible. Hence, this study expected them to strongly concentrate on the valence of feedback (win/loss) at the expense of its informational value (probability of the state of the world) although this information is crucial to achieve optimal decisions. This neglect of information regarding underlying uncertain events should be even further strengthened by the closed-mindedness that is typically observed in an implemental mindset. This study assumed that due to these effects, implemental participants would strongly focus on the previous win/loss outcome without updating information regarding uncertain events based on Bayes' rule, and hence to rely on the automatic reinforcement process more often.

This should be reflected in a higher error rate in the implemental mindset condition in case of conflict. The present study did not expect different effects of the deliberative and implemental mindsets on error rates in case of alignment of the two decision rules (after a first draw from Right) since in this case, the reinforcement heuristic points to the optimal solution and error rates are generally very low.

In order to examine whether any differences in performance in the belief-updating task are the function of the deliberative or the implemental mindset or both, the current research ran a neutral mindset condition and a baseline condition for further investigation. Classic mindset research has only included a neutral mindset to identify which type of mindsets play a role (Fujita et al., 2007). But some of the studies did not find different effects of deliberative and neutral mindsets (i.e., Henderson et al., 2008), and argued that individuals in the neutral mindset condition might still spontaneously adopt a particular mindset. In order to make sure to have a control condition with a really "neutral" mindset, this study included a baseline treatment, having no mindset induction prior to the probability-updating task.

2.2.2 Methods

The present research conducted a study with four different treatments. In addition to three treatments in which mindsets (deliberative, implemental and neutral) were induced, a further condition was implemented to measure the baseline of error rates in the Bayesian-updating task. The probability-updating task settings were exactly the same as described in Chapter 1 (see Chapter 1.3).

Participants

In the current study, participants received a payment based on the outcomes of their decisions in the Bayesian updating task plus a show-up fee of 7.5 Euros. In total 128 participants participated in the study and were randomly assigned to four experimental conditions (deliberative mindset vs. implemental mindset vs. neutral mindset vs. baseline) and two counterbalance conditions (winning ball color). Six participants were excluded from data analysis due to failure to properly follow the instructions of the mindset manipulation tasks. Thus 122 participants (61 female, age range 18 – 35, $M = 23.83$, SD 3.67) were considered for data analysis, 30 in the deliberative mindset condition, 29 in the implemental mindset condition, 31 in the neutral mindset condition and 32 in the baseline condition. Average earnings were 19.44 Euros (SD 0.67) including the show-up fee.

Procedure

All the mindset-inducing treatments followed the same procedure, implementing the mindset manipulation prior to the decision task. Before the mindset manipulation, participants read through the instructions of the decision task and answered several control questions to ensure they understood the rules of the decision task properly. Then those in the three mindset conditions proceeded with the manipulation task (deliberative, implemental or neutral mindset manipulation task). Immediately afterwards participants continued with the decision task, which lasted around 10 minutes. Participants in the baseline condition started the decision task directly after answering the control questions. After the decision task, participants in the baseline condition conducted a filler task, which was the same as the neutral mindset manipulation task. In this way the present study ensured that the experiment duration of the baseline condition was similar to the other three conditions, and hence the hourly payment rates were comparable among the four conditions. When the decision task was finished, all participants filled in questionnaires (which did not differ across the four conditions). The questionnaires (see Appendix B.3) included the Self-Esteem Scale (Rosenberg, 1965), a mood scale consisting of 8 adjectives (Taylor and Gollwitzer, 1995), a measure of relative perceived risk derived from Perloff and Fetzer (1986), faith in intuition (Epstein et al., 1996) and demographic questions, including two items on self-evaluated knowledge in statistic/stochastics. A session lasted about 1.5 hours.

To induce the deliberative and implemental mindsets, the current research used the classic induction paradigms from Gollwitzer and Kinney (1989), which have been frequently used in previous studies (e.g., Gollwitzer and Bayer, 1999; Hügelschäfer and Achtziger, 2014). For the neutral mindset induction, this study followed Harmon-Jones and Harmon-Jones's (2002) manipulation paradigm (see also Henderson et al., 2008).

Mindset Manipulation

In order to induce the *deliberative* mindset, participants were asked to think about a personal concern which they were currently deliberating on, without yet having reached a decision on the matter (e.g., whether to change the major or not). Accordingly, participants were instructed to deliberate about a concern and to imagine realizing vs. not realizing this unresolved concern, and then to list potential short-term and long-term, positive and negative consequences of both alternatives. After that, they rated for each consequence how positive/negative this consequence would be for them on a Likert scale ranging from -5 (very negative) to 5 (very positive), along with the estimation of the probability of each consequence actually would occur. On average the deliberative mindset task took around 25 minutes.

Participants in the *implemental* mindset condition were asked to identify their most important personal goal which they definitely intended to achieve in the next couple of months (e.g., to change a flat), but for which they had not made any concrete plans yet. Participants were ask to write down their goal, and then to list five to seven steps which were necessary to accomplish the goal, and finally to specify where, when, and how they intended to realize each of these steps. The implemental mindset task took around 15 minutes.

For the *neutral* mindset induction, participants were instructed to think about an ordinary day in their life and to describe at least seven things that they normally do during a typical day. The neutral mindset task lasted on average around 3 minutes.

More details regarding the mindset manipulation procedure can be found in Appendix B.2.

2.2.3 Results

Equivalence of the Groups

There were no differences in mood, self-esteem, perceived other-own risk to negative events, faith in intuition, self-evaluations of knowledge in statistics (according to one-way ANOVAs) and gender ratio among the four groups (according to a chi-square test), with *p*-values above .146.

Error Rates

Individual averages of the second-draw error rates were examined by Kruskal-Wallis tests, with mindset condition (deliberative vs. implemental vs. neutral vs. baseline) as a between-participants variable. Achtziger and Alós-Ferrer (2014) used the same decision paradigm and found that forced first-draw decisions resulted in more second-draw errors. Thus for a more detailed analysis this study also split the tests conditional on free draws and forced draws. For pairwise comparisons on error rates, the current study relied on non-parametric, two-tailed Rank-Sum tests. Average error rates in case of conflict are presented in Figure 2.4.

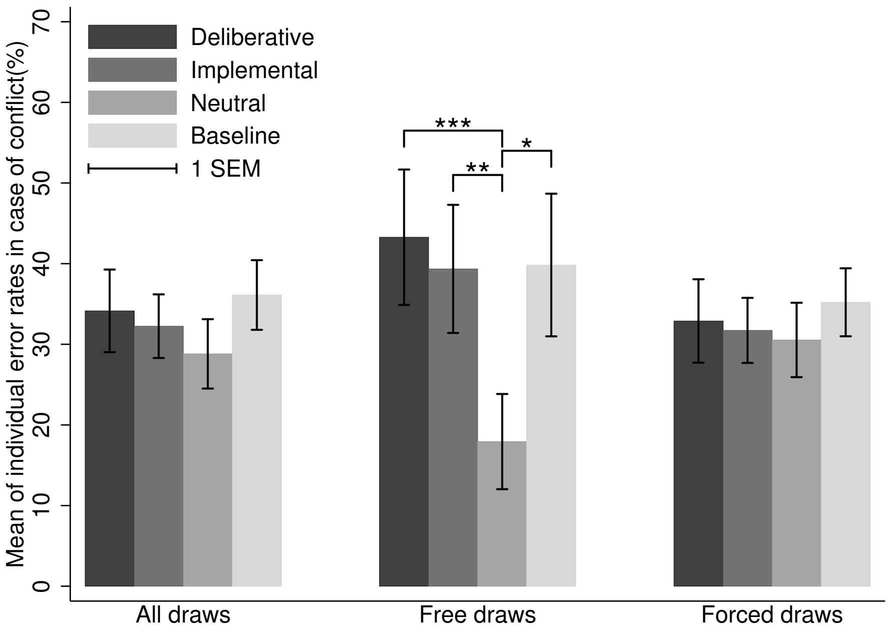

Fig. 2.4 Study 2. Means of the individual average error rates in case of conflict.

*Note: * p <.10, ** p <.05, *** p <.01.*

For free draws in case of conflict, a marginally significant effect of mindset condition on error rates was found, $\chi^2(3) = 7.75$, $p = .052$. Pairwise comparisons revealed that the neutral mindset condition ($N = 17$, $M = 17.93\%$, $Mdn = 0$, $SD = 24.34\%$) evidenced significantly lower error rates compared to the deliberative ($N = 16$, $M = 43.28\%$, $Mdn = 45.00\%$, $SD = 33.59\%$), $z = -2.66$, $p = .008$, and the implemental ($N = 13$, $M = 39.35\%$, $Mdn = 40.00\%$, $SD = 28.65\%$) mindset conditions, $z = -2.15$, $p = .032$, and marginally significant lower error rates compared to the baseline (*N* = 17, *M* = 39.83%, *Mdn* = 50.00%, *SD* = 36.47%), $z = -1.79$, $p = .074$. Note that the reduced sample sizes are due to the fact that some participants avoided starting with the Left Urn when first draws were free, and hence provided no data for this particular comparison (indeed, this possibility is the original reason for including forced draws in the design). All other pairwise comparisons yielded no significant differences, with *p*-values above .561. For pooled draws and for forced draws in case of conflict, the effect of mindset condition on error rates was not significant, $\chi^2(3) = 1.47$, $p = .689$ and $\chi^2(3) = 0.86$, $p = .834$. Further pairwise comparisons did not reveal any significant differences, with *p*-values above .239 and .369 in pooled draws and forced draws respectively. Hence, when Bayes' rule and reinforcement were opposed, after autonomous 1st-draws, participants in the neutral mindset condition committed fewer reinforcement errors than the other three conditions.

Average error rates in case of alignment are presented in Figure 2.5. In case of alignment, there were no significant effect of mindset condition on the 2nd-draw error rates according to the Kruskal-Wallis tests, neither in pooled draws ($\chi^2(3) = 2.93$, $p = .403$), nor in free draws ($\chi^2(3) = 3.59$, $p = .309$) or forced draws ($\chi^2(3) = 2.11$, $p = .549$). But pairwise comparisons revealed that for free draws, the error rates in the neutral mindset condition (*N* = 28, *M* = 1.04%, *Mdn* = 0, *SD* = 3.19%) were marginally significantly lower than in the implemental mindset condition (*N* = 29, *M* = 2.58%, *Mdn* = 0, *SD* = 6.70%), $z = -1.68$, $p = .093$, and the baseline (*N* = 29, *M* = 4.16%, *Mdn* = 0, *SD* = 12.79%), $z = -1.70$, $p = .089$. All other pairwise comparisons after free draws yielded no significant differences, with *p*-values above .330. The pairwise comparisons did not show any significant differences among mindset conditions in either pooled draws or forced draws, with *p*-values above .154 and .220 respectively. Hence, also when Bayes' rule and reinforcement were aligned, after free draws, the error rate in the neutral mindset condition was particularly low.

Regression Analysis

Data of the current study forms a strongly balanced panel, with 60 second-draw observations per participant, and hence this study can test the stability of the results derived from non-

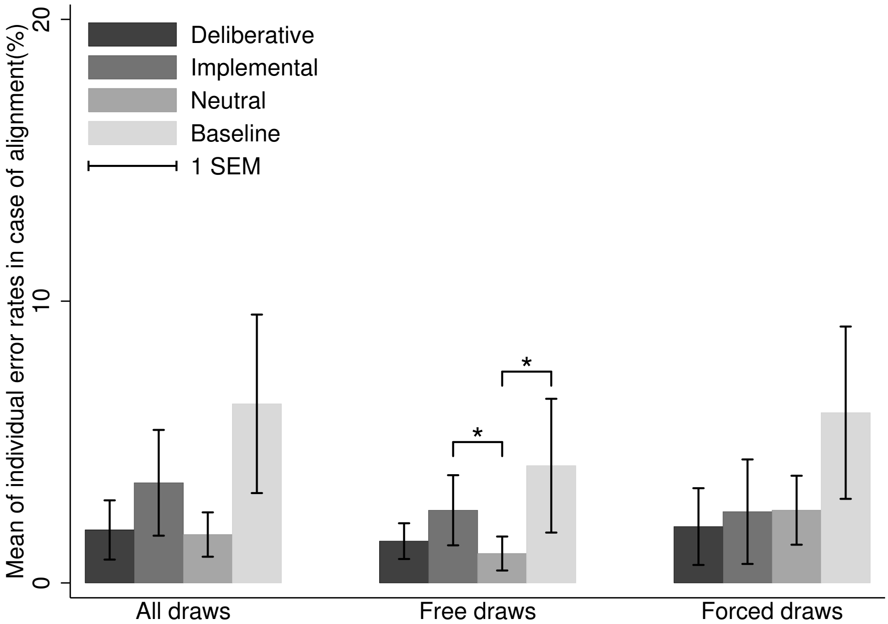

Fig. 2.5 Study 2. Means of the individual average error rates in case of alignment.

*Note: * p <.10, ** p <.05, *** p <.01.*

parametric tests while controlling for a variety of task variables (e.g., win/loss in the 1st draw, round number). Specific effects can be tested by means of linear combinations tests.

Table 2.1 reports random-effects probit regressions on second-draw errors. The first model includes the basic variables and the mindset manipulations. Here the results showed a highly significant effect of the dummy variable of conflict between Bayesian updating and reinforcement on the probability of making an error, capturing that errors are more likely in case of decision conflict. This effect is consistent with previous studies (Achtziger and Alós-Ferrer, 2014; Charness and Levin, 2005). A significant learning or practice effect (reflected by the variable of round number) was found, meaning that the likelihood of making 2nd-draw errors was reduced over the course of the experiment. The dummy of 1st-draw result and the counterbalance dummy showed no significance, indicating win vs. loss in the first draw and winning ball color (black or white) had no significant influence on the 2nd-draw errors. The dummy variable of forced draw exhibited a significant effect, indicating that in free draws errors were less likely, consistent with the results of Achtziger and Alós-Ferrer (2014).

The second model further includes the mindset manipulations. We used the baseline condition as the reference category. Regarding the basic variables, the significant effects in the 1st-model still held in Model 2. The mindset manipulations have no significant effect on the 2nd-draw errors.

The third model further includes the interaction dummies of mindset manipulations and decision conflict (since this study had particular interest in the mindset effects in the conflicting situations). The present study used the baseline condition as the reference category. Regarding the basic variables, the significant effects in the 1st-model still held in Model 2. Linear combination tests did not yield significant effects for any comparison of mindsets in case of conflict, with p-values above .214. Concerning decisions under alignment, the deliberative mindset dummy was significant and negative, and the interaction dummy of deliberative mindset and decision conflict was significant and positive, indicating that in aligned situations, the deliberative mindset decreased the probability of making 2nd-draw errors compared to the baseline treatment. Also for participants in a neutral mindset, 2nd-draw errors in case of alignment were significantly less likely compared to the baseline. To further compare the treatments in case of alignment, this study relied on linear combination tests. The tests showed that the deliberative ($\beta_{Deliberative} - \beta_{Implemental} = -0.45$, $p = .093$) and the neutral ($\beta_{Neutral} - \beta_{Implemental} = -0.43$, $p = .103$) mindsets had a marginally significant effect on decreasing the probability of making 2nd-draw errors compared to the implemental mindset. The other comparisons of mindset effects under alignment yielded no significance, with p-values greater than .454. Thus, the present study did not observe results consistent with the hypothesis in Model 2. Instead, results showed that in case of alignment the deliberative and neutral mindsets decreased 2nd-draw errors compared to the baseline condition and the implemental mindset condition.

Table 2.1 Study 2. Random-effects probit regressions on second-draw errors (1 = error)

Variables	Model 1	Model 2	Model 3	Model 4
	$\beta(SE)$	$\beta(SE)$	$\beta(SE)$	$\beta(SE)$
WinColor(1 = Yes)	-0.00(.16)	-0.01(.15)	-0.00(.16)	-0.01(.16)
FirstResult(1 = Success)	0.07(.05)	0.07(.05)	0.07(.05)	0.07(.05)
Round	-0.57(.09)***	-0.57(.09)***	-0.58(.09)***	-0.58(.09)***
Conflict(1 = Yes)	1.75(.06)***	1.75(.06)***	1.52(.10)***	1.55(.17)***
Forced(1 = Yes)	0.18(.06)***	0.18(.06)***	0.19(.06)***	0.29 (.15)*
Conflict x Forced				-0.07(.21)
DEL(1 = Yes)		-0.13(.22)	-0.63(.26)**	-0.53(.29)
IMP(1 = Yes)		-0.10(.22)	-0.18(.24)	-0.03(.26)
NEU(1 = Yes)		-0.35(.22)	-0.61(.25)**	-0.69(.29)**
DEL x Conflict			0.65(.17)***	0.85(.27)***
IMP x Conflict			0.12(.15)	-0.01(.26)
NEU x Conflict			0.35(.16)**	0.14(.28)
DEL x Forced				-0.17(.28)
IMP x Forced				-0.36(.25)
NEU x Forced				0.15(.27)
DEL x Conflict x Forced				-0.22(.35)
IMP x Conflict x Forced				0.33(.34)
NEU x Conflict x Forced				0.21(.35)
Constant	-2.28(.13)***	-2.14(.18)***	-1.97(.19)***	-2.02(.20)***
Wald chi2	983.07***	984.43***	957.42***	963.50***
Log likelihood	-1780.53	-1779.14	-1770.68	-1762.75
No. of Obs.	7320	7320	7320	7320

Note: * $p < .10$, ** $p < .05$, *** $p < .01$

In Model 4, the 3-way interaction of dummy variables (decision conflict, mindset conditions and draw type (forced vs. free)) was inserted. Although the interaction effects were not significant, linear combination tests were computed to compare the effects of mindsets on the probability of making 2nd-draw errors for all combinations of draw type and conflict vs. alignment. Results showed that for free draws in case of conflict, the probability of making an error in the 2nd draw was significantly lower in the neutral mindset condition than in the deliberative mindset ($\beta_{Neutral} + \beta_{Neutral} * \beta_{Conflict} - \beta_{Deliberative} - \beta_{Deliberative} * \beta_{Conflict} = -0.86$, $p = .002$) and in the baseline condition ($\beta_{Neutral} + \beta_{Neutral} * \beta_{Conflict} = -0.55$, $p = .048$), and marginally significantly lower than in the implemental mindset condition ($\beta_{Neutral} + \beta_{Neutral} * \beta_{Conflict} - \beta_{Implemental} - \beta_{Implemental} * \beta_{Conflict} = -0.52$, $p = .084$). All the other comparisons of treatments showed no significance in conflict situations after free 1st-draws, with p-values larger than .239. All comparisons of mindsets in case of conflict with forced draws showed no significance, with p-values above .391.

For free draws in case of alignment, 2nd-draw errors were significantly less likely in the neutral mindset condition than the implemental mindset condition ($\beta_{Neutral} - \beta_{Implemental} = -0.67$, $p = .026$) and the baseline condition ($\beta_{Neutral} = -0.69$, $p = .018$). Further, the likelihood of making a 2nd-draw error was marginally significant lower in the deliberative mindset condition than in the implemental mindset condition ($\beta_{Deliberative} - \beta_{Implemental} = -0.51$, $p = .085$) and the baseline ($\beta_{Deliberative} = -0.54$, $p = .065$). The other comparisons after free draws in case of alignment exhibited no significant effects, with p-values above .620. For forced draws in case of alignment, the results showed effects of both neutral and deliberative mindset on the likelihood of 2nd-draw decision errors: errors were significantly less frequent in the neutral ($\beta_{Neutral} + \beta_{Neutral} * \beta_{Forced} = -0.55$, $p = .050$) and deliberative ($\beta_{Deliberative} + \beta_{Deliberative} * \beta_{Forced} = -0.70$, $p = .017$) mindsets conditions than in the baseline condition. All the other comparisons of mindsets in this case showed no significance, with p-values greater than .166. Hence, this study observed that in case of conflict after free draws, the neutral mindset decreased error likelihood compared to the other treatments. In aligned situations, the neutral mindset showed the same trend in both free draws and forced draws. The error rates in the deliberative mindset were also less likely in both free draws and forced draws.

2.2.4 Discussion

Neutral Mindset

According to the results from the non-parametric tests and the regression analysis, Study 2 surprisingly found a significant effect of the neutral mindset manipulation on the 2nd-draw error rates in free draws in case of conflict: for autonomous decisions, the neutral mindset led to lower error rates compared to the other three conditions. The current study did not expect mindsets to affect the error rates in case of alignment, since in that situation the reinforcement heuristic gives the same prescription as Bayesian updating and error rates are very low. This study still observed an effect of the neutral mindset on the frequency of 2nd-draw errors under alignment, indicating that in free draws (and, according to the regression analysis, also in forced draws), participants in the neutral mindset condition tended to have lower 2nd draw-error rates compared to participants in the other conditions (after including the excluded participants, the above effects of neutral mindset still hold).

There are several possible explanations for the present results. One possibility is cognitive demand and resulting depletion. The effect of the neutral mindset might be caused by the heightened cognitive demand in the deliberative and implemental mindset conditions, since the manipulation tasks inducing these two mindsets took longer and were more cognitively demanding than the task inducing the neutral mindset. For instance, classic self-control depletion literature showed that conducting a cognitively demanding task impairs subsequent cognitive performance (Masicampo and Baumeister, 2008; Pohl et al., 2013; Schmeichel et al., 2003). One could argue that error rates should have been lowest in the baseline condition, since there was no demand or possibility of depletion at all, However, it is conceivable that the neutral mindset manipulation resulted in something like a warm-up effect, which was absent in the baseline. Positive warm-up effects on strenuous physical activity are well documented, and research has also shown positive effects of warm-up on cognitive skills (measured by attention and memory tasks), and that the effectiveness of warm-up is independent of the type of task that follows (Kahol et al., 2009). Specifically speaking, the deliberative and implemental mindset tasks are very cognitively demanding, and the baseline task has no cognitive task prior to the decision task at all, thus a task with mild cognitive load, like the neutral mindset task, might create a cognitive warm-up effect and enhance the subsequent decision performance. The present study cannot directly test this assumption, but can use the duration of the manipulation task as a proxy for cognitive demand. This study included task duration as a regressor in the random-effects probit regression models (this study coded the task duration in the baseline condition as 0, since there was no task prior to the decision task). The present study found that the manipulation task duration has no significant effect on the probability of making 2nd-draw errors. Further, the results regarding the effect of the neutral mindset still hold when the task duration was controlled, indicating that cognitive demand (depletion or cognitive warm-up) cannot explain the decreased error rates in the neutral mindset condition.

