

Keep your fingers crossed!  
The influence of superstition on subsequent  
task performance and its mediating  
mechanism

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# TABLE OF CONTENTS

ABSTRACT .....	VII
DEUTSCHE KURZZUSAMMENFASSUNG .....	VIII
INTRODUCTION.....	10
THEORETICAL PART.....	12
The prevalence of superstitions.....	12
<i>Incidence of superstition</i> .....	12
<i>Change of prevalence over time</i> .....	12
<i>Superstitious half-beliefs</i> .....	13
The superstitious personality .....	13
<i>Demographics of superstition</i> .....	13
<i>Superstition and gender</i> .....	13
<i>Superstition and age</i> .....	14
<i>Superstition and level of education</i> .....	14
<i>Superstition and personality traits</i> .....	14
Superstitious groups .....	15
<i>Superstitious students</i> .....	15
<i>Superstitious athletes</i> .....	16
<i>Similarities of students and athletes</i> .....	16
The “superstitious situation” .....	17
<i>Superstitious situations in sports</i> .....	18
<i>Superstition and experienced psychological stress</i> .....	19
<i>Superstition and experienced uncontrollability</i> .....	19
The benefits of superstitions .....	20
<i>The influence of superstition on performance enhancement</i> .....	20
<i>The prevention of performance impairment by superstitions</i> .....	21
First research question .....	23
The mechanism of performance influence.....	24
Self-efficacy .....	25
<i>Description of the self-efficacy concept</i> .....	25
<i>Influence of self-efficacy beliefs on intellectual achievement</i> .....	26
<i>Influence of self-efficacy beliefs on athletic achievement</i> .....	27
<i>Dimension and characteristics of self-efficacy beliefs</i> .....	28

<i>Implication of self-efficacy specificity</i> .....	29
Psychological benefits of superstition .....	30
<i>Correlates of belief in good luck</i> .....	31
<i>Illusion of control</i> .....	32
Second research question .....	34
Summary .....	35
The present research.....	36
EMPIRICAL PART .....	38
Study 1 .....	38
<i>Methods</i> .....	38
<i>Results</i> .....	39
Study 2.....	40
<i>Methods</i> .....	41
<i>Results</i> .....	42
<i>Discussion</i> .....	43
Study 3.....	44
<i>Methods</i> .....	44
<i>Results</i> .....	45
<i>Discussion</i> .....	46
Study 4.....	47
<i>Methods</i> .....	47
<i>Results</i> .....	48
<i>Discussion</i> .....	50
Study 5.....	51
<i>Methods</i> .....	52
<i>Results</i> .....	55
<i>Discussion</i> .....	59
Study 6.....	60
<i>Methods</i> .....	61
<i>Results</i> .....	63
<i>Discussion</i> .....	66
GENERAL DISCUSSION .....	70
Significance of the present findings .....	70
Alternative Explanations .....	72
<i>Performance enhancement as mood effect</i> .....	72
<i>Performance enhancement as a request</i> .....	73

<i>Distinction between superstitions and pre-performance routines</i> .....	74
Maintenance of superstitions .....	75
Relation to previous research .....	77
<i>Influences on task performance</i> .....	77
<i>Self-efficacy – performance link</i> .....	77
<i>Effect of superstition on self-efficacy</i> .....	78
Implications for future directions .....	79
<i>Mechanism of the self-efficacy – performance link</i> .....	79
<i>Distinction between different categories of superstitious beliefs</i> .....	81
<i>Necessity of believing</i> .....	83
Applied implications .....	85
CONCLUSION .....	87
REFERENCES .....	89
APPENDIX.....	115

# ABSTRACT

Superstitious thoughts or behaviors have been demonstrated to occur frequently and persistently in our current population. Typically, they are held or performed in the context of an important performance task with the aim to gain good luck or prevent bad luck. However, to date, little is known about the reason for the maintenance of this seemingly irrational phenomenon, its psychological functions, or its behavioral consequences. The current analysis suggests that superstitions exert a causal influence on subsequent task performance. In particular, I contend that superstitions associated with the concept of good luck that are activated prior to a performance task enhance performance. Furthermore, I argue that this influence is explained by the underlying mechanism of increased levels of perceived task-specific self-efficacy beliefs.