Since the neutral mindset effect was mainly limited to autonomous decisions (especially for the critical conflict situations), another possibility is that enhanced self-efficacy is the reason for lower error rates in the decision task. The neutral mindset induction task asked participants to write down personal daily life activities, which is less cognitively demanding and simpler than the deliberative and implemental mindset induction tasks, thus conducting the neutral mindset manipulation task might increase participants' self-efficacy feelings. According to the self-efficacy literature, conducting easy tasks (Sanna, 1992) and imagining conducting easy tasks (Silvia, 2003) have been shown to successfully boost self-efficacy. In addition, positive effects of self-efficacy on performance are well documented, for instance, self-efficacy improves persistence in studying and course grades (Lent et al., 1984), and research productivity of university faculty staffs (Taylor et al., 1984). More relevant for the present probability-updating task, studies have shown that self-efficacy is positively correlated with performance in mathematics (Bandura and Schunk, 1981; Bayer and Gollwitzer, 2007; Pietsch et al., 2003). This study argues that after conducting the neutral mindset task, participants might have exhibited enhanced self-efficacy, which in turn resulted in a better performance in the decision task. Furthermore, there is some evidence that positive self-efficacy effects on performance are enhanced when high autonomy is given, which fits the results (stronger effects after autonomous 1st draws). The experience of autonomy facilitates individuals' perception of themselves as the initiator of their behaviors (Ryan and Deci, 2000). Extensive studies have shown that a more autonomous extrinsic motivation is associated with more engagement and better performance (for reviews, see Ryan and Deci, 2000). This fits the observation of reduced error rates in autonomous decisions (see Model 1). But, more importantly, the experience of autonomy can boost the effects of self-efficacy on performance. For instance, in a study on job autonomy, self-efficacy and performance in the workplace, job autonomy was found to be an antecedent of self-efficacy's positive effects on performance (Wang and Netemyer, 2002). This could explain why some of the observed effects of the neutral mindset manipulation were limited to autonomous first-draw decisions.

The present study is one of the first including a baseline in addition to the neutral mindset. The results showed that the neutral mindset is definitely not neutral. It would not have known this without the baseline. For other studies in which did not use a baseline, their conclusions might not be warranted. Especially when strange findings might be explained by the fact that the neutral mindset is not neutral. Hence the current study strongly recommends to always include a baseline.

Deliberative and Implemental Mindsets

This study did not find (different) effects of deliberative vs. implemental mindsets on the decision performance in case of conflict between reinforcement and Bayesian updating, which is inconsistent with the assumptions. However, in case of alignment, according to the regression analysis, it was found that the error rate was significantly lower in the deliberative mindset condition than the implemental mindset and the baseline conditions. This could be regarded as evidence that errors under alignment might also result from a biased information processing (e.g., closed-mindedness) and hence the deliberative mindset, which is associated with unbiased processing and open-mindedness, can reduce error likelihood. Still, it is difficult to explain why the current study only found effects under alignment and not under conflict between the reinforcement heuristic and Bayesian updating.

Study 2 strictly sticked to the classic deliberative and implemental mindsets manipulation procedures (e.g., Gollwitzer and Bayer, 1999; Hügelschäfer and Achtziger, 2014). This study additionally checked the results of the manipulation tasks carefully to ensure that the participants were deeply involved in the task, and excluded those who did not take the manipulation task seriously. Hence, the present study can exclude the possibility that the null-findings regarding the deliberative and implemental mindset are due to manipulation failures. There are several possible explanations for why the current study did not find effects of deliberative vs. implemental mindset (in case of conflict) on the decision performance in the present study. Firstly, this study argues that this might due to the high task complexity. Taking a look at the literature on mindset theory, most studies that observed different effects of deliberative vs. implemental mindset used relatively simple performance measurements, for instance, memory recognition (Fujita et al., 2007), items hunting (Armor and Taylor, 2003), and attitude assessment (Harmon-Jones and Harmon-Jones, 2002). The mindset effects might be less pronounced when several different cognitive processes are involved in the performance at a task. Secondly, the decision task performance in the current study was incentivized. In contrast, the majority of deliberative and implemental mindsets studies did not remunerate participants contingent on their performance. It is well-known that offering performance-contingent monetary incentives usually reduce performance variance, which might be caused by thoughtless, unmotivated subjects (Camerer and Hogarth, 1999). Hence, the current research can speculate that mindset effects might have been stronger with a non-incentivized task.

In summary, through inducing deliberative, implemental, and neutral mindsets in addition to a baseline condition, the effect of mindsets on decisions under uncertainty was examined. Inconsistent with the present study's hypothesis, this study did not find different effects of deliberative and implemental mindsets on the decision performance. But surprisingly, the current research found that after free draws, the 2nd-draw error rate in the decision task was significantly lower in the neutral mindset condition in both conflict and alignment decision situations (the effect also holds in forced draws in case of alignment). The present research argues that maybe the enhanced self-efficacy after conducting the neutral mindset manipulation task is the reason to lead to a lower error rates in the decision task.

2.3 Study 3: Framing and Reinforcement Heuristic

2.3.1 Overview

The framing effect in judgment and decision making refers to the finding that different, but logically equivalent descriptions of the same decision problem can lead to astonishingly different choices. For instance, people tend to avoid risks that are described in terms of benefits, but tend to take the same risks when described in terms of losses (Tversky and Kahneman, 1981). This is due to loss aversion, the tendency to prefer avoiding losses over acquiring gains of equal mathematical value ("losses loom larger than gains"), which can bias the decision process.

Optimal decision making under uncertainty requires integrating all available information through using Bayes' rule. For instance, the outcomes of previous decisions can deliver information on underlying uncertain events. However, if these outcomes lead to feedback in a success/failure format, they also create an impulse for a simple "win-stay, lose-shift" decision rule: decisions that led to success in the past are repeated, and decisions that led to failure are avoided. This reinforcement heuristic, which might be an effective shortcut in simple settings, can conflict with the normative rule (i.e., prescribe a different response than Bayesian updating) in more complex settings. Achtziger and Alós-Ferrer (2014); Charness and Levin (2005) showed that, under such a conflict, individuals frequently rely on the faulty heuristic, hence committing many decision errors.

The present study aimed at investigating whether such reinforcement errors, particularly the error to shift away from an option after failure, would be affected by framing of failure feedback, i.e., whether it is presented as a loss or as the absence of a gain. For simple reinforcement-learning paradigms, there is some evidence that loss frames are more motivating than gain frames. For instance, Niznikiewicz and Delgado (2011) found enhanced learning effects and a stronger modulation of activity in the brain's reward circuitry when participants learned to avoid monetary losses, compared to when they learned to earn monetary rewards. Whether a similar effect also holds for decision making in complex economic setting is still an open question.

Following the literature on loss aversion, this study hypothesized that the impulse to shift away from an unsuccessful option would be strengthened when failure feedback is presented under a loss frame compared to a gain frame.

To test the assumption, the present study relied on the probability-updating paradigm shown in Chapter 1.3 in which participants are repeatedly confronted with situations where rational reasoning (Bayesian updating) conflicts with the reinforcement heuristic. Hence, participants can commit two types of decision errors (win-stay errors and lose-shift errors). This study manipulated the framing of the goal of the decision task (win vs. loss frame) and tested the effect of this manipulation on participants' decision behavior. Specifically, the current study hypothesized that a loss frame would result in more lose-shift errors compared to a gain frame. In this paradigm, certain situations also result in the alignment of Bayesian updating and reinforcement, i.e. both processes make identical prescriptions. Since in these cases, accuracy rates are close to a ceiling, this study only focused on conflict situations.

2.3.2 Methods

Participants

64 participants were recruited and were randomly assigned to two framing conditions (win vs. loss frame) and two counterbalance conditions (winning ball color). In exchange for participation, they received a payment based on the outcomes in the decision task plus a show-up fee of 7.5 Euros. Two participants were excluded from data analysis due to failure to properly understand the instructions. Thus 62 participants (36 female, age range 19 – 35, $M = 24.58$, $SD = 3.70$) were considered for data analysis, 31 in each condition. Average earnings were 19.41 Euros ($SD = 0.83$), including the show-up fee.

Procedure

The experimental settings of the decision task were the same as depicted in Chapter 1.3. The framing manipulation was implemented by means of the experimental instructions (see Appendix C.1) that participants read before the start of the decision task. Half of participants received win-framed instructions, and the other half received loss-framed instructions. The manipulation only referred to the goal of the decision task and the payment mechanism, apart from that the wording of the instructions was exactly the same, and both types of instructions were logically equivalent.

In the win-framing condition, the goal of the decision task was described as drawing as many winning balls as possible in order to earn as much money as possible. Participants were told that they would earn 18 Euro cents for each winning ball they would draw, whereas they would receive nothing for drawing a ball of the other color.

In the loss-frame condition, the goal was described as drawing as few losing balls as possible in order to lose as little money as possible. Participants were informed that they would be given an endowment of 36 Euro cents for each round. Whenever they would draw a losing ball, 18 Euro cents would be deducted from this endowment, whereas they would not lose money by drawing a ball of the other color.

Participants first read the instructions for the decision task, and then answered several control questions to ensure they understood the decision rule. After that, they proceeded with the decision task, which lasted around 10 minutes.

2.3.3 Results

Lose-Shift Errors

In order to test whether the proportion of lose-shift errors in case of conflict was higher in the loss-frame condition compared to the win-frame condition, two-tailed Rank-Sum tests were conducted on the 2nd-draw error rates after failure feedback (drawing an unpaid or a losing ball) from the Left Urn. Achtziger and Alós-Ferrer (2014) used the same task paradigm and found that forced first-draw decisions resulted in more second-draw errors. Thus for a more detailed analysis this study also split the tests conditional on free draws and forced draws. Average lose-shift error rates in case of conflict are presented in Figure 2.6. For free draws, results are consistent with the hypothesis: Participants in the loss-frame condition ($N = 15$, $M = 68.82\%$, $Mdn = 75.00\%$, $SD = 31.52\%$) committed significantly more lose-shift errors than those in the win-frame condition ($N = 13$, $M = 29.26\%$, $Mdn = 15.38\%$, $SD = 35.94\%$) ($N = 28$, $z = 2.59$, $p < .010$). The difference was not significant when pooling forced and free draws ($N = 62$, $z = 0.65$, $p = .515$) and when analyzing forced draws only ($N = 62$, $z = 0.61$, $p = .541$).

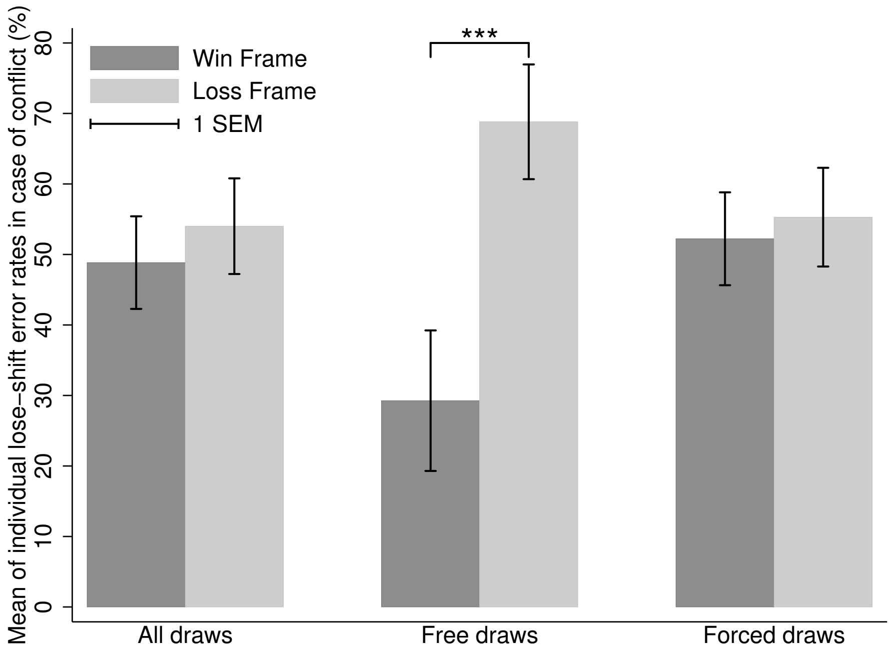

Fig. 2.6 Study 3. Means of individual average lose-shift error rates in case of conflict.

*Note: * p <.10, ** p <.05, *** p <.01.*

Win-Stay Errors

To check whether there was also a framing effect on the win-stay errors in case of conflict, this study conducted two-tailed Rank-Sum tests on the 2nd-draw error rates after 1st-draw success feedback (drawing a winning ball or a non-losing ball) from the Left Urn. Error rates are shown in Figure 2.7. The error rates did not differ between both conditions, neither when pooling forced and free draws ($N = 62$, $z = 0.25$, $p = .805$), nor when only analyzing forced draws ($N = 62$, $z = 0.32$, $p = .748$) or only free draws ($N = 27$, $z = -0.85$, $p = .395$).

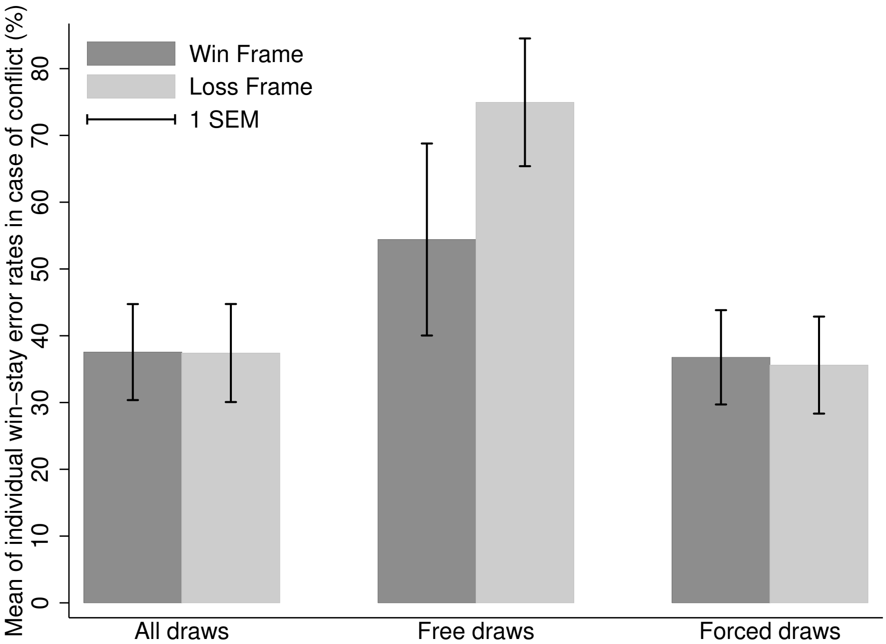

Fig. 2.7 Study 3. Means of individual average win-stay error rates in case of conflict.

*Note: * p <.10, ** p <.05, *** p <.01.*

2.3.4 Conclusion and Discussion

Study 3 observed evidence supporting the hypothesis that a loss frame increases the tendency to shift away from an unsuccessful option. In contrast, loss framing did not affect the impulse to repeat a successful decision.

The finding is consistent with the literature on loss aversion, and with evidence of a higher impact of negative compared to positive reinforcers on behavior and brain activity in simple reinforcement-learning tasks. The results show that this phenomenon also affects the use of a reinforcement heuristic in more complex settings of economic decision making, and that a subtle manipulation is sufficient to bias decision behavior accordingly.

Interestingly, the effect was limited to decisions where the failure resulted from autonomous choices, in contrast to choices dictated to the participant. This might imply a special meaning of self-inflicted losses.

2.4 Study 4: Decision Inertia

In Studies 1 – 3, possible moderators on reinforcement heuristic or Bayesian rationality were investigated. In the current study, the focus is exploring whether a third decision process, decision inertia, exists in the Bayesian updating paradigm this dissertation based on (as described in Chapter 1.3). In the same paradigm, Achtziger and Alós-Ferrer (2014) suggested the existence of decision inertia, the tendency to repeat previous decisions, indicating that there might have a third process apart from the reinforcement and Bayesian updating.

2.4.1 Overview

As described in Newtonian physics, the term "inertia" refers to the fact that, in the absence of external resistance, a moving object will keep moving in the same direction. This word has also been used across multiple fields as a metaphor to describe related characteristics of human behavior. For example, in management and organization science, the expression "cognitive inertia" describes the phenomenon that managers might fail to reevaluate a situation even in the face of change (Hodgkinson, 1997; Huff et al., 1992; Reger and Palmer, 1996; Tripsas and Gavetti, 2000). In medical studies, "therapeutic inertia" or "clinical inertia" describe the failure of health care providers to intensify therapy when treatment goals are unattained (Okonofua et al., 2006; Phillips et al., 2001). In sociology, "social inertia" depicts the resistance to change or the (excess) stability of relationships in societies or social groups (Bourdieu, 1985). In psychology, the "inertia effect" describes individuals' reluctance to reduce their confidence in a decision following disconfirming information (Pitz and Reinhold, 1968). The concept of "psychological inertia" has been proposed to describe the tendency to maintain the status-quo (Gal, 2006). Suri et al. (2013) speak of "patient inertia" to describe the phenomenon that many patients stick to inferior options or fail to initiate treatment even after the diagnosis of a medical problem. Further, the expression "inaction inertia" has been used to represent the tendency to avoid a subsequent similar choice after having missed an initial good opportunity (e.g. Tykocinski et al., 1995).

Summing up, the concept of inertia has been used to describe many different phenomena related to a resistance to change. The existence of these phenomena has been linked to the status-quo bias (Ritov and Baron, 1992; Samuelson and Zeckhauser, 1988), described as the tendency to maintain the defaults either by repeating a decision or avoiding action. So far, however, the understanding of the processes underlying inertia in decision making is rather limited. The present study aimed to contribute to this understanding by focusing on a particular facet of inertia, which the current study term "decision inertia:" the tendency to repeat a previous choice, regardless of its outcome, in a subsequent decision. This study investigated whether this tendency existed in active decision making and explored the psychological processes behind it using a belief-updating task.

The phenomenon the current study explored here is consistent with previous evidence from the decision-making literature. For instance, Pitz and Geller (1970) found a tendency to repeat previous decisions even following disconfirming information. In a study on reinforcement in belief-updating tasks, Charness and Levin (2005) have observed a "taste for consistency", corresponding to the phenomenon that people were prone to repeat their choices, no matter whether these choices led to success or failure. In a study on perceptual decision-making, Akaishi et al. (2014) showed that choices tend to be repeated on subsequent trials, even on the basis of little sensory evidence. Erev and Haruvy (2013) review studies on decision-making from experience where, for instance, participants repeatedly choose between a risky prospect and a safe option, and receive immediate feedback (e.g. Nevo and Erev, 2012). Erev and Haruvy (2013) conclude that there exists a strong tendency to simply repeat the most recent decision, which is even stronger than the tendency to best reply to the most recent outcome. Furthermore, Zhang et al. (2014) showed that the tendency to repeat previous decisions exists even for unethical behavior. There might also be a relation to the extensive literature on choice-induced preference change. Ariely et al. (2003) proposed a model in which individuals use observations of past actions as an input for later decisions. According to the model, previous behavior is used as a signal about one's own preferences. In turn, preference change results in a repetition (or rationalization) of earlier decisions (see also Alós-Ferrer et al., 2012; Ariely and Norton, 2008; Sharot et al., 2010).

To understand decision inertia, this study considered a multiple-process framework (Alós-Ferrer and Strack, 2014; Evans, 2008; Sanfey and Chang, 2008; Weber and Johnson, 2009), that is, this study considered individuals' decisions as the result of the interaction of multiple decision processes. Specifically, the current research followed the assumptions of parallel-competitive structured process theories, which propose that multiple processes affect behavior simultaneously, resulting in conflict or alignment among these processes (e.g. Epstein, 1994; Sloman, 1996; Strack and Deutsch, 2004). Whenever several decision processes are in conflict (i.e., deliver different responses), cognitive resources should be taxed, resulting in longer response times and higher error rates. These predictions were confirmed in a response-times study by Achtziger and Alós-Ferrer (2014), which showed that more errors arise and responses are slower when Bayesian updating (i.e., normatively optimal behavior) is opposed to reinforcement learning of the form "win-stay, lose-shift." This research relied on a variant of the experimental paradigms employed in Achtziger and Alós-Ferrer (2014) but focused on the conflict with decision inertia, viewed as a further decision process. Hence, this study employed error rates and response times measurements to investigate the role of decision inertia in a belief-updating task. Specifically, the present study hypothesized that decision inertia is a further process potentially conflicting with optimal behavior and affecting decision outcomes and decision times. Accordingly, the main hypotheses were that more errors and slower choices would be made in cases of conflict between decision inertia and Bayesian updating.

To further explore decision inertia, Study 4 considered possible individual correlates of this decision process. The current study hypothesized that decision inertia would be associated with preference for consistency (PFC), which is a desire to be and look consistent within words, beliefs, attitudes, and deeds, as measured by the scale with the same name (Cialdini et al., 1995). Cialdini (2008) argues that because of the tendency to be consistent, individuals fall into the habit of being automatically consistent with previous decisions. Once decision makers make up their minds about a given issue, consistency allows them to not think through that issue again, but leads them to fail to update their beliefs in the face of new information when confronting new but similar decision situations. Furthermore, Pitz (1969) observed that inertia in the revision of opinions is the result of a psychological commitment to initial judgments. Thus, the present study hypothesized that preference for consistency might be one of the possible mechanisms driving decision inertia, in which case an individual's behavioral tendency to rely on decision inertia should be positively associated with their preference for consistency (PFC).

The last hypothesis concerned the kind of decisions leading to decision inertia. If this phenomenon arises from a tendency to be consistent with previous decisions, and hence economize decision costs, the effect should be stronger in autonomous decisions (free choices) than in required ones (forced choices). The present research made good use of the fact that the standard implementation of the paradigms the current study relies on include both forced and free choices to test this hypothesis.

2.4.2 Study 4a

Methods

Experimental design. The present study used the two-draw decision paradigm (Achtziger and Alós-Ferrer, 2014; Charness and Levin, 2005), where of course Bayesian updating is the rational strategy to derive optimal decisions. The experimental design is similar as the Bayesian updating task presented in Chapter 1 and used in Studies 1 – 3. The experimental task differs from the other studies only (but crucially) in the urn composition. The urn composition (i.e., number of black and white balls) in Study 4a is given in Table 2.2. Given the urn compositions in Study 4a, straightforward computations show that an optimizer should stay with the same urn as in the first draw after a win and switch after a loss. For example, if a black ball is extracted from the Left Urn, the updated probability of being in the state "up" is $(1/2)(2/6)/((1/2)(2/6)+(1/2)(4/6)) = 1/3$, hence choosing the Left Urn again delivers an expected payoff of $(1/3)(2/6)+(2/3)(4/6) = 5/9$, while switching to the Right Urn delivers a smaller expected payoff of $(1/3)(4/6)+(2/3)(2/6) = 4/9$. Note that optimizing behavior given this particular urn composition is fully aligned with that prescribed by an intuitive reinforcement rule (win-stay, lose-shift); This current study will return to this point in Study 4b. Decision inertia, on the other hand, prescribes to always stay with the same urn as in the first draw, independently of whether that decision resulted in a win or a loss. Hence, Bayesian updating conflicts with decision inertia after drawing a losing ball in the first draw.

Table 2.2 Study 4a. Urn composition in the Bayesian updating task

State (Prob)	Left Urn	Right Urn
Up (1/2)	● ● ○ ○ ○ ○	● ● ● ● ○ ○
Down (1/2)	● ● ● ● ○ ○	● ● ○ ○ ○ ○

The other experimental settings of the decision task is the same as Studies 1 to 3 (see Chapter 1.3). Participants repeated the two-draw decision 60 times. Both forced first draws and free first draws were included, which allows the present study to explore the effect of decision inertia in autonomous choices as opposed to required choices. To avoid confounding forced choices and learning effects, participants made forced draws and free draws alternately.

Participants. 45 participants (29 female; age range $18-32$, $M = 23.51$) participated in exchange for performance-based payment plus a show-up fee of 2.50 Euros. Three further participants had to be excluded from data analysis due to technical problems (missing data).

Procedure. Participants were randomly assigned to the two counterbalanced conditions (winning ball color). Before the start of the experiment, participants read instructions and answered control questions to ensure they understood the experiment properly. Then the experimental task started, which lasted around 10 minutes. After the task, participants filled in questionnaires (see Appendix D.1) including the Preference for Consistency Scale (Cialdini et al., 1995) and demographic questions. A session lasted about 1 hour and average earnings were 13.85 Euros ($SD = 1.02$).

Results

Error rates. Average error rates are depicted in Figure 2.8. The average of the individual error rates in case of conflict between inertia and Bayesian updating was 21.98% ($SD =$ 20.91%), versus just 10.18% ($SD = 17.43\%$) in case of alignment. To test for differences in the distribution of individual-level error rates, studies presented in Study 4 relied on non-parametric, two-tailed Wilcoxon Signed-Rank tests (WSR). The difference is highly significant (median error rate 15.63% in case of conflict, 5.26% in case of alignment; $N =$ 45, $z = 3.79$, $p < .001$). When the present study split the tests conditional on forced draws and free draws, the result holds both for forced draws (median error rate 14.29% in case of conflict ($M = 21.31\%$, $SD = 23.12\%$), 6.67% in case of alignment ($M = 11.56\%$, $SD =$ 17.62%); WSR test, $z = 2.89$, $p = .004$) and free draws (median error rate 17.65% in case of conflict ($M = 23.68\%$, $SD = 22.56\%$), 0% in case of alignment ($M = 8.84\%$, $SD = 18.03\%$); WSR test, $z = 3.94$, $p < .001$). Paired t-tests provide similar results, but since error rates are not normally distributed this study favors WSR tests, which are ordinal in nature. This study relied on standard WSR tests that adjust for zero differences, but results are highly similar when using WSR tests that ignore zero differences. Furthermore, to test the robustness of the

WSR results, the current study additionally ran a two-way ANOVA (Factor 1: conflict with inertia vs. alignment with inertia; Factor 2: forced draw vs. free draw) on log-transformed error rates. Since several participants had error rates of 0% (which is commonly observed in the present paradigm), this study used the log(x+1) transformation following Bartlett (1947) to be able to deal with zero values. The ANOVA results were consistent with the results based on the WSR test, showing a significant main effect of conflict with vs. alignment with inertia, but no main effect of forced vs. free draw and no interaction.

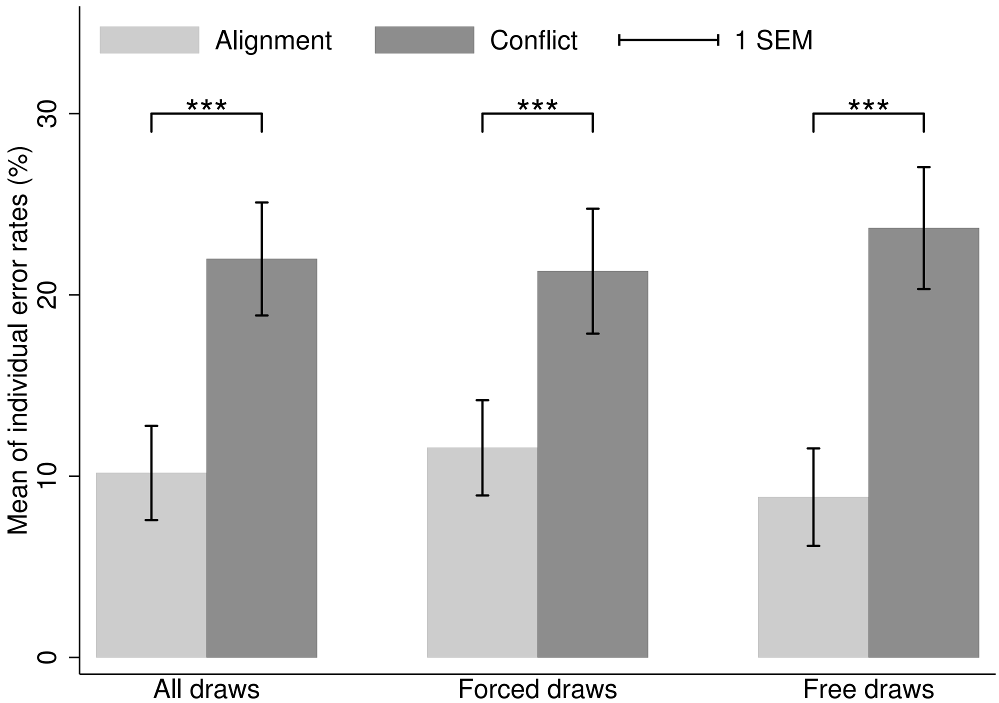

Fig. 2.8 Study 4a. Mean of individual error rates in case of alignment and conflict between Bayesian updating and inertia.

*Note: * p <.10, ** p <.05, *** p <.01*

Response times. Second-draw responses were significantly longer in case of conflict with inertia (Mdn = 973 ms, M = 1119 ms) than in case of alignment (Mdn = 903 ms, M = 1001 ms). The present research tested the difference in distributions with a WSR test on individual average response times (N = 45, z = 2.13, p = .033). However, the result only holds for free draws (z = 3.54, p < .001), but not for forced draws ($z = -.06$, p = .951).

This study further ran a two-way ANOVA (Factor 1: conflict with inertia vs. alignment with inertia; Factor 2: forced draw vs. free draw) on log-transformed response times (since the distribution of response times was skewed). Results were consistent with the WSR test, showing significant main effects of both factors and a significant interaction effect.

Discussion

The results of Study 4a support the idea that decision inertia corresponds to an automatic process conflicting with Bayesian updating, thereby affecting decision performance and decision times. In particular, more errors were made when Bayesian updating and decision inertia delivered different responses. Additionally, for free draws decisions were significantly slower when Bayesian updating and decision inertia were opposed compared to when they were aligned. However, this decision-times evidence of a decision conflict was not observed in forced draws, suggesting that the effect of decision inertia might be stronger following voluntary choices.

2.4.3 Study 4b

Study 4b investigated decision inertia in a more complex setting, where more than two decision processes are in conflict. Previous studies (Achtziger and Alós-Ferrer, 2014; Charness and Levin, 2005) have shown that in probability-updating paradigms, reinforcement processes (cued by winning or losing in the first draw) play a relevant role. By analyzing response times, Achtziger and Alós-Ferrer (2014) showed that reinforcement is a rather automatic process conflicting with the more controlled process of Bayesian updating. In Study 4a, due to the distribution of balls in the two urns, Bayesian updating and reinforcement were always aligned, and hence the current analysis could not be confounded with a conflict with reinforcement. Study 4b aimed to test if inertia still plays a role when reinforcement additionally conflicts with Bayesian updating. This present study used the same experimental paradigm as in Study 4a, but with a different urn composition, resulting in two kinds of (endogenous) decision situations. In the first kind, Bayesian updating and reinforcement were aligned, allowing for a conceptual replication of Study 4a. In the second kind, there was a conflict between Bayesian updating and reinforcement.

Method

Experimental design. All the experimental settings in Study 4b are the same as Studies 1 – 3. More details of the experimental design are shown in Chapter 1.3. Given this design, choosing the Right Urn in the first draw reveals the state of the world and the decision for the second draw is straightforward, i.e. win-stay, lose-shift. That is, as in Study 4a, both Bayesian updating and the reinforcement heuristic give the same prescription, but decision inertia conflicts with Bayesian updating after drawing a losing ball from this urn. Choosing the Left Urn in the first draw leads to a different situation. Given the posterior probability updated through Bayes' rule, Bayesian updating prescribes to stay after a loss and to switch after a win (win-shift, lose-stay), which is opposed to the prescriptions of reinforcement. Further, Bayesian updating conflicts with inertia after drawing a winning ball (but not after drawing a losing ball). Thus, after starting with left there are situations where reinforcement and decision inertia are aligned and both conflict with Bayesian updating.

Participants and Procedure. 44 participants (25 female; age range: $19-31$, $M = 23.80$) were recruited using the same enrollment method, experimental procedures, and payment rules as in Study 4a. Average earnings were 14.29 Euros ($SD = 0.78$). Four further participants had to be excluded from data analysis due to technical problems.

Results

Error rates. Figures 2.9 and 2.10 depict the averages of individual-level error rates depending on the type of draws in Study 4b. The comparison for situations with no conflict with reinforcement (the Right Urn situations; Figure 2.9) was analogous to Study 4a. In this case, error rates are naturally very low, because reinforcement learning prescribes the correct answer (e.g. Achtziger and Alós-Ferrer, 2014). The average error rate in case of conflict between decision inertia and Bayesian updating (further supported by reinforcement) was 5.37% ($SD = 11.67\%$), while in case of alignment between those two processes (hence alignment among all three processes) it was only 1.36% (SD = 5.31%). Although all medians were at a 0% error rate, the difference in distributions was significant (WSR test, $N = 44$, $z = 2.57$, $p = .010$). This result holds both for forced draws (WSR test: $N = 43$, $z = 2.21$, $p = .027$) and free draws (WSR test: $N = 43$, $z = 2.31$, $p = .021$). Note that for free draws the N is reduced due to a participant who avoided starting with the Right Urn when first draws were free, and hence provided no data for this particular comparison. We also excluded this participant from the corresponding analysis for forced draws to ensure that the subset of participants for the analysis of both draw types was the same. As in Study 4a, the current study additionally ran a two-way ANOVA on the transformed error rates as a robustness check. The pattern of results was consistent with the WSR tests, showing a significant main effect of conflict with vs. alignment with inertia, but no main effect of forced vs. free draw and no interaction.

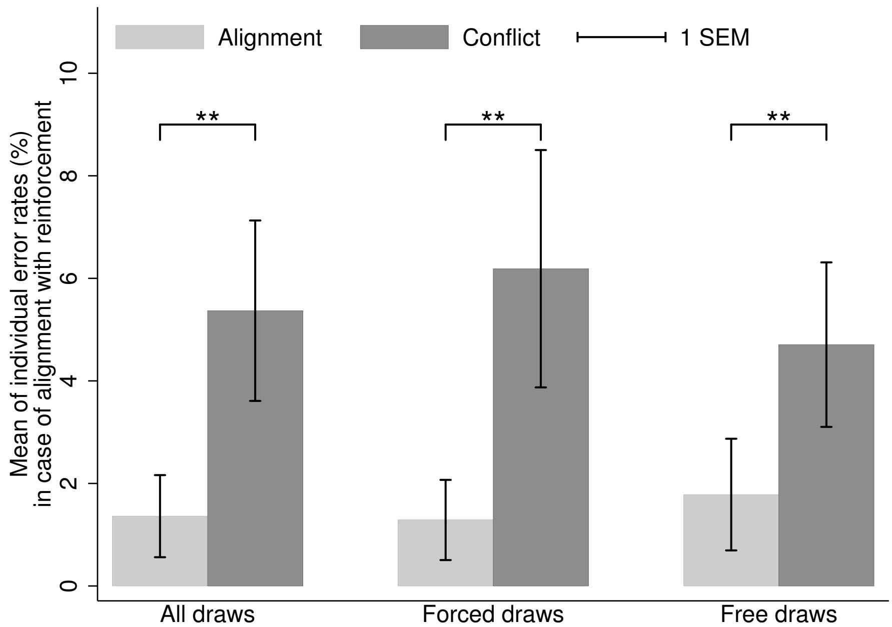

Fig. 2.9 Study 4b. Mean of individual error rates in case of alignment and conflict of Bayesian updating and inertia, for the situations where Bayesian updating is aligned with reinforcement (first draw from the Right Urn).

*Note: * p <.10, ** p <.05, *** p <.01*

In contrast, in situations where Bayesian updating conflicts with reinforcement (the Left Urn situations; Figure 2.10), error rates for the cases of conflict and alignment with decision inertia were similar (M = 49.92%, SD = 36.15% and M = 55.61%, SD = 31.44%, respectively). The difference was not significant (median in case of conflict 48.81%, in case of alignment 62.02%; WSR test: $N = 44$, $z = -0.86$, $p = .391$). If the present study considers only free draws, as expected, there are more errors in case of conflict between Bayesian updating and inertia (M = 74.19%, SD = 34.08%) than in case of alignment (M = 48.08%, SD = 34.23%). The difference in distributions is significant (median in case of conflict 90%, in case of alignment 50%; WSR test: $N = 25$, $z = 2.73$, $p = .006$). Note that in this case the test needs to exclude the participants who avoided starting with left when first draws were free, and hence provided no data for this particular comparison (indeed, this possibility is the original reason for including forced draws in the design). Again, this study also excluded these participants from the corresponding analysis for forced draws. If only considering forced draws, however, the difference of error rates between in case of conflict with inertia and in case of alignment with inertia is not significant (medians 66.67% in case of conflict (M = 63.26%, SD = 33.13%), 66.67% in case of alignment (M = 60.16%, SD = 27.61%); WSR test: $N = 25$, $z = 0.59$, $p = .554$). An additional ANOVA on the transformed error rates yielded results consistent with the WSR tests, showing a significant interaction effect, but no main effects of both factors.

Response times. In situations where Bayesian updating is aligned with reinforcement (the Right Urn situations), as expected, responses were slower in case of conflict between Bayesian updating and inertia (Mdn = 878 ms, M = 1025 ms) than in case of alignment (Mdn = 666 ms, M = 905). The WSR test was significant ($N = 44$, $z = 3.76$, $p < .001$). This result holds for both forced draws (median 943 ms in case of conflict and 744 in case of alignment; WSR test, $N = 43$, $z = 2.98$, $p = .003$) and free draws (median 796 ms in case of conflict and 623 in case of alignment; WSR test, $N = 43$, $z = 3.48$, $p < .001$). An additional ANOVA on log-transformed data yielded results consistent with the WSR tests, showing a significant main effect of conflict with vs. alignment with inertia and a significant main effect of forced vs. free draw, but no significant effect of interaction. In situations

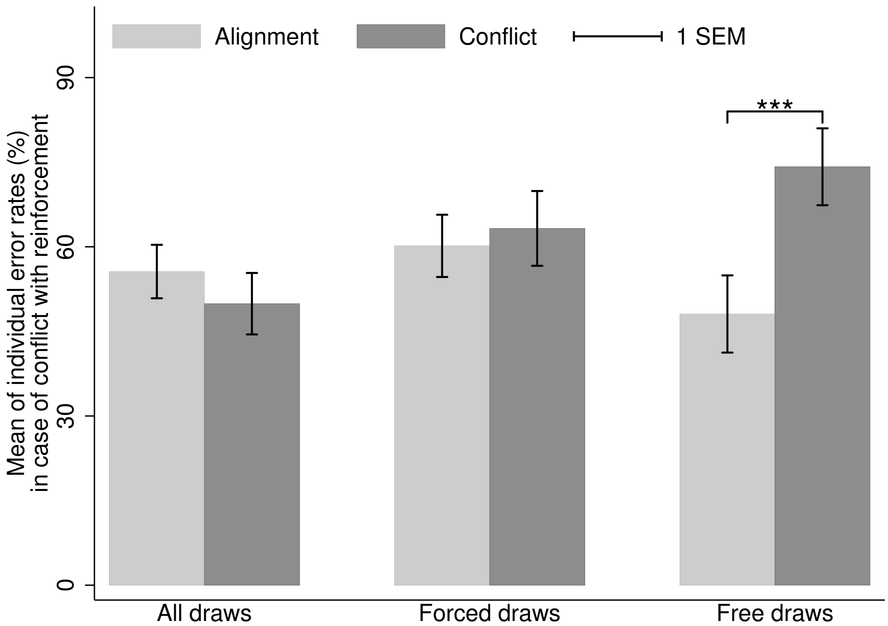

Fig. 2.10 Study 4b. Mean of individual average error rates in case of alignment and conflict of Bayesian updating and inertia, for the situations where Bayesian updating conflicts with reinforcement (first draw from the Left Urn).

*Note: * p <.10, ** p <.05, *** p <.01*

where Bayesian updating conflicts with reinforcement (the Left Urn situations), there is no significant difference between the response times in case of conflict between Bayesian updating and inertia (Mdn = 1579 ms, M = 1919 ms) and the response times in case of alignment (Mdn = 1595 ms, M = 2123 ms; WSR test: $N = 44$, $z = -.70$, $p = .484$). The same results hold when the test is made conditional on free draws (WSR test: $N = 25$, $z = .58$, $p = .563$). In forced draws, the results showed that the response times in case of conflict with inertia were faster than in case of alignment with inertia (median 1671 ms in case of conflict and 2182 in case of alignment; $N = 25$, $z = -2.19$, $p = .028$). An additional ANOVA on the transformed error rates yielded results consistent with the WSR tests, showing a significant main effect of forced vs. free draw, but no main effect of conflict with vs. aligment with inertia and no interaction.

Discussion

In decision situations without additional conflict due to reinforcement, which are comparable to Study 4a, the results show that more errors and slower responses are made in case of conflict between Bayesian updating and decision inertia in both forced and free draws, confirming that decision inertia exists for both required and autonomous choices. This replicates the results of Study 4a. When decisions are made in the presence of a conflict between Bayesian updating and reinforcement, the results suggest that decision inertia is only present for the case of voluntary (autonomous) previous choices. The response times results showed that after forced draws, faster responses are made in case of conflict with inertia than in case of alignment, which is inconsistent with the present study's assumption. The interpretation is that decision inertia is a subtle process, which might be partially washed out when reinforcement conflicts with Bayesian updating.

2.4.4 Decision Inertia and Preference for Consistency

This present research now investigates the proposed relationship between inertia and preference for consistency (PFC). At the same time, based on the insights from Studies 4a and 4b, the current research section examines more closely whether the effect of decision inertia varies according to the type of decisions (forced vs. free). This study measured PFC through the corresponding scale after the decision making part of the experiment was completed. The average PFC score in the current study was 4.28 ($SD = 1.86$). Internal consistency as measured by Cronbach's alpha was 0.83. To uncover the associations between decision inertia and PFC, and between decision inertia and decision autonomy, this study ran random-effects probit regressions on second-draw errors for the data from both studies (see Table 2.3). These regressions can control for a variety of other variables like round number, counterbalancing, and conflict with reinforcement (in Study 4b).

The results show that in both studies, the interaction effect of conflict with inertia and the PFC score is significantly positive, indicating that in case of conflict with inertia, a higher PFC score is associated with an increased probability of errors, which is consistent with the current study's assumption. In addition, in both studies, the interaction effect of conflict with inertia and forced draws is significantly negative, that is, the effect of decision inertia is stronger in free draws than in forced draws.

Table 2.3 Studies 4a-4b. Random-effects probit regressions on second-draw errors (1 = error)

Variables	Study 4a				Study 4b			
	Model 1		Model 2		Model 1		Model 2	
	$\beta(SE)$	p	$\beta(SE)$	p	$\beta(SE)$	p	$\beta(SE)$	p
ConflictR(1=Yes)					2.33(.09)***	< .001	2.43(.10)***	< .001
ConflictI(1=Yes)	0.19(.17)	.27	0.34(.18)*	.07	-0.34(.22)	.11	0.24(.24)	.32
PFC	-0.01(.07)	.92	-0.01(.07)	.92	0.11(.06)*	.08	0.11(.07)	.10
TrialNr	-0.31(.12)***	.007	-0.31(.12)***	.007	-0.30(.13)**	.02	-0.25(.13)	.06
WinColor(1=Black)	-0.38(.24)	.12	-0.37(.24)	.13	0.16(.20)	.43	0.16(.21)	.44
ConflictIxPFC	0.11(.04)***	.005	0.11(.04)***	.005	0.13(.04)***	.004	0.14(.04)***	.002
Forced(1=Yes)			0.20(.11)*	.06			0.54(.12)***	< .001
ConflictIxForced			-0.29(.14)**	.035			-1.03(.16)***	< .001
Constant	-1.23(.31)***	< .001	-1.34(.31)***	< .001	-2.84(.34)***	< .001	-3.27(.37)***	< .001
Wald chi2	97.54***	< .001	100.56***	< .001	617.22***	< .001	606.42***	< .001
Log likelihood	-954.66		-952.37		-780.66		-759.57	
No. of Obs.	2700		2700		2640		2640	

Note: * $p < .10$, ** $p < .05$, *** $p < .01$

2.4.5 General Discussion

Study 4 shows that decision inertia plays a role in human decision making under risk and investigates the underlying processes. This research finds a significant tendency to repeat previous choices in decision making with monetary feedback. Specifically, the current study found evidence for the existence of decision inertia in Study 4a and in decision situations without conflict with reinforcement in Study 4b. In contrast, in the Left-Urn situations in Study 4b, where reinforcement conflicts with Bayesian updating, only an effect of decision inertia after autonomous choices was found. The current study concludes that decision inertia seems to be subtle and easily overshadowed by stronger processes as e.g. reinforcement learning.