Results of one explorative analysis and 5 experimental studies support these assumptions. Specifically, Study 1 demonstrates the widespread prevalence of superstitions within the present population of undergraduate students at the University of Cologne and explores several specific superstitions that appear to be particularly common. In each of the subsequent studies, these common superstitions such as “lucky charms”, “keeping fingers crossed”, or the plain superstitious constructs of good or bad luck are manipulated between participants prior to various motor or cognitive performance tasks using manifold empirical methods. Results of Studies 2 through 4 demonstrate that performance in a golf-putting task or a motor dexterity game indeed is enhanced subsequent to the implementation of a good luck superstition, compared to a bad luck superstition or no superstition at all. Studies 5 and 6 replicate the effect of superstition on superior performance in cognitive tasks such as a Tetris-game and a Memory-game. Additionally, the results of these latter studies provide empirical evidence for the notion of the mediating function of self-efficacy beliefs on the observed effect of superstition on performance.

In this regard, the reported findings uniquely contribute to our understanding of superstitions and their effect on psychological as well as behavioral consequences. The present findings are in line with previous research on self-efficacy and performance factors in general. At the same time, these findings suggest new questions for future research on the subject of superstitions. Possible applications to the athletic or the educational field are discussed.

# DEUTSCHE KURZZUSAMMENFASSUNG

Abergläubische Überzeugungen und Verhaltensweisen sind auch in unserer heutigen Gesellschaft noch weit verbreitet. Insbesondere in Situationen, welche durch hohen wahrgenommenen psychologischen Stress und Aspekte der Unsicherheit oder Unkontrollierbarkeit gekennzeichnet sind, scheint abergläubisches Verhalten immer wieder aufzutreten. Damit konsistent sind Befunde, die zeigen, dass vor allem unter Studenten und Sportlern, welche in Prüfungen oder Wettkämpfen besonders häufig den beschriebenen Situationen ausgesetzt sind, ein hohes Maß an Aberglauben zu finden ist. Was ist der Grund für das vermehrte Vorkommen und die konstante Aufrechterhaltung dieser scheinbar irrationalen Gedanken und Verhaltensweisen? Ziel der vorliegenden Arbeit ist es, Evidenz für einen tatsächlichen Nutzen dieser abergläubischen Überzeugungen zu finden. Dabei soll insbesondere untersucht werden, ob Aberglauben einen Einfluss auf nachfolgende Leistungen ausüben, indem sie diese erhöhen. Darauf aufbauend möchte ich untersuchen, durch welchen zugrunde liegenden Mechanismus ein solcher Effekt vermittelt wird. Dabei wird die Annahme gemacht, dass die kausale Beziehung von aktiviertem Aberglaube auf Leistungsverbesserung auf einer Beeinflussung der wahrgenommenen Selbstwirksamkeitsüberzeugung basiert.

Die Befunde aus 6 empirischen Untersuchungen bestätigen meine Vorhersagen weitestgehend. Dabei bekräftigen die Ergebnisse der ersten Untersuchung – einer explorativen Fragebogen Studie – die weite Verbreitung von abergläubischen Überzeugungen speziell für die hier untersuchte Stichprobe bestehend aus Studenten der Universität zu Köln und identifiziert darüber hinaus einige konkrete Aberglauben, welche von besonders vielen Probanden als effektive empfunden werden. Die am weitesten verbreiteten Formen von Aberglauben (Daumen drücken, Glücksbringer dabei haben, an die Konzepte Glück und Pech glauben) wurden in den folgenden Untersuchungen herangezogen und anhand verschiedener methodischer Vorgehensweisen experimentell manipuliert. Im Anschluss wurde die erbrachte Leistung der Teilnehmer in verschiedenen motorischen oder kognitiven Aufgaben erfasst. So zeigt sich in den Experimenten 2 und 3, dass Teilnehmer besser in der Lage sind Golf zu spielen (häufigeres Treffen) wenn sie diese Aufgabe mit einem angeblichen Glücksball verglichen mit einem angeblichen Pechball oder einem neutralen Ball durchführen. Ähnlich zeigt sich in Experiment 4, dass Teilnehmer denen die



Daumen gedrückt werden ein Geduldspiel schneller vervollständigen können als Teilnehmer zweier Kontrollbedingungen.