The present study hypothesized that decision inertia would be positively associated with PFC. The regression analysis confirms this hypothesis, indicating that the tendency to repeat past choices is a relevant part of individuals' need for being consistent. This finding agrees with those of Pitz (1969), who showed that the inertia effect observed in the revision of opinions results from a psychological commitment to one's initial judgments. It is not consistent with the results of Zhang et al. (2014, Study 2b), who found no relation between repetition of earlier decisions and PFC scores. However, Zhang et al. (2014) targeted unethical decisions and hence their setting is hard to compare to ours. The moral framing of the decisions in that work might have interacted with the hypothesized need for consistency. The results for free vs. forced draws provide further evidence that decision inertia might (at least partly) be based on a mechanism of consistency-seeking. Both of studies 4a and 4b suggest that the effect of decision inertia might vary according to the type of first-draw decisions. The results of the regression analyses confirm this idea, indicating that decision inertia is significantly stronger in autonomous choices than in required ones. Since one would assume that a psychological desire to be consistent with one's own decisions is stronger for self-selected compared to assigned decisions, this result further supports an interpretation of decision inertia as a facet of consistency-seeking.

In conclusion, Study 4 finds clear evidence for the existence of decision inertia in incentivized decision making. The present study sheds light on the process underlying decision inertia, by showing that this behavioral tendency is positively associated with an individual's preference for consistency, and that the effect of decision inertia is stronger in voluntary choices than in required choices.

Chapter 3

General Discussion

3.1 The Present Research

3.1.1 Overview

The present dissertation studies combined methods from social psychology, experimental psychology, and experimental economics to examine the processes underlying human decision making. The main focus was on the conflict between automatic processes and controlled processes in the context of a Bayesian updating task. Automatic processes do not always conflict with controlled processes and even lead to good judgement (e.g., Glöckner and Betsch, 2008; Klein, 1993). However, the quality of intuitive decisions cannot always be ensured (Plessner and Czenna, 2008). Moreover, due to the characteristics of being fast and unconscious, automatic processes are difficult to manipulate. This dissertation investigated whether certain variables moderate the automatic processes. With these moderating variables in mind, corresponding interventions can be applied to reduce the reliance on automatic processes in situations which they are adverse to decision performance. The presented studies relied on a probability updating paradigm where optimal decisions (i.e. maximizing individual payoff) require Bayesian updating of beliefs. At the same time, there are impulsive heuristics (e.g. reinforcement heuristic) that can either conflict with or be aligned with the prescriptions given by Bayes's rule. In this dissertation, situations that heuristics oppose

Bayesian rationality were addressed. In this Bayesian updating paradigm, self-control depletion (Study 1), deliberative and implemental mindsets (Study 2) and win versus loss framing (Study 3) were examined to assess whether they affect the decision processes. In Study 4, the existence and the psychological mechanism of decision inertia, another decision process separate from the reinforcement heuristic and Bayesian updating, was explored.

The basic research paradigm on which the presented studies were based is dual-process models of judgment and decision making (Evans, 2008; Weber and Johnson, 2009), postulating that human decisions are the result of an interaction of (at least) two different processes: fast, effortless, and unconscious automatic-processes as well as slow, effortful, and conscious controlled-processes. Previous studies (Achtziger and Alós-Ferrer, 2014; Charness and Levin, 2005) have shown experimental evidence to support this assumption. Through analyzing response times, Achtziger and Alós-Ferrer (2014) proved that in a probability updating task a more controlled decision process, Bayesian updating, interacted with a more automatic process, reinforcement learning. Concerning the automaticity of reinforcement, a recent EEG study (Achtziger et al., 2015a) used a similar paradigm and found that the reinforcement process is evident in the feedback-related negativity, an early event-related component of the EEG, implying that the reinforcement heuristic corresponds to a very quick, highly automatic process which requires early conflict detection and process inhibition in order to be stopped. Due to the automatic nature, it is challenging to control the impulsive and fast processes.

3.1.2 Findings

The experimental studies (Studies 1 – 4) presented used the same belief-updating paradigm from previous studies (Achtziger and Alós-Ferrer, 2014; Charness and Levin, 2005) as the measurement of decision performance. Participants made 60 two-draw decisions, which included both forced first draws and free first draws, and their decisions were incentivized. Different moderators of the decision performance were investigated by using various manipulations prior to the decision task.

Study 1 examined the effects of ego depletion on the incentivized decision-making task where the reinforcement heuristic can either conflict or be aligned with Bayesian updating.

According to the limited-resource model of self-control, depleted participants should have difficulties inhibiting the heuristic and are expected to commit more decision errors in case of conflict. Consequently, Study 1 hypothesized that when reinforcement opposed Bayesian updating, depleted participants had more frequent errors than the participants in the control condition. Three sub-studies were conducted using different depletion manipulations plus controls with milder versions (as standard in the literature). Specifically, Study 1a used the computerized version of Baumeister et al.'s (1998) letter *e* task from Sripada et al. (2014), Study 1b adopted the Stroop task (Stroop, 1935), and Study 1c implemented the retyping task (Muraven, 2008). The manipulation checks indicated that ego-depletion was induced successfully in all the sub-studies, though only Study 1a found the predicted effect in case of conflict. Study 1b found decreased error rates for depleted participants in case of alignment, which is consistent with an increased reliance on the heuristic in this case. Study 1c did not find any effects of ego-depletion on the error rates, neither in conflicting situations nor in aligned cases. It seems that the effects of self-control depletion in complex decision-making tasks are less systematic and robust than previously assumed in the literature.

Study 2 investigated the effects of deliberative and implemental mindsets on decision behavior in the same incentivized decision task as in Study 1. According to mindset theory, deliberative and implemental mindsets affect cognition and performance differently. Individuals in the deliberative mindset process information in an unbiased way, whereas individuals in the implemental mindset process information selectively. Study 2 tested the hypothesis that these different styles of information processing would affect participants' reliance on the reinforcement heuristic or Bayesian updating, and hence their performance in the belief-updating task. In order to examine whether the changes of performance are caused by the deliberative mindset, the implemental mindset, or by both, Study 2 included a neutral mindset condition and a baseline condition, in which no mindset was induced prior to the decision task. Study 2 applied the classic deliberative and implemental mindsets manipulation from Gollwitzer and Kinney (1989). The results of the manipulation tasks were carefully checked to ensure that the participants were deeply involved in the task. Surprisingly, the results of Study 2 showed that the neutral mindset manipulation improved decision performance. This manipulation decreased participants' reliance on the reinforcement heuristic and accordingly their error rates in the decision task, compared to the deliberative and implemental mindsets conditions and the baseline condition. Since this effect was particularly pronounced in autonomous decisions, it follows that the performance enhancement might be based on a boost in self-efficacy. In Study 2, no differences were observed concerning the effects of the deliberative and the implemental mindsets on decision performance.

In light of the findings in Studies 1 and 2, Study 3 set out to investigate whether the reinforcement heuristic could be experimentally manipulated given its highly automatic nature. Previous study showed that in simple reinforcement-learning paradigms, there is some evidence that loss frames are more motivating than gain frames. For instance, Niznikiewicz and Delgado (2011) found enhanced learning effects and a stronger modulation of activity in the brain's reward circuitry when participants learned to avoid monetary losses, compared to when they learned to earn monetary rewards. Study 3 used the same incentivized probability-updating task as Studies 1 and 2, but framed the decision goal differently, thus investigated the effect of win/loss framing on individuals' use of a reinforcement heuristic. Consistent with the literature on loss aversion, the results of Study 3 showed that a loss frame strengthened the basic impulse to shift away from an unsuccessful option, if this option was chosen freely before.

Study 4 focused on exploring the existence and the mechanism of decision inertia, namly the tendency to repeat previous choices independently of the outcome, in the belief-updating tasks. Study 4a showed that, whenever decision inertia conflicts with normatively optimal behavior (Bayesian updating), error rates were larger and decisions were slower. This is consistent with a dual-process view of decision inertia as an automatic process conflicting with a more rational, controlled one. The results showed evidence of decision inertia in both required and autonomous decisions, but the effect of inertia was found to be more clear in the latter. Study 4b considered more complex decision situations where further conflict arises due to reinforcement processes. The same effects of decision inertia were found when reinforcement is aligned with Bayesian updating, but if the two latter processes conflict, the effects were limited to autonomous choices. Additionally, both studies showed that the tendency to rely on decision inertia was positively associated with preference for consistency.

To summarize, this research investigated the effect of self-control depletion, mindsets, framing, and preference for consistency on the dependence on intuitive heuristics. Although the results regarding ego-depletion effect were not systematic, the present dissertation found moderating effects on decision processes from a variety of other variables. As shown in Study 2, boosting self-efficacy would help with reducing the use of faulty heuristic in case of heuristic opposing rational strategies. Furthermore, according to the results from Study 3, reinforcement heuristic can be manipulated by introducing a loss frame. Specifically, a loss frame can strengthen the impulse to avoid the autonomous decision which previously led to negative outcomes. Moreover, Study 4 proved the existence of a decision inertia heuristic and found that preference for consistency is positively associated with the reliance on decision intertia. Thus, lowering the preference for consistency might weaken the tendency to repeat previous choices regardless of outcomes.

3.2 Implications, Future Research, and Limitations

Researchers in the field of social sciences have a growing interest in bridging psychology and economics (e.g., Van Lange, 2006). Both disciplines benefit from this bridging. For instance, economics can gain from psychological techniques and methods (e.g., measuring error rates or response times) to reveal the underlying processes or systems of human decisions, while psychology can greatly profit from the formal approaches characterizing modern economics. However, most decision research in psychology (especially social psychology) investigate simple decision tasks, such as binary choices (Vohs et al., 2008), or simple heuristic-based decisions (e.g., recognition heuristic) (Masicampo and Baumeister, 2008; Pohl et al., 2013). In contrast, the present dissertation adopted tasks from economics, where the best performance or the optimal decisions require full rationality, i.e. Bayesian updating. In the decision tasks, the conflict between simple heuristics and Bayesian updating was addressed. The investigation of the competition between automatic heuristics and more controlled Bayesian rationality is highly relevant to human decisions in reality because the actual human decision maker is more likely found somewhere between the fully rational homo economicus, who is unaffected by automatic reactions, and the completely irrational decision makers with "zero rationality", who follows mindless behavioral rules without deliberation. This argument is consistent with Zizzo et al.'s (2000) observation that, although participants violated the Bayes' rule, the participants did not perform randomly with "zero rationality". Hence, the probability updating paradigm this research implemented can simulate the actual environment of the human decision processes to some extent.

Many researchers have addressed the question whether biases or reliance on heuristics can be influenced by external manipulations (Fischhoff, 1982). Similarly, this research aimed to investigate if certain variables can alter the dependence on automatic or controlled processes. As previously stated, automatic processes might be an effective shortcut in simple settings. However, in some situations, the use of intuitive strategies can seriously impair decision performance. As previous studies (Achtziger and Alós-Ferrer, 2014; Charness and Levin, 2005) have shown, under a conflict between a reinforcement heuristic and Bayesian rationality, individuals frequently rely on the faulty heuristic, neglecting information on underlying uncertain events, and hence committing decision errors frequently. This dissertation examined the effect of self-control depletion, mindsets, framing, and preference for consistency on the use of automatic heuristics under circumstances in which the heuristics are adverse to decision performance. Although the automatic processes are fast and unconscious, the current research showed that some approaches can influence the dependence on intuitive strategies, for instance, by boosting self-efficacy or by weakening personal preference for consistency might help to decrease the use of intuitive reasoning.

Further research may explore how self-efficacy moderates the decision processes. This dissertation found that neutral mindset manipulation decreased participants' reliance on the reinforcement heuristic (see Study 2). The current research argued that the performance enhancement might have been caused by a boost in self-efficacy. It seems that when individuals perceive themselves as more competent, they might be less likely to rely on their intuition. Indeed, there are studies showing that intuitive decision making can enhance self-efficacy

(Leslie and Moilanen, 2010), but research regarding the effect of high self-efficacy on intuitive decisions is still rare. In addition, further research may investigate how autonomy moderates the use of intuitive decisions or automatic processes in decision making. This dissertation observed that autonomous decisions are more sensitive to the influence of moderators on intuitive reasoning. Specifically, the influence from the neutral mindset manipulation (see Study 2) and the loss frame on decision processes (see Study 3) is only limited to decisions with free first draw. Moreover, Study 4 showed evidence of decision inertia in both required and autonomous decisions, but the effect of inertia was found to be stronger in the latter. These findings indicate that autonomy might play a role in the decision process. For future studies, investigating if and how autonomy interacts with these moderators on automatic decision making or intuitive reasoning might be interesting.

This dissertation also found results inconsistent with some hypotheses. For instance, Study 1 used three different ego-depletion manipulations to examine the ego-depletion effect on decision making. But only Study 1a supported the hypothesis that ego-depletion can lead to a higher reliance on automatic processes, which in turn resulted in more frequent errors in the decision task in case of conflict. Studies 1b and 1c did not provide evidence consistent with the hypothesis. Possible reasons, such as monetary incentive, were mentioned in Chapter 2 to explain these inconsistent results. For the ego-depletion effect, it is obvious that the mechanism of ego-depletion itself is still unclear. More research is needed to uncover the mechanism of the limited self-control resource. Secondly, Study 2 found that the deliberative versus implemental mindsets did not affect decision performance differentially. It is possible that Study 2 failed to identify any differences between deliberative and implemental mindsets because of the complexity of the decision task at hand. The effects of deliberative and implemental mindsets might be more salient in tasks with lower complexity, since the differentiated effect of deliberative versus implemental mindsets is always found in simpler tasks. Thus, future research can further investigate these variables with a different decision paradigm. For this purpose, the experimental paradigm provided by Daw et al. (2011) (to study the interaction of model-based and model-free values) can be modified slightly and then implemented as a simpler paradigm such that it is comparable to the probability updating task in the current research.

3.3 Conclusion

In the context of probability updating tasks, decision inertia was found as another decision process apart from a reinforcement-based heuristic and Bayesian rationality. It was demonstrated that self-efficacy, loss frame, and preference for consistency affect the reliance on heuristics in the case that there are conflicts between Bayesian updating and intuitive strategies. These results are of considerable significance because in many daily situations people have to make decisions based on prior knowledge and new information, therefore experiencing conflict between intuitive and rational reasoning. In such conflict situations, faulty reliance on non-deliberative reasoning can impair decision performance, with significant negative impact on the decision maker. The current study suggested some hints to reduce decision makers' use of detrimental heuristics, for example, by boosting self-efficacy or reducing personal preference for consistency. Moreover, future work could be done to better understand the mechanism of how these variables moderate the automatic decision processes.

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Appendix A

Material of Study 1 (in German)

A.1 General Instructions

Liebe Versuchsteilnehmerin, lieber Versuchsteilnehmer,

vielen Dank für Ihre Teilnahme an diesem Experiment.

Das Experiment wird insgesamt maximal 1 Stunde und 45 Minuten dauern. Bitte beachten Sie, dass während dieser Zeit jegliche Kommunikation mit anderen Versuchsteilnehmern untersagt ist und zum Ausschluss von allen Zahlungen führt. Sollten Sie irgendwelche Fragen haben, heben Sie bitte deutlich Ihre Hand und bleiben ruhig an Ihrem Platz sitzen bis wir zu Ihnen kommen um Ihre Frage zu beantworten.

Im Labor sind eine Kamera sowie ein Mikrofon installiert. Diese dienen lediglich der Beaufsichtigung des Ablaufs des Experiments. Es werden weder Bild noch Ton aufgezeichnet.

Im Experiment werden Sie verschiedene Aufgaben bearbeiten.
Die wesentliche Aufgabe besteht in einem **Entscheidungsspiel**, bei welchem Sie Kugeln aus Urnen ziehen und durch geschickte Entscheidungen sowie etwas Glück Geld verdienen

können. Außerdem gibt es eine Reaktionsaufgabe, bei der es darum geht, möglichst schnell auf Wörter zu reagieren (***for Studies 1a-1b***). [Außerdem gibt es eine Textverarbeitungsaufgabe, bei der es darum geht, einen vorgegebenen Text möglichst schnell abzutippen (***for Study 1c***)]. Am Ende des Experiments folgt noch ein Fragebogen.

Ihre **Auszahlung**, die Sie am Ende des Experimentes erhalten, setzt sich folgendermaßen zusammen:

- Auszahlung aus dem Entscheidungsspiel: Diese hängt von Ihren Entscheidungen sowie vom Zufall ab. Dies wird in den zugehörigen Instruktionen genau erklärt.
- Teilnahmevergütung: Entsprechend dem Umfang des Experiments erhalten Sie zusätzlich zur üblichen Teilnahmevergütung von 2,50 Euro noch 5,00 Euro extra.

Am Ende des Experiments wird Ihnen die Gesamtsumme (Betrag in Euro aus dem Entscheidungsspiel plus 7,50 Euro) bar und anonym ausgezahlt.

Zunächst werden Sie Instruktionen für das Entscheidungsspiel und die Reaktionsaufgabe erhalten. Es ist wichtig, dass Sie die Instruktionen sowie alle Erläuterungen am Computerbildschirm genau durchlesen.

Wir werden nun als erstes die Instruktionen für das Entscheidungsspiel austeilen.

A.2 Decision Task Instructions

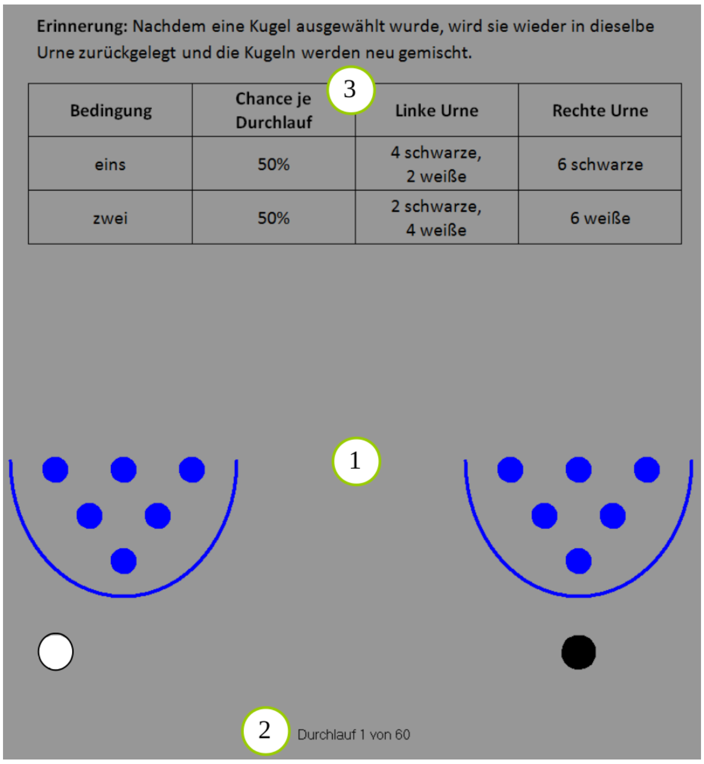
(*Note that instructions for the decision task in Studies 1, 2 and 4b are exactly the same. Instructions for the decision task in Study 4a only differ in the urn composition from the current version*)

A.2.1 Instructions for counterbalance condition 1

Bei diesem Spiel werden Ihnen auf dem Bildschirm zwei Behälter („Urnen“) präsentiert. In diesen Urnen befinden sich schwarze und weiße Kugeln. Ziel des Spiels ist es, möglichst viele schwarze Kugeln zu ziehen. Dazu muss nach bestimmten Regeln möglichst geschickt aus den beiden Urnen gezogen werden. Im Folgenden werden zunächst die Elemente auf dem Bildschirm und die Bedienung über Tastatur erklärt. Anschließend folgen die genauen Spielregeln.

Bildschirm

1) In der Bildschirmmitte werden Ihnen zwei Urnen angezeigt. In jeder Urne befinden sich sechs Kugeln. Es gibt schwarze und weiße Kugeln. Am Bildschirm werden sie blau angezeigt, so lange sie „verdeckt“ in der Urne sind. Unter den Urnen wird angezeigt, welche Kugeln Sie in diesem Durchgang bereits gezogen haben. Im obigen Beispiel also eine schwarze und eine weiße.
Beachten Sie: *Wenn eine Urne nicht blau, sondern grau angezeigt wird, können Sie gerade nicht aus ihr ziehen und müssen deshalb die andere wählen.*
2) Unten in der Mitte werden Sie informiert, wie viele Durchläufe Sie bereits absolviert haben.
3) Im oberen Bereich des Bildschirms sind zentrale Informationen aus den Spielregeln zusammengefasst.



Bedienung

Die Bedienung erfolgt ausschließlich über drei Tasten. Zwei Tasten sind auf der Tastatur gelb markiert. Mit der linken („F“) ziehen Sie eine Kugel aus der linken Urne und entsprechend mit der rechten („J“) eine aus der rechten Urne. Mit der Leertaste starten Sie einen neuen Durchlauf, wenn Sie auf dem Bildschirm dazu aufgefordert werden.

Beachten Sie: *Sie können nur dann aus einer Urne ziehen, wenn diese blau angezeigt wird. Wenn eine der beiden Urnen grau angezeigt wird, müssen Sie also die andere per Tastendruck auswählen. Wenn beide Urnen blau angezeigt werden, können Sie sich frei für eine der beiden Urnen entscheiden.*

Spielregeln

Ablauf

Insgesamt werden 60 Durchläufe absolviert, von denen jeder aus zwei Zügen besteht. Zu Beginn jedes Durchlaufs ziehen Sie per Tastendruck eine Kugel aus einer Urne. In allen ungeraden Durchläufen (Durchlauf 1, 3, 5, usw.) ist die Urne, aus der der erste Zug erfolgt, festgelegt; in allen geraden Durchläufen (Durchlauf 2, 4, 6, usw.) können Sie die Urne für den ersten Zug frei wählen. Der Zufall bestimmt, welche der Kugeln aus der Urne gezogen wird. Das Ergebnis (schwarz oder weiß) wird unter der Urneangezeigt und Sie dürfen erneut ziehen. Auch das Ergebnis des zweiten Zugs wird unter der entsprechenden Urne angezeigt. Abschließend beginnen Sie nach dem Hinweis auf dem Bildschirm durch Betätigen der Leertaste einen neuen Durchlauf.

Beachten Sie: Eine gezogene Kugel wird sofort wieder in die Urne zurückgelegt! Durch das Ziehen einer Kugel verändert sich also zwischen erstem und zweitem Zug nicht die Anzahl der schwarzen und weißen Kugeln in den Urnen. Sie ziehen beide Male aus den absolut selben Urnen.

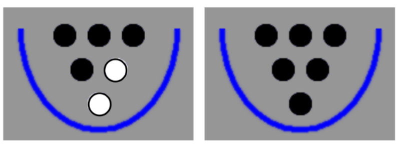
Gewinnmöglichkeit

Für jede **schwarze** Kugel, die Sie ziehen, bekommen Sie **18 Cent** gutgeschrieben; für das Ziehen einer weißen Kugel bekommen Sie nichts. Durch geschicktes Ziehen und mit ein bisschen Glück können Sie in diesem Experiment also eine beträchtliche Summe verdienen!

Umweltbedingungen

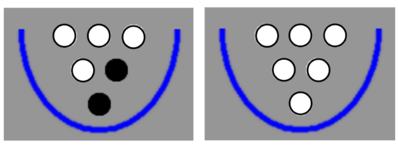
Das Wichtigste an diesem Spiel ist daher, dass Sie verstehen, wie viele schwarze und weiße Kugeln sich in den Urnen befinden. Lesen Sie die folgenden Abschnitte also besonders aufmerksam! Im Experiment werden *zwei Umweltbedingungen* unterschieden:

In der **ersten Umweltbedingung** befinden sich in der linken Urne 4 schwarze und 2 weiße Kugeln, in der rechten Urne befinden sich 6 schwarze Kugeln.



linke Urne rechte Urne

In der **zweiten Umweltbedingung** befinden sich in der linken Urne 2 schwarze und 4 weiße Kugeln, in der rechten Urne befinden sich 6 weiße Kugeln.

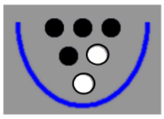
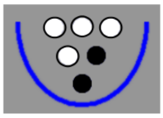
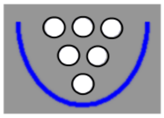


linke Urne rechte Urne

Wie bereits erwähnt, müssen Sie in jedem Durchlauf zuerst eine Kugel aus einer der beiden Urnen ziehen, die dann wieder zurück gelegt wird, und Sie ziehen danach die nächste Kugel. Allerdings wissen Sie dabei nicht, ob für den jeweiligen Durchlauf die erste oder die zweite Umweltbedingung herrscht. Dies wird für jeden einzelnen Durchlauf per Zufall durch den Zufallsgenerator des Computers festgelegt. Die Chance dafür, in einem Durchlauf die erste oder die zweite Umweltbedingung vorzufinden, liegt jedes Mal bei 50 %.

Beachten Sie: Während eines Durchlaufs verändert sich die Umweltbedingung nicht!

In der folgenden Tabelle ist die Verteilung der schwarzen und weißen Kugeln unter den verschiedenen Umweltbedingungen nochmals zusammenfassend dargestellt.

Bedingung	**Chance je Durchlauf**	**Linke Urne**		**Rechte Urne**	
eins	50 %	4 schwarze, 2 weiße		6 schwarze	
zwei	50 %	2 schwarze, 4 weiße		6 weiße	

Um möglichst oft eine schwarze Kugel zu ziehen und damit möglichst viel Geld zu verdienen, ist es wichtig, dass Sie die obige Tabelle wirklich verstanden haben. Bei Unklarheiten dazu oder zum Versuch generell fragen Sie bitte nach, indem Sie deutlich die Hand heben und warten, bis jemand an Ihren Platz kommt.

Zur Erinnerung: Für jede gezogene **schwarze** Kugel werden Ihnen **18 Cent** gutgeschrieben.

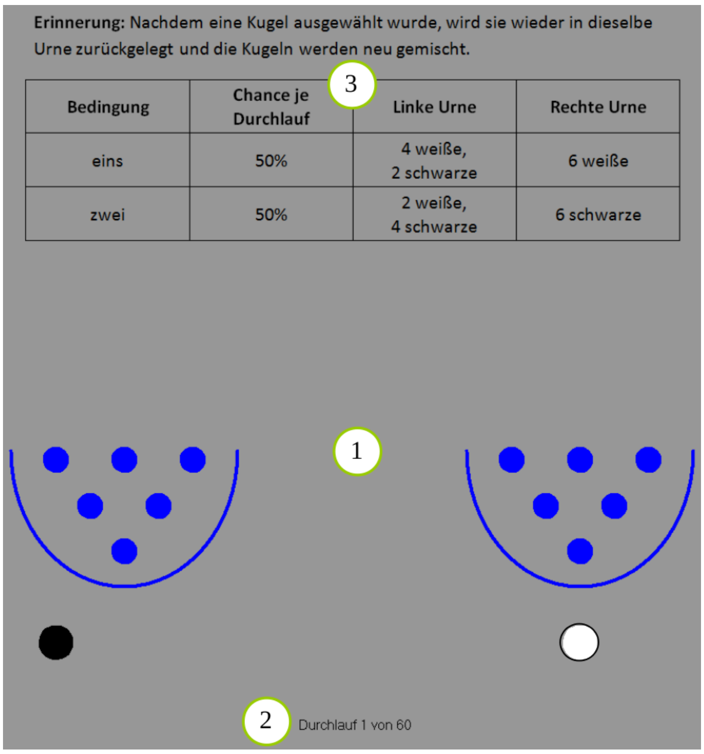
Viel Spaß und viel Erfolg!

A.2.2 Instructions for counterbalance condition 2

(*Note that instructions for the decision task in Studies 1, 2 and 4b are exactly the same. Instructions for the decision task in Study 4a only differ in the urn composition from the current version*)

Bei diesem Spiel werden Ihnen auf dem Bildschirm zwei Behälter („Urnen“) präsentiert. In diesen Urnen befinden sich weiße und schwarze Kugeln. Ziel des Spiels ist es, möglichst viele weiße Kugeln zu ziehen. Dazu muss nach bestimmten Regeln möglichst geschickt aus den beiden Urnen gezogen werden. Im Folgenden werden zunächst die Elemente auf dem Bildschirm und die Bedienung über Tastatur erklärt. Anschließend folgen die genauen Spielregeln.

Bildschirm



1) In der Bildschirmmitte werden Ihnen zwei Urnen angezeigt. In jeder Urne befinden

sich sechs Kugeln. Es gibt weiße und schwarze Kugeln. Am Bildschirm werden sie blau angezeigt, so lange sie „verdeckt“ in der Urne sind. Unter den Urnen wird angezeigt, welche Kugeln Sie in diesem Durchgang bereits gezogen haben. Im obigen Beispiel also eine schwarze und eine weiße.

Beachten Sie: *Wenn eine Urne nicht blau, sondern grau angezeigt wird, können Sie gerade nicht aus ihr ziehen und müssen deshalb die andere wählen.*

2) Unten in der Mitte werden Sie informiert, wie viele Durchläufe Sie bereits absolviert haben.

3) Im oberen Bereich des Bildschirms sind zentrale Informationen aus den Spielregeln zusammengefasst.

Bedienung

Die Bedienung erfolgt ausschließlich über drei Tasten. Zwei Tasten sind auf der Tastatur gelb markiert. Mit der linken („F“) ziehen Sie eine Kugel aus der linken Urne und entsprechend mit der rechten („J“) eine aus der rechten Urne. Mit der Leertaste starten Sie einen neuen Durchlauf, wenn Sie auf dem Bildschirm dazu aufgefordert werden.

Beachten Sie: *Sie können nur dann aus einer Urne ziehen, wenn diese blau angezeigt wird. Wenn eine der beiden Urnen grau angezeigt wird, müssen Sie also die andere per Tastendruck auswählen. Wenn beide Urnen blau angezeigt werden, können Sie sich frei für eine der beiden Urnen entscheiden.*

Spielregeln

Ablauf

Insgesamt werden 60 Durchläufe absolviert, von denen jeder aus zwei Zügen besteht. Zu Beginn jedes Durchlaufs ziehen Sie per Tastendruck eine Kugel aus einer Urne. In allen ungeraden Durchläufen (Durchlauf 1, 3, 5, usw.) ist die Urne, aus der der erste Zug erfolgt, festgelegt; in allen geraden Durchläufen (Durchlauf 2, 4, 6, usw.) können Sie die Urne für den ersten Zug frei wählen. Der Zufall bestimmt, welche der Kugeln aus der Urne gezogen wird. Das Ergebnis (weiß oder schwarz) wird unter der Urne angezeigt und Sie dürfen erneut ziehen. Auch das Ergebnis des zweiten Zugs wird unter der entsprechenden Urne angezeigt. Abschließend beginnen Sie nach dem Hinweis auf dem Bildschirm durch Betätigen der Leertaste einen neuen Durchlauf.

Beachten Sie: Eine gezogene Kugel wird sofort wieder in die Urne zurückgelegt! Durch das Ziehen einer Kugel verändert sich also zwischen erstem und zweitem Zug nicht die Anzahl der weißen und schwarzen Kugeln in den Urnen. Sie ziehen beide Male aus den absolut selben Urnen.

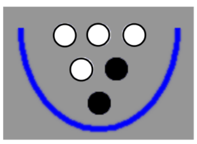
Gewinnmöglichkeit

Für jede **weiße** Kugel, die Sie ziehen, bekommen Sie **18 Cent** gutgeschrieben; für das Ziehen einer schwarzen Kugel bekommen Sie nichts. Durch geschicktes Ziehen und mit ein bisschen Glück können Sie in diesem Experiment also eine beträchtliche Summe verdienen!

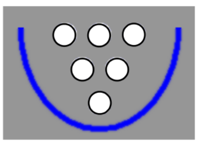
Umweltbedingungen

Das Wichtigste an diesem Spiel ist daher, dass Sie verstehen, wie viele weiße und schwarze Kugeln sich in den Urnen befinden. Lesen Sie die folgenden Abschnitte also besonders aufmerksam! Im Experiment werden zwei Umweltbedingungen unterschieden:

In der **ersten Umweltbedingung** befinden sich in der linken Urne 4 weiße und 2 schwarze Kugeln, in der rechten Urne befinden sich 6 weiße Kugeln.

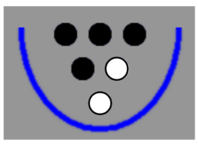


linke Urne



rechte Urne

In der **zweiten Umweltbedingung** befinden sich in der linken Urne 2 weiße und 4 schwarze Kugeln, in der rechten Urne befinden sich 6 schwarze Kugeln.



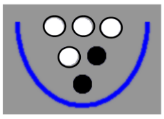
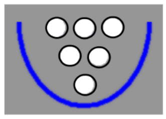
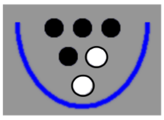
linke Urne

rechte Urne

Wie bereits erwähnt, müssen Sie in jedem Durchlauf zuerst eine Kugel aus einer der beiden Urnen ziehen, die dann wieder zurück gelegt wird, und Sie ziehen danach die nächste Kugel. Allerdings wissen Sie dabei nicht, ob für den jeweiligen Durchlauf die erste oder die zweite Umweltbedingung herrscht. Dies wird für jeden einzelnen Durchlauf per Zufall durch den

Zufallsgenerator des Computers festgelegt. Die Chance dafür, in einem Durchlauf die erste oder die zweite Umweltbedingung vorzufinden, liegt jedes Mal bei 50 %.
Beachten Sie: Während eines Durchlaufs verändert sich die Umweltbedingung nicht!

In der folgenden Tabelle ist die Verteilung der weißen und schwarzen Kugeln unter den verschiedenen Umweltbedingungen nochmals zusammenfassend dargestellt.

Bedingung	**Chance je Durchlauf**	**Linke Urne**		**Rechte Urne**	
eins	50 %	4 weiße, 2 schwarze		6 weiße	
zwei	50 %	2 weiße, 4 schwarze		6 schwarze	

Um möglichst oft eine weiße Kugel zu ziehen und damit möglichst viel Geld zu verdienen, ist es wichtig, dass Sie die obige Tabelle wirklich verstanden haben. Bei Unklarheiten dazu oder zum Versuch generell fragen Sie bitte nach, indem Sie deutlich die Hand heben und warten, bis jemand an Ihren Platz kommt.

Zur Erinnerung: Für jede gezogene **weiße** Kugel werden Ihnen **18 Cent** gutgeschrieben.

Viel Spaß und viel Erfolg!

A.3 Control Questions

(*note that control questions for the decision task in Studies 1 – 3 and Study 4b are exactly the same; The control questions in Study 4a only differ slightly from the current version according to the different urn composition*)

1. Wie hoch (in Prozent) ist die Wahrscheinlichkeit, in einem Durchlauf die zweite Umweltbedingung vorzufinden?

2. Aus wievielen Zügen besteht ein Durchlauf?

3. Wie oft wird der Umweltzustand durch den Zufallsgenerator des Computers neu festgelegt?

4. Angenommen, Sie befinden sich in Umweltzustand 1. Wieviele schwarze Kugeln befinden sich in der rechten Urne? (***counterbalance condition 1***)

4. Angenommen, Sie befinden sich in Umweltzustand 1. Wieviele weiße Kugeln befinden sich in der rechten Urne? (***counterbalance condition 2***)

5. Angenommen, Sie befinden sich in Umweltzustand 2. Wieviele weiße Kugeln befinden sich in der linken Urne? (***counterbalance condition 1***)

5. Angenommen, Sie befinden sich in Umweltzustand 2. Wieviele schwarze Kugeln befinden sich in der linken Urne? (***counterbalance condition 2***)

6. Angenommen, Sie befinden sich in Umweltzustand 2 und haben im ersten Zug eine schwarze Kugel aus der linken Urne gezogen. Wieviele schwarze Kugeln befinden sich in der linken Urne, wenn Sie das zweite Mal aus dieser Urne ziehen? (***counterbalance condition 1***)

6. Angenommen, Sie befinden sich in Umweltzustand 2 und haben im ersten Zug eine weiße Kugel aus der linken Urne gezogen. Wieviele weiße Kugeln befinden sich in der linken Urne, wenn Sie das zweite Mal aus dieser Urne ziehen? (***counterbalance condition 2***)

7. Für Kugeln welcher Farbe werden Sie im Experiment bezahlt?

8. Welchen Cent-Betrag erhalten Sie für das Ziehen einer Kugel mit der entsprechenden Farbe?

A.4 Final Questionnaire

(*final questionnaire for Studies 1a – 1c*)

Bitte bewegen Sie den Schieberegler auf jeder Skala von links nach rechts um anzugeben, inwieweit Sie den folgenden Aussagen zu Ihrer Person zustimmen bzw. nicht zustimmen. Es gibt hierbei keine richtigen oder falschen Antworten.

1. Ich fühle mich mental erschöpft.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

2. Es würde mir im Moment schwer fallen, mich auf etwas zu konzentrieren.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

3. Ich brauche etwas Angenehmes, um mich besser zu fühlen.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

4. Ich bin motiviert.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

5. Wenn ich jetzt eine schwierige Aufgabe gestellt bekäme, würde ich schnell aufgeben.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

6. Ich fühle mich erledigt

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

7. Ich habe viel Energie.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

8. Ich fühle mich abgespannt.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

9. Wenn ich im Augenblick durch etwas in Versuchung geführt würde, würde es mir sehr schwer fallen, zu widerstehen.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

10. Ich würde jede schwierige Aufgabe, die mir gestellt würde, aufgeben wollen.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

11. Ich fühle mich ausgeglichen.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

12. Ich kann keine Information mehr aufnehmen.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

13. Ich fühle mich antriebslos.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

14. Im Moment würde es mir schwer fallen, Pläne für die Zukunft zu schmieden.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

15. Ich fühle mich wach und konzentriert.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

16. Ich möchte aufgeben.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

17. Dies wäre ein guter Zeitpunkt für mich, um eine wichtige Entscheidung zu treffen.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

18. Ich fühle mich, als hätte ich keine Willenskraft mehr.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

19. Es fällt mir schwer, momentan meine Aufmerksamkeit aufrechtzuerhalten.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

20. Ich bin im Moment in der Lage, mich gut konzentrieren zu können.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

21. Mein geistiger Akku ist leer.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

22. Im Augenblick würde mich eine neue Herausforderung reizen.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

23. Ich würde mich gerne eine Weile entspannen.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

24. Es fällt mir gerade schwer, meine Bedürfnisse zu kontrollieren.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

25. Ich fühle mich entmutigt.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

Bitte bewegen Sie den Schieberegler auf jeder Skala von links nach rechts um anzugeben, inwieweit Sie den folgenden Aussagen zu Ihrer Person zustimmen bzw. nicht zustimmen. Es gibt hierbei keine richtigen oder falschen Antworten.

1. Wie glücklich fühlen Sie sich im Moment?

   gar nicht ⟵⟶ sehr

2. Wie niedergeschlagen fühlen Sie sich im Moment?

   gar nicht ⟵⟶ sehr

3. Wie euphorisch fühlen Sie sich im Moment?

   gar nicht ⟵⟶ sehr

4. Wie zufrieden fühlen Sie sich im Moment?

   gar nicht ⟵⟶ sehr

5. Wie aufgeregt fühlen Sie sich im Moment?

   gar nicht ⟵⟶ sehr

6. Wie traurig fühlen Sie sich im Moment?

   gar nicht ⟵⟶ sehr

7. Wie einsam fühlen Sie sich im Moment?

   gar nicht ⟵⟶ sehr

8. Wie besorgt fühlen Sie sich im Moment?

gar nicht ⟷ sehr

Bitte bewegen Sie den Schieberegler auf jeder Skala von links nach rechts um anzugeben, inwieweit Sie den folgenden Aussagen zu Ihrer Person zustimmen bzw. nicht zustimmen. Es gibt hierbei keine richtigen oder falschen Antworten

1. Es fällt mir schwer, schlechte Angewohnheiten abzulegen.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

2. Ich bin faul.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

3. Ich sage unangebrachte Dinge.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

4. Ich mache gewisse Dinge, die schlecht für mich sind, wenn sie Spaß machen.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

5. Ich lehne es ab, Dinge zu tun, die mir schaden.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

6. Ich wünschte, ich hätte mehr Selbstdisziplin.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

7. Ich kann Versuchungen gut widerstehen.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

8. Menschen würden über mich sagen, dass ich eiserne Selbstdisziplin besitze.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

9. Ich habe Schwierigkeiten, mich zu konzentrieren.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

10. Ich kann gut auf Langzeitziele hin arbeiten.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

11. Manchmal kann ich mich nicht stoppen, etwas zu tun, auch wenn ich weiß, dass es falsch ist.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

12. Ich handle oft, ohne mir dabei Gedanken über Alternativen zu machen.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

13. Spaß und Vergnügen halten mich manchmal davon ab, eine Arbeit zu erledigen.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

Bitte beantworten Sie die folgenden Fragen.

(*self-evaluations of statistics knowledge. Note that these two items are included in the final questionnaires for Studies 1 – 4*)

1. Wie schätzen Sie Ihre allgemeinen statistischen Vorkenntnisse ein?
2. Wie schätzen Sie Ihre Fähigkeiten in der Berechnung von Wahrscheinlichkeiten ein?

Bitte geben Sie die Farbe an, in der die folgenden Wörter geschrieben sind:

(*color test for Study 1b*)

Herbst: ____________________________

Kaiser: ____________________________

Wohnung: ____________________________

Reaktion: ____________________________

Einkauf: ____________________________

Monat: ____________________________

Appendix B

Material of Study 2 (in German)

B.1 General Instructions

Liebe Versuchsteilnehmerin, lieber Versuchsteilnehmer,

vielen Dank für Ihre Teilnahme an diesem Experiment.

Das Experiment wird insgesamt maximal 2 Stunden dauern. Bitte beachten Sie, dass während dieser Zeit jegliche Kommunikation mit anderen Versuchsteilnehmern untersagt ist und zum Ausschluss von allen Zahlungen führt. Sollten Sie irgendwelche Fragen haben, heben Sie bitte deutlich Ihre Hand und bleiben ruhig an Ihrem Platz sitzen bis wir zu Ihnen kommen um Ihre Frage zu beantworten.

Im Experiment werden Sie **verschiedene Aufgaben** bearbeiten.
Die wesentliche Aufgabe besteht in einem **Entscheidungsspiel**, bei welchem Sie **Kugeln** aus **Urnen** ziehen und durch **geschickte Entscheidungen** sowie etwas Glück Geld verdienen können. Außerdem gibt es eine **Abwägeaufgabe**, bei der es darum geht zu beschreiben, wie Sie **positive und negative Aspekte** eines ihrer **persönlichen Vorhaben** gegeneinander abwägen (*for deliberative mindset treatment*). [Außerdem gibt es eine **Planaufgabe**, bei der es darum geht zu beschreiben, wie man das Erreichen eines **persönlichen Ziels plant**

(*for implemental mindset treatment*)./Außerdem gibt es eine Aufgabe, bei der es darum geht, **Alltagshandlungen** zu beschreiben, also **Dinge**, die wir als **Teil unseres Alltags** erledigen (*for neutral mindset treatment and baseline treatment*).] Am Ende des Experiments folgt noch ein Fragebogen.

Ihre **Auszahlung**, die Sie am Ende des Experimentes erhalten, setzt sich folgendermaßen zusammen:
• Auszahlung aus dem **Entscheidungsspiel**: Diese hängt von Ihren **Entscheidungen** sowie vom Zufall ab. Dies wird in den zugehörigen Instruktionen genau erklärt.
• Teilnahmevergütung: Entsprechend dem Umfang des Experiments erhalten Sie zusätzlich zur üblichen Teilnahmevergütung von 2,50 Euro noch 5,00 Euro extra.

Am Ende des Experiments wird Ihnen die Gesamtsumme (Betrag in Euro aus dem **Entscheidungsspiel** plus 7,50 Euro) bar und anonym ausgezahlt.

Zunächst werden Sie Instruktionen für das **Entscheidungsspiel** und für die **Abwägeaufgabe** (*for deliberative mindset treatment*) [**Planaufgabe** (*for implemental mindset treatment*)/**Aufgabe über ihre Alltagshandlungen** (*for neutral mindset treatment and baseline treatment*)] erhalten. Es ist wichtig, dass Sie die Instruktionen sowie alle Erläuterungen am Computerbildschirm genau durchlesen.

Wir werden nun als erstes die Instruktionen für das Entscheidungsspiel austeilen.

B.2 Mindsets Manipulations

Abwägen positiver und negativer Konsequenzen eines wichtigen persönlichen Anliegens

(*manipulation task to induce deliberative mindset*)

Die vorliegende Studie untersucht inwiefern Personen dazu in der Lage sind, **positive und negative Konsequenzen** ihrer persönlichen, wichtigen Anliegen gegeneinander abzuwägen. Ein solches Anliegen könnte sein: „Ich will die Universität wechseln!" oder „Ich will mir eine neue WG suchen!". Ein Uni-Wechsel zieht **positive** (evtl. besseres Studienangebot) und **negative Konsequenzen** (man muss sich auf neue Leute einstellen) nach sich. Bevor man sich für oder gegen einen Wechsel entscheidet, wägt man normalerweise die **positiven Konsequenzen** und die **negativen Konsequenzen** gegeneinander ab. Genau diesen Ab wägeprozess möchten wir in der vorliegenden Studie untersuchen. D.h. Sie werden in den nachfolgenden Unterlagen dazu aufgefordert werden, **positive und negative Konsequenzen** eines Ihrer **persönlichen Anliegen** zueinander in Beziehung zu setzen, d.h. **positive und negative Konsequenzen** gegeneinander abzuwägen.

Stellen Sie sich hierzu bitte dasjenige Ihrer persönlichen Anliegen vor, das Sie derzeit am meisten beschäftigt und das für Sie persönlich sehr wichtig ist. Uns interessiert hierbei vor allem ein Anliegen von dem Sie sich zwar vorstellen können, es auch wirklich in die Realität umzusetzen, das Sie aber noch nicht in die Realität umgesetzt haben. Weiterhin ist es für unsere Studie wichtig, dass Sie **noch nicht ausreichend** über die **positiven und negativen Konsequenzen** der Umsetzung dieses Anliegens nachgedacht haben. D.h. es sollte sich um ein Anliegen handeln, hinsichtlich dessen Sie sich **noch nicht endgültig für oder gegen** eine Realisierung entschieden haben. **Bezogen auf unser Beispiel**: Sie spielen zwar mit dem Gedanken, die Uni zu wechseln, sind aber noch unentschieden ob Sie das wirklich tun sollen oder nicht und haben sich das Für und Wider eines Uni-Wechsels noch nicht intensiv durch den Kopf gehen lassen.

Ihre Daten werden absolut ANONYM und vertraulich behandelt.
INDIVIDUELLE UNTERSCHIEDE in der Bearbeitungsgeschwindigkeit sind vollkommen normal; nehmen Sie sich deshalb bitte für die Bearbeitung (zwecks der Güte der Studie!) die Zeit, die Sie für die Bearbeitung benötigen! Es handelt sich hier nicht um eine Geschwindigkeitsmessung!
Falls Sie Fragen haben, wenden Sie sich bitte an die Versuchsleiterin!

Denken Sie nun über ein derzeit persönliches Anliegen nach und notieren Sie es anschließend im unteren Textkasten. [Ihr derzeit wichtigstes **persönliches Anliegen** kann aus jedem Lebensbereich stammen (d.h. Beruf, Beziehung, Karriere, pers. Entwicklung etc.)]

Mein derzeit wichtigstes **persönliches Anliegen** lautet: ____________________

Der nachfolgende Fragenkatalog soll Ihnen das Nachdenken über **positive und negative Konsequenzen** Ihres Anliegens anhand eines Leitfadens erleichtern:

Stellen Sie sich dazu die **positiven und negativen Konsequenzen** Ihres Anliegens detailliert und intensiv vor und notieren Sie diese dann gemäß der vorgegebenen Struktur (siehe Beispiel Seite 2) in den dafür vorgesehenen Zeilen! Nachdem Sie eine **Konsequenz** niedergeschrieben haben, bewerten Sie bitte auf der daneben stehenden Skala, für wie **positiv** bzw. **negativ** Sie diese **Konsequenz** (Folge) halten. Notieren Sie weiters, wie hoch Sie die **Wahrscheinlichkeit** einschätzen, dass diese **Konsequenz** auch wirklich eintreten wird.

Bevor Sie beginnen, finden Sie zur Orientierung auf der folgenden Seite noch ein Beispiel!

Beispiel

Mein derzeit persönliches Anliegen lautet: **Soll ich mit einigen Freunden im Sommer einen 10 tägigen Zelturlaub machen?**

Ich entscheide mich **für die Realisierung** meines persönlichen Anliegens (d.h. Ich entscheide mich für die Realisierung eines 10 tägigen Zelturlaubs im Sommer mit meinen Freunden). **Kurzfristige** positive und negative Konsequenzen meiner Entscheidung.	Wie negativ bzw. positiv ist die jeweilige Konsequenz für Sie? **sehr negativ: -5** **weder noch: 0** **sehr positiv: +5**	Wie hoch schätzen Sie die Wahrscheinlichkeit (von 0-100%) ein, dass diese Konsequenz eintritt, wenn Sie sich für die Realisierungdes Zelturlaubs entscheiden?
1. POSITIVE KONSEQUENZ: **Ich helfe bei den Vorbereitungen und habe das Gefühl einen Beitrag geleistet zu haben.**	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 **+5**	**92%**
2. NEGATIVE KONSEQUENZ: **Finde dadurch weniger Zeit, um auf meine bevorstehenden Prüfungen zu lernen.**	-5 -4 **-3** -2 -1 0 +1 +2 +3 +4 +5	**75%**

Ich entscheide mich **gegen die Realisierung** meines persönlichen Anliegens (d.h. Ich entscheide mich gegen die Realisierung eines 10tägigen Zelturlaubs im Sommer mit meinen Freunden). **Kurzfristige** positive und negative Konsequenzen meiner Entscheidung.	Wie negativ bzw. positiv ist die jeweilige Konsequenz für Sie? **sehr negativ: -5** **weder noch: 0** **sehr positiv: +5**	Wie hoch schätzen Sie die Wahrscheinlichkeit (von 0-100%) ein, dass diese Konsequenz eintritt, wenn Sie sich gegen die Realisierung des Zelturlaubs entscheiden?
1. POSITIVE KONSEQUENZ: **Habe weniger Aufwand mit der ganzen Planung.**	-5 -4 -3 -2 -1 0 +1 **+2** +3 +4 +5	**55%**
2. NEGATIVE KONSEQUENZ: **Befürchte, dass sich die anderen dann über meine Inaktivität beschweren.**	-5 -4 -3 **-2** -1 0 +1 +2 +3 +4 +5	**80%**

Beispiel

Mein derzeit persönliches Anliegen lautet: **Soll ich mit einigen Freunden im Sommer einen 10 tägigen Zelturlaub machen?**

Ich entscheide mich **für die Realisierung** meines persönlichen Anliegens (d.h. Ich entscheide mich für die Realisierung eines 10tägigen Zelturlaubs im Sommer mit meinen Freunden). **Langfristige** positive und negative Konsequenzen meiner Entscheidung.	Wie negativ bzw. positiv ist die jeweilige Konsequenz für Sie? **sehr negativ: -5** **weder noch: 0** **sehr positiv: +5**	Wie hoch schätzen Sie die Wahrscheinlichkeit (von 0-100%) ein, dass diese Konsequenz eintritt, wenn Sie sich gegen die Realisierung des Zelturlaubs entscheiden?
1. POSITIVE KONSEQUENZ: **Meine Freunde werden sich merken, dass ich einen Großteil der Tour geplant habe.**	-5 -4 -3 -2 -1 0 +1 +2 +3 **+4** +5	**67%**
2. NEGATIVE KONSEQUENZ: **Ich werde vermutlich bei jeder gemeinsamen Unternehmung als Planer eingesetzt.**	-5 -4 -3 -2 **-1** 0 +1 +2 +3 +4 +5	**75%**

Ich entscheide mich **gegen die Realisierung** meines persönlichen Anliegens (d.h. Ich entscheide mich gegen die Realisierung eines 10tägigen Zelturlaubs im Sommer mit meinen Freunden). **Langfristige** positive und negative Konsequenzen meiner Entscheidung.	Wie negativ bzw. positiv ist die jeweilige Konsequenz für Sie? **sehr negativ: -5** **weder noch: 0** **sehr positiv: +5**	Wie hoch schätzen Sie die Wahrscheinlichkeit (von 0-100%) ein, dass diese Konsequenz eintritt, wenn Sie sich gegen die Realisierung des Zelturlaubs entscheiden?
1. POSITIVE KONSEQUENZ: **Ich erspare mir auch weiterhin Zeit und kann diese für wichtigere Dinge nutzen.**	-5 -4 -3 -2 -1 0 **+1** +2 +3 +4 +5	**25%**
2. NEGATIVE KONSEQUENZ: **Meine Freunde werden mich aufgrund meiner Passivität nicht mehr mitnehmen wollen.**	**-5** -4 -3 -2 -1 0 +1 +2 +3 +4 +5	**78%**

Ich entscheide mich für die Realisierung meines persönlichen Anliegens

Abwägen kurzfristiger positiver und negativer Konsequenzen meiner Entscheidung

Ich entscheide mich **für die Realisierung** meines persönlichen Anliegens. **Kurzfristige** positive und negative Konsequenzen meiner Entscheidung.	Wie negativ bzw. positiv ist die jeweilige Konsequenz für Sie? **sehr negativ: -5** **weder noch: 0** **sehr positiv: +5**	Wie hoch schätzen Sie die Wahrscheinlichkeit (von 0-100%) ein, dass diese Konsequenz eintritt, wenn Sie sich für die Realisierung Ihres persönlichen Anliegens entscheiden?
1. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
2. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
3. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
4. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
5. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
6. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
7. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
8. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
9. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
10. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	

Ich entscheide mich gegen die Realisierung meines persönlichen Anliegens

Abwägen kurzfristiger positiver und negativer Konsequenzen meiner Entscheidung

Ich entscheide mich **gegen die Realisierung** meines persönlichen Anliegens. **Kurzfristige** positive und negative Konsequenzen meiner Entscheidung.	Wie negativ bzw. positiv ist die jeweilige Konsequenz für Sie? **sehr negativ: -5** **weder noch: 0** **sehr positiv: +5**	Wie hoch schätzen Sie die Wahrscheinlichkeit (von 0-100%) ein, dass diese Konsequenz eintritt, wenn Sie sich gegen die Realisierung Ihres persönlichen Anliegens entscheiden?
1. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
2. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
3. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
4. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
5. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
6. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
7. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
8. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
9. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
10. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	

Ich entscheide mich für die Realisierung meines persönlichen Anliegens

Abwägen langfristiger positiver und negativer Konsequenzen meiner Entscheidung

Ich entscheide mich **für die Realisierung** meines persönlichen Anliegens. **langfristige** positive und negative Konsequenzen meiner Entscheidung.	Wie negativ bzw. positiv ist die jeweilige Konsequenz für Sie? **sehr negativ: -5** **weder noch: 0** **sehr positiv: +5**	Wie hoch schätzen Sie die Wahrscheinlichkeit (von 0-100%) ein, dass diese Konsequenz eintritt, wenn Sie sich für die Realisierung Ihres persönlichen Anliegens entscheiden?
1. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
2. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
3. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
4. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
5. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
6. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
7. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
8. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
9. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
10. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	

Ich entscheide mich für die Realisierung meines persönlichen Anliegens

Abwägen langfristiger positiver und negativer Konsequenzen meiner Entscheidung

Ich entscheide mich **gegen die Realisierung** meines persönlichen Anliegens. **langfristige** positive und negative Konsequenzen meiner Entscheidung.	Wie negativ bzw. positiv ist die jeweilige Konsequenz für Sie? **sehr negativ: -5** **weder noch: 0** **sehr positiv: +5**	Wie hoch schätzen Sie die Wahrscheinlichkeit (von 0-100%) ein, dass diese Konsequenz eintritt, wenn Sie sich gegen die Realisierung Ihres persönlichen Anliegens entscheiden?
1. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
2. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
3. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
4. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
5. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
6. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
7. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
8. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
9. POSITIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	
10. NEGATIVE KONSEQUENZ:	-5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5	

Erstellen von Plänen die der Umsetzung eines meiner derzeit aktuellen Ziele möglich machen

(*manipulation task to induce implemental mindset*)

Wir alle verfolgen in unserem Leben eine Vielzahl von **persönlichen Zielen**, die wir früher oder später erreichen wollen. Beispiele für Ziele sind „Ich will die Uni wechseln!” oder „Ich will in eine neue WG ziehen!”.

Diese Ziele können sich in vielerlei Hinsicht voneinander unterscheiden, wie bspw. in ihrer Komplexität (beispielsweise ist das Planen einer Radtour womöglich komplexer als das Kochen eines 5-Gänge Menü), ihrer zeitlichen Nähe (möglicherweise ist das Ziel, die eigene Wohnung zu putzen heute noch zu erreichen, während das Ziel das Studienabschluss zu bestehen evtl. erst in einem Jahr aktuell wird) oder in ihrem Schwierigkeitsgrad (Studiumsabschluss vs. zum Arzt gehen); um nur einige Unterscheidungsaspekte kurz zu nennen. Deshalb ist die **Realisierung von Zielen** unterschiedlich schwierig, interessant oder zeitaufwendig.

Da Menschen gleichzeitig viele verschiedene persönliche Ziele mit unterschiedlichen Merkmalen besitzen, sind wir in dieser Studie besonders daran interessiert, wie Personen die **Erreichung** eines ihrer Ziele planen, um besser verstehen zu können, was eine **effektive Planung eines Ziels** ausmacht, um dieses Ziel dann später wirklich umzusetzen.

Ihre Daten werden absolut ANONYM und vertraulich behandelt.

INDIVIDUELLE UNTERSCHIEDE in der Bearbeitungsgeschwindigkeit sind vollkommen normal; nehmen Sie sich deshalb bitte für die Bearbeitung (zwecks der Güte der Studie!) die **Zeit** , die Sie für die Bearbeitung benötigen! Es handelt sich hier nicht um eine Geschwindigkeitsmessung!

Falls Sie Fragen haben, wenden Sie sich bitte an die Versuchsleiterin!

Denken Sie nun über Ihr derzeit wichtigstes persönliches Ziel nach, das Sie unbedingt und definitiv erreichen wollen. Hierbei ist es wichtig, dass Sie noch keine konkreten Schritte zur Erreichung dieses Ziels eingeleitet haben. Notieren Sie dieses Ziel bitte im unteren Textkasten.
[Ihr derzeit **persönliches Ziel** kann aus jedem Lebensbereich heraus sein (Beruf, Beziehung, Karriere, persönliche Entwicklung etc.; siehe oben unsere Beispiele!)]

Mein derzeit **persönliches Ziel** lautet: ______________________________

Der nächste Teil unserer Studie beschäftigt sich damit, welche konkreten Handlungen Sie zur **Erreichung** Ihres Ziels vornehmen müssen. Notieren Sie diese in den dafür vorgesehenen Zeilen (mindestens **fünf**, maximal **sieben Handlungen**!).
Legen Sie anschließend im letzten Teil **Situation**, **Zeit** und Art der **Handlung** für jede Ihrer **einzelnen Handlungen** konkret fest.

Der nachfolgende Fragenkatalog soll Ihnen hierbei helfen.

Bevor Sie beginnen, finden Sie zur Orientierung auf der folgenden Seite noch ein Beispiel!

BEISPIEL

1. Teil: Konkretes Festlegen auf ein persönliches Ziel, für dessen Realisierung Sie sich bereits definitiv entschlossen haben!

Planung meines Umzugs in eine neue Wohnung

2. Teil: Festlegung der einzelnen Handlungen (mindestens: fünf; maximal: sieben!), die für die Erreichung Ihres Ziels notwendig sind!

1. **Handlungsschritt:** preisgünstige Wohnungen suchen
2. **Handlungsschritt:** Wohnungsbesichtigung
3. **Handlungsschritt:** Kauf notwendiger Renovierungsmittel
4. **Handlungsschritt:** Renovierung erledigen
5. **Handlungsschritt:** Umzugswagen und Helfer organisieren
6. **Handlungsschritt:** Anmeldung, Strom, GEZ erledigen
7. **Handlungsschritt:**

3. Teil: Festlegung von Situation, Zeit und Handlungsart (wo, wann u. wie) für jede einzelne Handlung

1. **Handlungsschritt:** preisgünstige Wohnungen suchen

wo: Wochenanzeiger, Tageszeitung (Internet und Zeitung)

wann: jeweils mittwochs und samstags

wie: 3 Zimmerwohnungen bis max. € 600 markieren oder ausdrucken

2. **Handlungsschritt:** Wohnungsbesichtigung, alle offenen Fragen klären

wo: in den Wohnungen, für die ich mich interessiere

wann: frage alles erst gegen Ende des Gesprächs, wenn Vermieter fertig geredet hat

wie: schaue alle Räume inkl. Balkon genauestens an (vor allem Fußboden, Küche und Bad); spreche Vermieter gleich am Telefon auf einen Besichtigungstermin morgen an

3. **Handlungsschritt:** Kauf notwendiger Renovierungsmittel

wo: wenn ich nächste Woche bei meinem Bekannten bin, da dort ein Baumarkt in der Nähe ist

wann: nachmittags nach der Arbeit

wie: kaufe nur die Utensilien, die auf meiner Liste stehen ein etc.

1. Teil: Konkretes Festlegen auf ein persönliches Ziel, für dessen Realisierung Sie sich bereits definitiv entschlossen haben!

(Bitte tragen Sie in die untenstehende Zeile nochmals Ihr Ziel ein!)

____

2. Teil: Festlegung der einzelnen Handlungen (mindestens: fünf; maximal: sieben!), die für die Erreichung Ihres Ziels notwendig sind!

Meine erste **Handlung** lautet: ______________________________

Meine zweite **Handlung** lautet: ______________________________

Meine dritte **Handlung** lautet: ______________________________

Meine vierte **Handlung** lautet: ______________________________

Meine fünfte **Handlung** lautet: ______________________________

Meine sechste **Handlung** lautet: ______________________________

Meine siebte **Handlung** lautet: ______________________________

3. Teil: Festlegung von Situation, Zeit und Handlungsart (wo, wann u. wie) für jede einzelne Handlung

(Bitte tragen Sie in die untenstehende Zeile nochmals Ihr Ziel ein!)

Meine erste **Handlung** lautet: ______________________________

Wann bietet sich für Sie ein günstiger **Zeitpunkt**, um zu handeln?

____

Wo bietet sich für Sie eine günstige **Situation**, um zu handeln?

____

Auf welche **Art und Weise** beabsichtigen Sie dann zu handeln?

____

Meine zweite **Handlung** lautet: ______________________________

Wann bietet sich für Sie ein günstiger **Zeitpunkt**, um zu handeln?

____

Wo bietet sich für Sie eine günstige **Situation**, um zu handeln?

____

Auf welche **Art und Weise** beabsichtigen Sie dann zu handeln?

____

Meine dritte **Handlung** lautet: ______________________________

Wann bietet sich für Sie ein günstiger **Zeitpunkt**, um zu handeln?

____

Wo bietet sich für Sie eine günstige **Situation**, um zu handeln?

____

Auf welche **Art und Weise** beabsichtigen Sie dann zu handeln?

____

Meine vierte **Handlung** lautet: ____

Wann bietet sich für Sie ein günstiger **Zeitpunkt**, um zu handeln?

____

Wo bietet sich für Sie eine günstige **Situation**, um zu handeln?

____

Auf welche **Art und Weise** beabsichtigen Sie dann zu handeln?

____

Meine fünfte **Handlung** lautet: ______________________________

Wann bietet sich für Sie ein günstiger **Zeitpunkt**, um zu handeln?

____

Wo bietet sich für Sie eine günstige **Situation**, um zu handeln?

____

Auf welche **Art und Weise** beabsichtigen Sie dann zu handeln?

____

Meine sechste **Handlung** lautet: ______________________________

Wann bietet sich für Sie ein günstiger **Zeitpunkt**, um zu handeln?

____

Wo bietet sich für Sie eine günstige **Situation**, um zu handeln?

____

Auf welche **Art und Weise** beabsichtigen Sie dann zu handeln?

____

Meine siebte **Handlung** lautet: ______________________________

Wann bietet sich für Sie ein günstiger **Zeitpunkt**, um zu handeln?

____

Wo bietet sich für Sie eine günstige **Situation**, um zu handeln?

____

Auf welche **Art und Weise** beabsichtigen Sie dann zu handeln?

____

Persönliche Alltagshandlungen

Die folgende Studie untersucht die Alltagshandlungen von Personen, also Dinge, die wir als Teil unseres Alltags erledigen.

Diese Handlungen können sein: „aufstehen und duschen” oder „Emails checken”.

Denken Sie nun bitte an einen normalen Tag und beschreiben Sie mindestens 7 Dinge, die Sie normalerweise während eines typischen Tages tun.

Ihre Daten werden absolut ANONYM und vertraulich behandelt.

INDIVIDUELLE UNTERSCHIEDE in der Bearbeitungsgeschwindigkeit sind vollkommen normal; nehmen Sie sich deshalb bitte für die Bearbeitung (zwecks der Güte der Studie!) die Zeit, die Sie für die Bearbeitung benötigen! Es handelt sich hier nicht um eine Geschwindigkeitsmessung!

Falls Sie Fragen haben, wenden Sie sich bitte an die Versuchsleiterin!

Denken Sie nun bitte an einen normalen Tag und beschreiben Sie mindestens 7 Dinge, die Sie normalerweise an einem typischen Tag machen, und schreiben Sie diese in die untenstehende Box. [Ihre täglichen Handlungen können alle möglichen Tätigkeiten sein, die Sie an einem normalen Tag ausüben]

Handlung 1:

Handlung 2:

Handlung 3:

Handlung 4:

Handlung 5:

Handlung 6:

Handlung 7:

Handlung 8:

Handlung 9:

Handlung 10:

B.3 Final Questionnaire

(*final questionnaire for Study 2*)

Bitte bewegen Sie den Schieberegler auf jeder Skala von links nach rechts um anzugeben, inwieweit Sie den folgenden Aussagen zu Ihrer Person zustimmen bzw. nicht zustimmen. Es gibt hierbei keine richtigen oder falschen Antworten.

1. Wie glücklich fühlen Sie sich im Moment?

gar nicht ⟵⟶ sehr

2. Wie niedergeschlagen fühlen Sie sich im Moment?

gar nicht ⟵⟶ sehr

3. Wie euphorisch fühlen Sie sich im Moment?

gar nicht ⟵⟶ sehr

4. Wie zufrieden fühlen Sie sich im Moment?

gar nicht ⟵⟶ sehr

5. Wie aufgeregt fühlen Sie sich im Moment?

gar nicht ⟵⟶ sehr

6. Wie traurig fühlen Sie sich im Moment?

gar nicht ⟵⟶ sehr

7. Wie einsam fühlen Sie sich im Moment?

gar nicht ⟵⟶ sehr

8. Wie besorgt fühlen Sie sich im Moment?

gar nicht ⟵⟶ sehr

Bitte bewegen Sie den Schieberegler auf jeder Skala von links nach rechts um anzugeben, inwieweit Sie den folgenden Aussagen zu Ihrer Person zustimmen bzw. nicht zustimmen. Es gibt hierbei keine richtigen oder falschen Antworten.

1. Manchmal glaube ich, dass ich zu überhaupt nichts gut bin.

stimme ich nicht zu ⟵⟶ stimme ich zu

2. Ich bin mir oft nichts wert.

stimme ich nicht zu ⟵⟶ stimme ich zu

3. Ich kann mich manchmal selbst nicht leiden.

stimme ich nicht zu ⟵⟶ stimme ich zu

4. Eigentlich bin ich mit mir ganz zufrieden.

stimme ich nicht zu ⟵⟶ stimme ich zu

5. Manchmal weiß ich nicht, wofür ich eigentlich lebe.

stimme ich nicht zu ⟵⟶ stimme ich zu

6. Ich wollte, ich könnte mehr Achtung vor mir haben.

stimme ich nicht zu ⟵⟶ stimme ich zu

7. Manchmal fühle ich mich zu nichts nütze.

stimme ich nicht zu ⟵⟶ stimme ich zu

8. Wenn ich mich mit gleichaltrigen Personen vergleiche, schneide ich eigentlich ganz gut ab.

stimme ich nicht zu ⟵⟶ stimme ich zu

9. Ich finde mich ganz in Ordnung.

stimme ich nicht zu ⟵⟶ stimme ich zu

10. Ich bin zufrieden mit mir.

stimme ich nicht zu ⟵⟶ stimme ich zu

Bitte bewegen Sie den Schieberegler auf jeder Skala von links nach rechts um anzugeben, inwieweit Sie den folgenden Aussagen zu Ihrer Person zustimmen bzw. nicht zustimmen. Es gibt hierbei keine richtigen oder falschen Antworten.

1. Wenn ich mir eine Meinung zu einer Sache bilden soll, verlasse ich mich ganz auf meine Intuition.

   Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

2. Bei den meisten Entscheidungen ist es sinnvoll, sich auf sein Gefühl zu verlassen.

   Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

3. Ich bin ein sehr intuitiver Mensch.

   Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

4. Wenn es um Menschen geht, kann ich meinem unmittelbaren Gefühl vertrauen.

   Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

5. Ich vertraue meinen unmittelbaren Reaktionen auf andere.

   Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

6. Ich glaube, ich kann meinen Gefühlen vertrauen.

   Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

7. Der erste Einfall ist oft der beste.

   Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

8. Wenn die Frage ist, ob ich anderen vertrauen soll, entscheide ich normalerweise aus dem Bauch heraus.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

9. Ich erkenne meistens, ob eine Person recht oder unrecht hat, auch wenn ich nicht erklären kann, warum.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

10. Mein erster Eindruck von anderen ist fast immer zutreffend.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

11. Ich kann mir über andere sehr schnell einen Eindruck bilden.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

12. Bei Kaufentscheidungen entscheide ich oft aus dem Bauch heraus.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

13. Ich spüre es meistens sofort, wenn jemand lügt.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

14. Wenn ich mich (mit dem Auto/Rad) verfahren habe, entscheide ich mich an Straßenkreuzungen meist ganz spontan, in welche Richtung ich weiterfahre.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

15. Ich denke, dass ich den Charakter einer Person sehr gut nach ihrer äußeren Erscheinung beurteilen kann.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

Bitte schätzen Sie für jedes der folgenden Ereignisse ein, für wie wahrscheinlich Sie es halten, dass Sie selbst - irgendwann im Laufe Ihres eigenen Lebens - mit dem jeweiligen Ereignis konfrontiert werden.

1. Für wie wahrscheinlich halten Sie es, dass Sie Opfer eines Überfalls werden?

0% ⟵⟶ 0%

2. Für wie wahrscheinlich halten Sie es, dass Sie an Diabetes erkranken?

0% ⟵⟶ 0%

3. Für wie wahrscheinlich halten Sie es, dass Sie irgendwann einmal geschieden werden?

0% ⟵⟶ 0%

4. Für wie wahrscheinlich halten Sie es, dass Sie selbst ein Alkoholproblem entwickeln?

0% ⟵⟶ 0%

5. Für wie wahrscheinlich halten Sie es, dass Sie herzkrank werden?

0% ⟵⟶ 0%

6. Für wie wahrscheinlich halten Sie es, dass Sie Opfer eines Flugzeugabsturzes werden?

0% ⟵⟶ 0%

Bitte schätzen Sie für jedes der folgenden Ereignisse ein, für wie wahrscheinlich Sie es halten, dass eine/r Ihrer Mitstudenten/innen - irgendwann im Laufe ihres Lebens - mit dem jeweiligen Ereignis konfrontiert werden.

1. Für wie wahrscheinlich halten Sie es, dass eine/r Ihrer Mitstudenten/innen – irgendwann im Laufe seines/ihres Lebens - Opfer eines Überfalls wird?

0% ⟵⟶ 0%

2. Für wie wahrscheinlich halten Sie es, dass eine/r Ihrer Mitstudenten/innen – im Laufe seines/ihres Lebens – an Diabetes erkrankt?

0% ⟵⟶ 0%

3. Für wie wahrscheinlich halten Sie es, dass eine/r Ihrer Mitstudenten/innen – im Laufe seines/ihres Lebens – einmal geschieden wird?

0% ⟵⟶ 0%

4. Für wie wahrscheinlich halten Sie es, dass eine/r Ihrer Mitstudenten/innen – im Laufe seines/ihres Lebens – ein Alkoholproblem entwickelt?

0% ⟵⟶ 0%

5. Für wie wahrscheinlich halten Sie es, dass eine/r Ihrer Mitstudenten/innen – im Laufe seines/ihres Lebens – herzkrank wird?

0% ⟵⟶ 0%

6. Für wie wahrscheinlich halten Sie es, dass eine/r Ihrer Mitstudenten/innen – im Laufe seines/ihres Lebens – Opfer eines Flugzeugabsturzes wird?

0% ⟵⟶ 0%

Bitte beantworten Sie die folgenden Fragen.

(*self-evaluations of statistics knowledge*)

1. Wie schätzen Sie Ihre allgemeinen statistischen Vorkenntnisse ein?
2. Wie schätzen Sie Ihre Fähigkeiten in der Berechnung von Wahrscheinlichkeiten ein?

Appendix C

Material of Study 3 (in German)

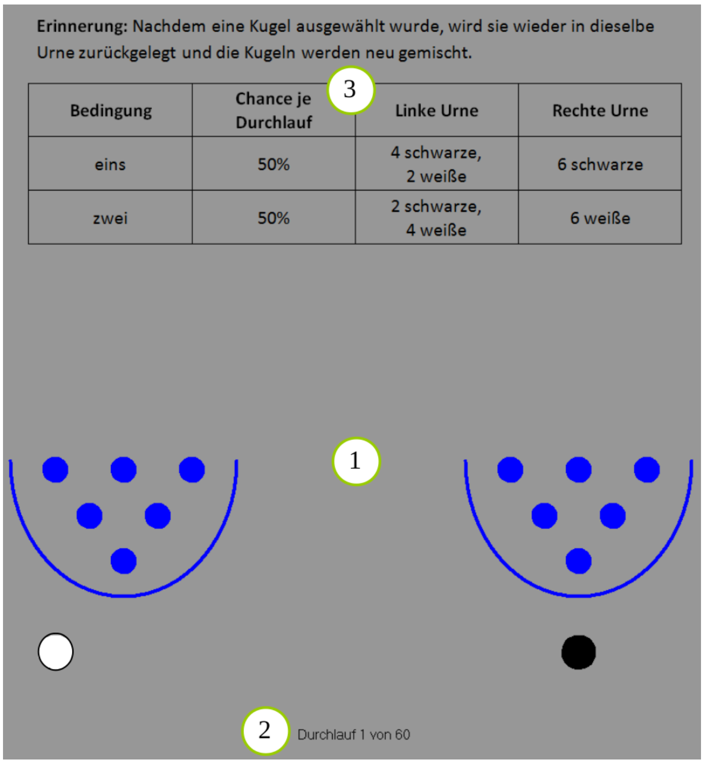
C.1 Decision Task Instructions

C.1.1 Instructions for counterbalance condition 1 (gain frame)

Bei diesem Spiel werden Ihnen auf dem Bildschirm zwei Behälter („Urnen“) präsentiert. In diesen Urnen befinden sich schwarze und weiße Kugeln. Ziel des Spiels ist es, möglichst viele schwarze Kugeln zu ziehen. Dazu muss nach bestimmten Regeln möglichst geschickt aus den beiden Urnen gezogen werden. Im Folgenden werden zunächst die Elemente auf dem Bildschirm und die Bedienung über Tastatur erklärt. Anschließend folgen die genauen Spielregeln.

Bildschirm

1) In der Bildschirmmitte werden Ihnen zwei Urnen angezeigt. In jeder Urne befinden sich sechs Kugeln. Es gibt schwarze und weiße Kugeln. Am Bildschirm werden sie blau angezeigt, so lange sie „verdeckt“ in der Urne sind. Unter den Urnen wird angezeigt, welche Kugeln Sie in diesem Durchgang bereits gezogen haben. Im obigen Beispiel also eine schwarze und eine weiße.
Beachten Sie: *Wenn eine Urne nicht blau, sondern grau angezeigt wird, können Sie gerade nicht aus ihr ziehen und müssen deshalb die andere wählen.*
2) Unten in der Mitte werden Sie informiert, wie viele Durchläufe Sie bereits absolviert haben.



3) Im oberen Bereich des Bildschirms sind zentrale Informationen aus den Spielregeln zusammengefasst.

Bedienung

Die Bedienung erfolgt ausschließlich über drei Tasten. Zwei Tasten sind auf der Tastatur gelb markiert. Mit der linken („F“) ziehen Sie eine Kugel aus der linken Urne und entsprechend mit der rechten („J“) eine aus der rechten Urne. Mit der Leertaste starten Sie einen neuen Durchlauf, wenn Sie auf dem Bildschirm dazu aufgefordert werden.

Beachten Sie: *Sie können nur dann aus einer Urne ziehen, wenn diese blau angezeigt wird. Wenn eine der beiden Urnen grau angezeigt wird, müssen Sie also die andere per Tastendruck auswählen. Wenn beide Urnen blau angezeigt werden, können Sie sich frei für eine der beiden Urnen entscheiden.*

Spielregeln

Ablauf

Insgesamt werden 60 Durchläufe absolviert, von denen jeder aus zwei Zügen besteht. Zu Beginn jedes

Durchlaufs ziehen Sie per Tastendruck eine Kugel aus einer Urne. In allen ungeraden Durchläufen (Durchlauf 1, 3, 5, usw.) ist die Urne, aus der der erste Zug erfolgt, festgelegt; in allen geraden Durchläufen (Durchlauf 2, 4, 6, usw.) können Sie die Urne für den ersten Zug frei wählen. Der Zufall bestimmt, welche der Kugeln aus der Urne gezogen wird. Das Ergebnis (schwarz oder weiß) wird unter der Urneangezeigt und Sie dürfen erneut ziehen. Auch das Ergebnis des zweiten Zugs wird unter der entsprechenden Urne angezeigt. Abschließend beginnen Sie nach dem Hinweis auf dem Bildschirm durch Betätigen der Leertaste einen neuen Durchlauf.
Beachten Sie: Eine gezogene Kugel wird sofort wieder in die Urne zurückgelegt! Durch das Ziehen einer Kugel verändert sich also zwischen erstem und zweitem Zug nicht die Anzahl der schwarzen und weißen Kugeln in den Urnen. Sie ziehen beide Male aus den absolut selben Urnen.

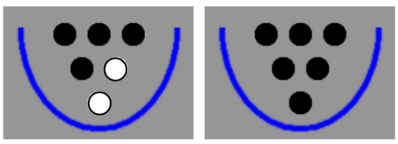
Gewinnmöglichkeit

Für jede **schwarze** Kugel, die Sie ziehen, bekommen Sie **18 Cent** gutgeschrieben; für das Ziehen einer weißen Kugel bekommen Sie nichts. Durch geschicktes Ziehen und mit ein bisschen Glück können Sie in diesem Experiment also eine beträchtliche Summe verdienen!

Umweltbedingungen

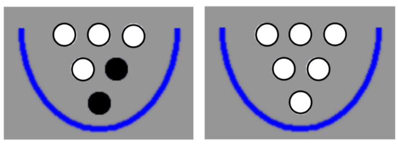
Das Wichtigste an diesem Spiel ist daher, dass Sie verstehen, wie viele schwarze und weiße Kugeln sich in den Urnen befinden. Lesen Sie die folgenden Abschnitte also besonders aufmerksam! Im Experiment werden *zwei Umweltbedingungen* unterschieden:

In der **ersten Umweltbedingung** befinden sich in der linken Urne 4 schwarze und 2 weiße Kugeln, in der rechten Urne befinden sich 6 schwarze Kugeln.



linke Urne rechte Urne

In der **zweiten Umweltbedingung** befinden sich in der linken Urne 2 schwarze und 4 weiße Kugeln, in der rechten Urne befinden sich 6 weiße Kugeln.

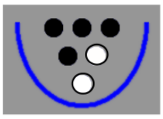
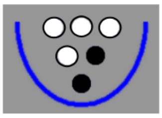
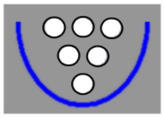


linke Urne rechte Urne

Wie bereits erwähnt, müssen Sie in jedem Durchlauf zuerst eine Kugel aus einer der beiden Urnen ziehen, die dann wieder zurück gelegt wird, und Sie ziehen danach die nächste Kugel. Allerdings wissen Sie dabei nicht, ob für den jeweiligen Durchlauf die erste oder die zweite Umweltbedingung herrscht. Dies wird für jeden einzelnen Durchlauf per Zufall durch den Zufallsgenerator des Computers festgelegt. Die Chance dafür, in einem Durchlauf die erste oder die zweite Umweltbedingung vorzufinden, liegt jedes Mal bei 50 %.

Beachten Sie: Während eines Durchlaufs verändert sich die Umweltbedingung nicht!

In der folgenden Tabelle ist die Verteilung der schwarzen und weißen Kugeln unter den verschiedenen Umweltbedingungen nochmals zusammenfassend dargestellt.

Bedingung	**Chance je Durchlauf**	**Linke Urne**		**Rechte Urne**	
eins	50 %	4 schwarze, 2 weiße		6 schwarze	
zwei	50 %	2 schwarze, 4 weiße		6 weiße	

Um möglichst oft eine schwarze Kugel zu ziehen und damit möglichst viel Geld zu verdienen, ist es wichtig, dass Sie die obige Tabelle wirklich verstanden haben. Bei Unklarheiten dazu oder zum Versuch generell fragen Sie bitte nach, indem Sie deutlich die Hand heben und warten, bis jemand an Ihren Platz kommt.

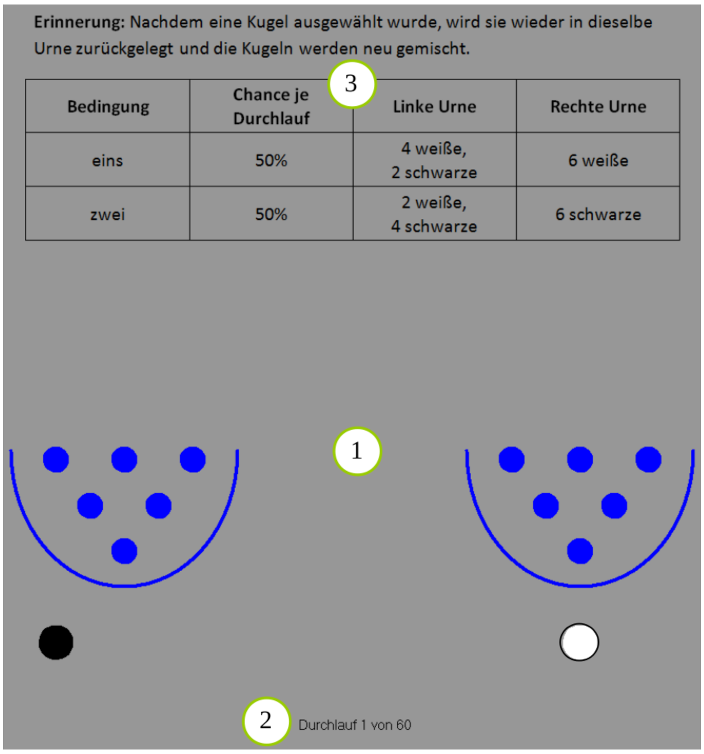
Zur Erinnerung: Für jede gezogene **schwarze** Kugel werden Ihnen **18 Cent** gutgeschrieben.

Viel Spaß und viel Erfolg!

C.1.2 Instructions for counterbalance condition 2 (gain frame)

Bei diesem Spiel werden Ihnen auf dem Bildschirm zwei Behälter („Urnen") präsentiert. In diesen Urnen befinden sich weiße und schwarze Kugeln. Ziel des Spiels ist es, möglichst viele weiße Kugeln zu ziehen. Dazu muss nach bestimmten Regeln möglichst geschickt aus den beiden Urnen gezogen werden. Im Folgenden werden zunächst die Elemente auf dem Bildschirm und die Bedienung über Tastatur erklärt. Anschließend folgen die genauen Spielregeln.

Bildschirm



1) In der Bildschirmmitte werden Ihnen zwei Urnen angezeigt. In jeder Urne befinden sich sechs Kugeln. Es gibt weiße und schwarze Kugeln. Am Bildschirm werden sie blau angezeigt, so lange sie „verdeckt" in der Urne sind. Unter den Urnen wird angezeigt, welche Kugeln Sie in diesem Durchgang bereits gezogen haben. Im obigen Beispiel also eine schwarze und eine weiße.

Beachten Sie: *Wenn eine Urne nicht blau, sondern grau angezeigt wird, können Sie gerade nicht aus ihr ziehen und müssen deshalb die andere wählen.*

2) Unten in der Mitte werden Sie informiert, wie viele Durchläufe Sie bereits absolviert haben.
3) Im oberen Bereich des Bildschirms sind zentrale Informationen aus den Spielregeln zusammengefasst.

Bedienung

Die Bedienung erfolgt ausschließlich über drei Tasten. Zwei Tasten sind auf der Tastatur gelb markiert. Mit der linken („F") ziehen Sie eine Kugel aus der linken Urne und entsprechend mit der rechten („J") eine aus der rechten Urne. Mit der Leertaste starten Sie einen neuen Durchlauf, wenn Sie auf dem Bildschirm dazu aufgefordert werden.

Beachten Sie: *Sie können nur dann aus einer Urne ziehen, wenn diese blau angezeigt wird. Wenn eine der beiden Urnen grau angezeigt wird, müssen Sie also die andere per Tastendruck auswählen. Wenn beide Urnen blau angezeigt werden, können Sie sich frei für eine der beiden Urnen entscheiden.*

Spielregeln

Ablauf

Insgesamt werden 60 Durchläufe absolviert, von denen jeder aus zwei Zügen besteht. Zu Beginn jedes Durchlaufs ziehen Sie per Tastendruck eine Kugel aus einer Urne. In allen ungeraden Durchläufen (Durchlauf 1, 3, 5, usw.) ist die Urne, aus der der erste Zug erfolgt, festgelegt; in allen geraden Durchläufen (Durchlauf 2, 4, 6, usw.) können Sie die Urne für den ersten Zug frei wählen. Der Zufall bestimmt, welche der Kugeln aus der Urne gezogen wird. Das Ergebnis (weiß oder schwarz) wird unter der Urne angezeigt und Sie dürfen erneut ziehen. Auch das Ergebnis des zweiten Zugs wird unter der entsprechenden Urne angezeigt. Abschließend beginnen Sie nach dem Hinweis auf dem Bildschirm durch Betätigen der Leertaste einen neuen Durchlauf.

Beachten Sie: Eine gezogene Kugel wird sofort wieder in die Urne zurückgelegt! Durch das Ziehen einer Kugel verändert sich also zwischen erstem und zweitem Zug nicht die Anzahl der weißen und schwarzen Kugeln in den Urnen. Sie ziehen beide Male aus den absolut selben Urnen.

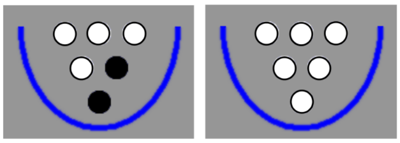
Gewinnmöglichkeit

Für jede **weiße** Kugel, die Sie ziehen, bekommen Sie **18 Cent** gutgeschrieben; für das Ziehen einer schwarzen Kugel bekommen Sie nichts. Durch geschicktes Ziehen und mit ein bisschen Glück können Sie in diesem Experiment also eine beträchtliche Summe verdienen!

Umweltbedingungen

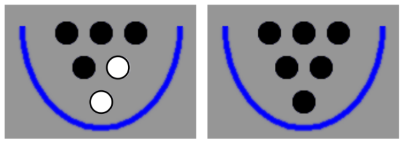
Das Wichtigste an diesem Spiel ist daher, dass Sie verstehen, wie viele weiße und schwarze Kugeln sich in den Urnen befinden. Lesen Sie die folgenden Abschnitte also besonders aufmerksam! Im Experiment werden zwei Umweltbedingungen unterschieden:

In der **ersten Umweltbedingung** befinden sich in der linken Urne 4 weiße und 2 schwarze Kugeln, in der rechten Urne befinden sich 6 weiße Kugeln.



linke Urne rechte Urne

In der **zweiten Umweltbedingung** befinden sich in der linken Urne 2 weiße und 4 schwarze Kugeln, in der rechten Urne befinden sich 6 schwarze Kugeln.



linke Urne rechte Urne

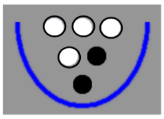
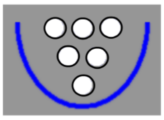
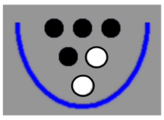
Wie bereits erwähnt, müssen Sie in jedem Durchlauf zuerst eine Kugel aus einer der beiden Urnen ziehen, die dann wieder zurück gelegt wird, und Sie ziehen danach die nächste Kugel. Allerdings wissen Sie dabei nicht, ob für den jeweiligen Durchlauf die erste oder die zweite Umweltbedingung herrscht. Dies wird für jeden einzelnen Durchlauf per Zufall durch den Zufallsgenerator des Computers festgelegt. Die Chance dafür, in einem Durchlauf die erste oder die zweite Umweltbedingung vorzufinden, liegt jedes Mal bei 50 %.

Beachten Sie: Während eines Durchlaufs verändert sich die Umweltbedingung nicht!

In der folgenden Tabelle ist die Verteilung der weißen und schwarzen Kugeln unter den verschiedenen Umweltbedingungen nochmals zusammenfassend dargestellt.

Um möglichst oft eine weiße Kugel zu ziehen und damit möglichst viel Geld zu verdienen, ist es wichtig, dass Sie die obige Tabelle wirklich verstanden haben. Bei Unklarheiten dazu oder zum Versuch generell fragen Sie bitte nach, indem Sie deutlich die Hand heben und warten, bis jemand an Ihren Platz kommt.

Zur Erinnerung: Für jede gezogene **weiße** Kugel werden Ihnen **18 Cent** gutgeschrieben.

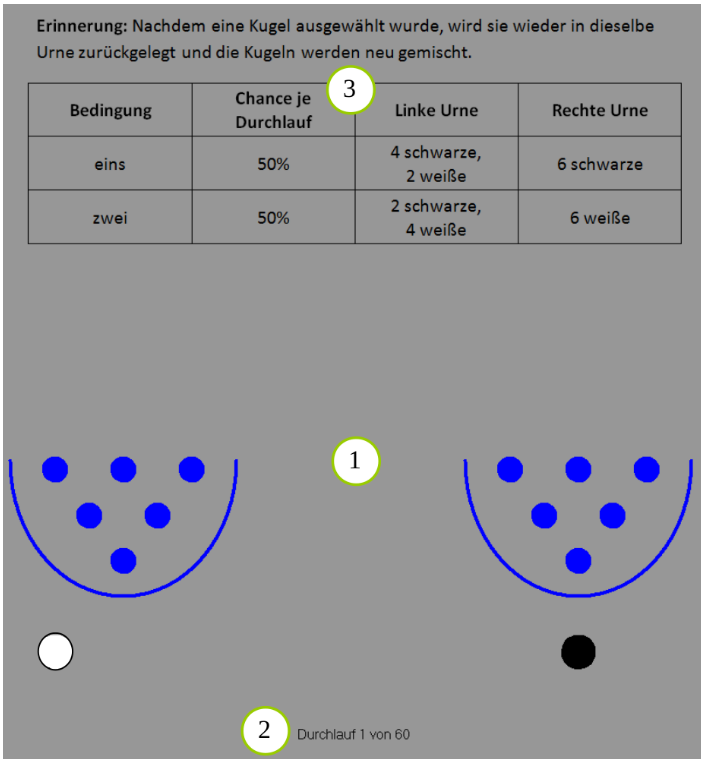
Bedingung	**Chance je Durchlauf**	**Linke Urne**	**Rechte Urne**
eins	50 %	4 weiße, 2 schwarze 	6 weiße 
zwei	50 %	2 weiße, 4 schwarze 	6 schwarze 

Viel Spaß und viel Erfolg!

C.1.3 Instructions for counterbalance condition 1 (loss frame)

Bei diesem Spiel werden Ihnen auf dem Bildschirm zwei Behälter („Urnen“) präsentiert. In diesen Urnen befinden sich schwarze und weiße Kugeln. Ziel des Spiels ist es, möglichst viele schwarze Kugeln zu ziehen. Dazu muss nach bestimmten Regeln möglichst geschickt aus den beiden Urnen gezogen werden. Im Folgenden werden zunächst die Elemente auf dem Bildschirm und die Bedienung über Tastatur erklärt. Anschließend folgen die genauen Spielregeln.

Bildschirm



1) In der Bildschirmmitte werden Ihnen zwei Urnen angezeigt. In jeder Urne befinden sich sechs Kugeln. Es gibt schwarze und weiße Kugeln. Am Bildschirm werden sie blau angezeigt, so lange sie „verdeckt“ in der Urne sind. Unter den Urnen wird angezeigt, welche Kugeln Sie in diesem Durchgang bereits gezogen haben. Im obigen Beispiel also eine schwarze und eine weiße.
Beachten Sie: *Wenn eine Urne nicht blau, sondern grau angezeigt wird, können Sie gerade nicht aus ihr ziehen und müssen deshalb die andere wählen.*

2) Unten in der Mitte werden Sie informiert, wie viele Durchläufe Sie bereits absolviert haben.
3) Im oberen Bereich des Bildschirms sind zentrale Informationen aus den Spielregeln zusammengefasst.

Bedienung

Die Bedienung erfolgt ausschließlich über drei Tasten. Zwei Tasten sind auf der Tastatur gelb markiert. Mit der linken („F") ziehen Sie eine Kugel aus der linken Urne und entsprechend mit der rechten („J") eine aus der rechten Urne. Mit der Leertaste starten Sie einen neuen Durchlauf, wenn Sie auf dem Bildschirm dazu aufgefordert werden.

Beachten Sie: *Sie können nur dann aus einer Urne ziehen, wenn diese blau angezeigt wird. Wenn eine der beiden Urnen grau angezeigt wird, müssen Sie also die andere per Tastendruck auswählen. Wenn beide Urnen blau angezeigt werden, können Sie sich frei für eine der beiden Urnen entscheiden.*

Spielregeln

Ablauf

Insgesamt werden 60 Durchläufe absolviert, von denen jeder aus zwei Zügen besteht. Zu Beginn jedes Durchlaufs ziehen Sie per Tastendruck eine Kugel aus einer Urne. In allen ungeraden Durchläufen (Durchlauf 1, 3, 5, usw.) ist die Urne, aus der der erste Zug erfolgt, festgelegt; in allen geraden Durchläufen (Durchlauf 2, 4, 6, usw.) können Sie die Urne für den ersten Zug frei wählen. Der Zufall bestimmt, welche der Kugeln aus der Urne gezogen wird. Das Ergebnis (schwarz oder weiß) wird unter der Urneangezeigt und Sie dürfen erneut ziehen. Auch das Ergebnis des zweiten Zugs wird unter der entsprechenden Urne angezeigt. Abschließend beginnen Sie nach dem Hinweis auf dem Bildschirm durch Betätigen der Leertaste einen neuen Durchlauf.
Beachten Sie: Eine gezogene Kugel wird sofort wieder in die Urne zurückgelegt! Durch das Ziehen einer Kugel verändert sich also zwischen erstem und zweitem Zug nicht die Anzahl der schwarzen und weißen Kugeln in den Urnen. Sie ziehen beide Male aus den absolut selben Urnen.

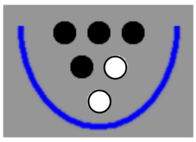
Ihre Auszahlung

In jedem Durchgang werden Ihnen zunächst 36 Cent gutgeschrieben; allerdings werden Ihnen für jede **weiße** Kugel, die Sie ziehen, **18 Cent** wieder **abgezogen**; für das Ziehen einer schwarzen Kugel be- kommen Sie nichts abgezogen. Durch geschicktes Ziehen und mit ein bisschen Glück können Sie in diesem Experiment also einen beträchtlichen Teil der maximalen Auszahlung behalten!

Umweltbedingungen

Das Wichtigste an diesem Spiel ist daher, dass Sie verstehen, wie viele schwarze und weiße Kugeln sich in den Urnen befinden. Lesen Sie die folgenden Abschnitte also besonders aufmerksam! Im Experiment werden *zwei Umweltbedingungen* unterschieden:

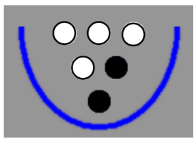
In der **ersten Umweltbedingung** befinden sich in der linken Urne 4 schwarze und 2 weiße Kugeln, in der rechten Urne befinden sich 6 schwarze Kugeln.



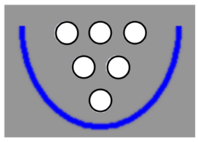
linke Urne

rechte Urne

In der **zweiten Umweltbedingung** befinden sich in der linken Urne 2 schwarze und 4 weiße Kugeln, in der rechten Urne befinden sich 6 weiße Kugeln.



linke Urne



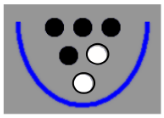
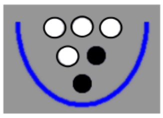
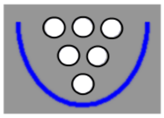
rechte Urne

Wie bereits erwähnt, müssen Sie in jedem Durchlauf zuerst eine Kugel aus einer der beiden Urnen ziehen, die dann wieder zurück gelegt wird, und Sie ziehen danach die nächste Kugel. Allerdings wissen Sie dabei nicht, ob für den jeweiligen Durchlauf die erste oder die zweite Umweltbedingung herrscht. Dies wird für jeden einzelnen Durchlauf per Zufall durch den Zufallsgenerator des Computers festgelegt. Die Chance dafür, in einem Durchlauf die erste oder die zweite Umweltbedingung vorzufinden, liegt jedes Mal bei 50 %.

Beachten Sie: Während eines Durchlaufs verändert sich die Umweltbedingung nicht!

In der folgenden Tabelle ist die Verteilung der schwarzen und weißen Kugeln unter den verschiedenen Umweltbedingungen nochmals zusammenfassend dargestellt.

Um möglichst selten eine weiße Kugel zu ziehen und damit möglichst wenig Geld zu verlieren, ist es wichtig, dass Sie die obige Tabelle wirklich verstanden haben. Bei Unklarheiten dazu oder zum Versuch generell fragen Sie bitte nach, indem Sie deutlich die Hand heben und warten, bis jemand an Ihren Platz kommt.

Bedingung	**Chance je Durchlauf**	**Linke Urne**		**Rechte Urne**	
eins	50 %	4 schwarze, 2 weiße		6 schwarze	
zwei	50 %	2 schwarze, 4 weiße		6 weiße	

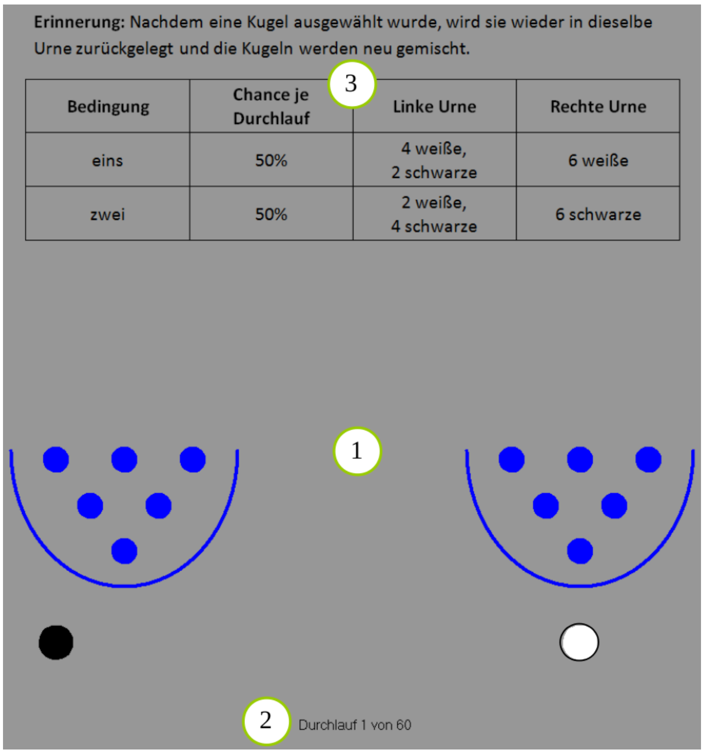
Zur Erinnerung: Für jede gezogene **weiße** Kugel werden Ihnen **18 Cent** abgezogen.

Viel Spaß und viel Erfolg!

C.1.4 Instructions for counterbalance condition 2 (loss frame)

Bei diesem Spiel werden Ihnen auf dem Bildschirm zwei Behälter („Urnen“) präsentiert. In diesen Urnen befinden sich weiße und schwarze Kugeln. Ziel des Spiels ist es, möglichst viele weiße Kugeln zu ziehen. Dazu muss nach bestimmten Regeln möglichst geschickt aus den beiden Urnen gezogen werden. Im Folgenden werden zunächst die Elemente auf dem Bildschirm und die Bedienung über Tastatur erklärt. Anschließend folgen die genauen Spielregeln.

Bildschirm



1) In der Bildschirmmitte werden Ihnen zwei Urnen angezeigt. In jeder Urne befinden sich sechs Kugeln. Es gibt weiße und schwarze Kugeln. Am Bildschirm werden sie blau angezeigt, so lange sie „verdeckt“ in der Urne sind. Unter den Urnen wird angezeigt, welche Kugeln Sie in diesem Durchgang bereits gezogen haben. Im obigen Beispiel also eine schwarze und eine weiße.

Beachten Sie: *Wenn eine Urne nicht blau, sondern grau angezeigt wird, können Sie gerade nicht aus ihr ziehen und müssen deshalb die andere wählen.*

2) Unten in der Mitte werden Sie informiert, wie viele Durchläufe Sie bereits absolviert haben.
3) Im oberen Bereich des Bildschirms sind zentrale Informationen aus den Spielregeln zusammengefasst.

Bedienung

Die Bedienung erfolgt ausschließlich über drei Tasten. Zwei Tasten sind auf der Tastatur gelb markiert. Mit der linken („F“) ziehen Sie eine Kugel aus der linken Urne und entsprechend mit der rechten („J“) eine aus der rechten Urne. Mit der Leertaste starten Sie einen neuen Durchlauf, wenn Sie auf dem Bildschirm dazu aufgefordert werden.
Beachten Sie: *Sie können nur dann aus einer Urne ziehen, wenn diese blau angezeigt wird. Wenn eine der beiden Urnen grau angezeigt wird, müssen Sie also die andere per Tastendruck auswählen. Wenn beide Urnen blau angezeigt werden, können Sie sich frei für eine der beiden Urnen entscheiden.*

Spielregeln

Ablauf

Insgesamt werden 60 Durchläufe absolviert, von denen jeder aus zwei Zügen besteht. Zu Beginn jedes Durchlaufs ziehen Sie per Tastendruck eine Kugel aus einer Urne. In allen ungeraden Durchläufen (Durchlauf 1, 3, 5, usw.) ist die Urne, aus der der erste Zug erfolgt, festgelegt; in allen geraden Durchläufen (Durchlauf 2, 4, 6, usw.) können Sie die Urne für den ersten Zug frei wählen. Der Zufall bestimmt, welche der Kugeln aus der Urne gezogen wird. Das Ergebnis (weiß oder schwarz) wird unter der Urne angezeigt und Sie dürfen erneut ziehen. Auch das Ergebnis des zweiten Zugs wird unter der entsprechenden Urne angezeigt. Abschließend beginnen Sie nach dem Hinweis auf dem Bildschirm durch Betätigen der Leertaste einen neuen Durchlauf.
Beachten Sie: Eine gezogene Kugel wird sofort wieder in die Urne zurückgelegt! Durch das Ziehen einer Kugel verändert sich also zwischen erstem und zweitem Zug nicht die Anzahl der weißen und schwarzen Kugeln in den Urnen. Sie ziehen beide Male aus den absolut selben Urnen.

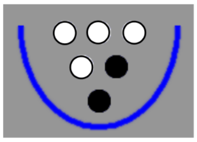
Ihre Auszahlung

In jedem Durchgang werden Ihnen zunächst 36 Cent gutgeschrieben; allerdings werden Ihnen für jede **schwarze** Kugel, die Sie ziehen, **18 Cent** wieder **abgezogen**; für das Ziehen einer weißen Kugel be- kommen Sie nichts abgezogen. Durch geschicktes Ziehen und mit ein bisschen Glück können Sie in diesem Experiment also einen beträchtlichen Teil der maximalen Auszahlung behalten!

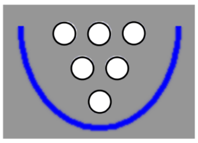
Umweltbedingungen

Das Wichtigste an diesem Spiel ist daher, dass Sie verstehen, wie viele weiße und schwarze Kugeln sich in den Urnen befinden. Lesen Sie die folgenden Abschnitte also besonders aufmerksam! Im Experiment werden zwei Umweltbedingungen unterschieden:

In der **ersten Umweltbedingung** befinden sich in der linken Urne 4 weiße und 2 schwarze Kugeln, in der rechten Urne befinden sich 6 weiße Kugeln.

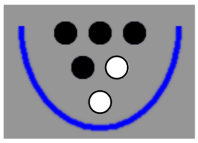


linke Urne



rechte Urne

In der **zweiten Umweltbedingung** befinden sich in der linken Urne 2 weiße und 4 schwarze Kugeln, in der rechten Urne befinden sich 6 schwarze Kugeln.



linke Urne

rechte Urne

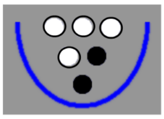
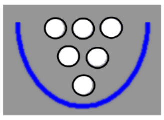
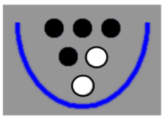
Wie bereits erwähnt, müssen Sie in jedem Durchlauf zuerst eine Kugel aus einer der beiden Urnen ziehen, die dann wieder zurück gelegt wird, und Sie ziehen danach die nächste Kugel. Allerdings wissen Sie dabei nicht, ob für den jeweiligen Durchlauf die erste oder die zweite Umweltbedingung herrscht. Dies wird für jeden einzelnen Durchlauf per Zufall durch den Zufallsgenerator des Computers festgelegt. Die Chance dafür, in einem Durchlauf die erste oder die zweite Umweltbedingung vorzufinden, liegt jedes Mal bei 50 %.

Beachten Sie: Während eines Durchlaufs verändert sich die Umweltbedingung nicht!

In der folgenden Tabelle ist die Verteilung der weißen und schwarzen Kugeln unter den verschiedenen Umweltbedingungen nochmals zusammenfassend dargestellt.

Um möglichst selten eine schwarze Kugel zu ziehen und damit möglichst wenig Geld zu verlieren, ist es wichtig, dass Sie die obige Tabelle wirklich verstanden haben. Bei Unklarheiten dazu oder zum Ver- such generell fragen Sie bitte nach, indem Sie deutlich die Hand heben und warten, bis jemand an Ih - ren Platz kommt.

Zur Erinnerung: Für jede gezogene **schwarze** Kugel werden Ihnen **18 Cent** gutgeschrieben.

Bedingung	**Chance je Durchlauf**	**Linke Urne**		**Rechte Urne**	
eins	50 %	4 weiße, 2 schwarze		6 weiße	
zwei	50 %	2 weiße, 4 schwarze		6 schwarze	

Viel Spaß und viel Erfolg!

Appendix D

Material of Study 4 (in German)

D.1 Final Questionnaire

(*final questionnaire for Studies 4a – 4b*)

Bitte bewegen Sie den Schieberegler auf jeder Skala von links nach rechts um anzugeben, inwieweit Sie den folgenden Aussagen zu Ihrer Person zustimmen bzw. nicht zustimmen. Es gibt hierbei keine richtigen oder falschen Antworten.

1. Es ist mir wichtig, dass die Menschen, die mich kennen, mein Verhalten voraussagen können.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

2. Ich möchte durch andere als berechenbare Person beschrieben werden.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

3. Es ist mir sehr wichtig, dass ich nach außen hin stimmig und frei von Widersprüchen erscheine.

Trifft gar nicht zu ←——————————————→ Trifft voll und ganz zu

4. Eine wichtige Voraussetzung für jeden meiner Freunde ist, dass ihre Persönlichkeit stimmig und frei von Widersprüchen ist.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

5. Ich ziehe es üblicherweise vor, Dinge immer auf die gleiche Art und Weise zu tun.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

6. Ich möchte, dass meine engen Freunde berechenbar sind.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

7. Es ist mir wichtig, dass andere mich als berechenbare Person ansehen.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

8. Ich gebe mir Mühe, anderen Menschen gegenüber stimmig und frei von Widersprüchen zu erscheinen.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu

9. Es stört mich nicht besonders, wenn meine Handlungen sich widersprechen.

Trifft gar nicht zu ⟵⟶ Trifft voll und ganz zu