Die Ergebnisse der Experimente 5 und 6 replizieren zunächst den leistungserhöhenden Einfluss von mit Glück assoziiertem Aberglaube auf kognitive Leistungen. So zeigt sich in Experiment 5, dass Teilnehmer, bei denen zuvor das Konzept Glück aktiviert wurde, eine bessere Leistung in einem Tetris-Spiel erbringen (mehr Reihen aufbauen) als wenn sie zuvor mit dem Wort Pech geprimt wurden – selbst wenn dieses Priming subliminal, das heißt außerhalb ihrer bewussten Wahrnehmung stattfindet. Die Ergebnisse des Experiments 6 demonstrieren, dass die Teilnehmer in Anwesenheit ihres persönlichen Glücksbringers besser in einem Memory-Spiel abschneiden als in Abwesenheit dieses Objektes. Darüber hinaus zeigt die statistische Analyse der Daten beider Studien, dass der Effekt des Aberglaubens auf Leistungsmaße durch ein erhöhtes Niveau der empfundenen aufgabenspezifischen Selbstwirksamkeit vermittelt wird.

Die dargestellten Befunde dieser Dissertation zeichnen sich insbesondere durch die Anwendung vielfältiger Methoden sowie die Neuartigkeit der gefundenen Ergebnisse aus. In diesem Sinne kann die vorliegende Arbeit maßgeblich zum Verständnis abergläubischer Überzeugungen und Verhaltensweisen sowie deren Einfluss auf psychologische und verhaltensbasierte Konsequenzen beitragen. Die dargestellten Ergebnisse sind mit früheren Forschungsbefunden zum Konstrukt der Selbstwirksamkeitsüberzeugung sowie zu leistungsbeeinflussenden Faktoren im Allgemeinen konsistent. Gleichzeitig gehen aus ihnen jedoch auch zahlreiche Fragestellungen für zukünftige Forschungsarbeiten zum Thema Aberglaube hervor. Eine mögliche Anwendung der vorliegenden Befunde im pädagogischen Bereich von Schule und Sport wird zum Abschluss der Arbeit diskutiert.

# INTRODUCTION

"To succeed, one cannot afford to be a realist."

~ Albert Bandura ~

Address before the American Psychological Association, 1998

There are many situations in life where it is important to perform at one's best. When we graduate from school or university, for example, our performance in the final exams might determine whether we get the job we are hoping for or whether someone else is luckier than we. Similarly, whether athletes find a sponsor or qualify for an important event such as the Olympic Games, for example, usually depends on their achieved performance in prior competitions. In light of the importance of a good performance, most people would approach these kind of situations as well-prepared as possible. That is, many students study extensively prior to an exam. Similarly, prior to a competition or a tournament, athletes practice their routines repeatedly and train to improve their physical condition. However, no matter how well prepared people are in such performance situations, there are always some factors that are not under their control. Students, for example, have no influence over the questions that are asked in the exam. Athletes have to face opponents or conditions (e.g. weather, equipment quality) that are determined by external, uncontrollable factors. This lack of control oftentimes provides a lack of confidence (Abramson, Seligman, & Teasdale, 1978; Maier & Seligman, 1976), which in turn is just as necessary for an excellent performance as studying or training (Bandura, 1977; Carver & Scheier, 1981, 2002). What can we do to retain a feeling of control and confidence?

One way of dealing with situations like this could simply be to hope for and rely on an extra bit of good luck, which could help to reach the aspired performance standard. Even though, by definition, luck is nothing else but chance, people go much further than simply hoping for good luck. In fact, many of them actually engage in certain kinds of thinking or behavior to gain that extra bit of good luck or prevent bad luck from happening (Jahoda, 1969; Vyse, 1997; Womack, 1992). Throughout his whole career, Michael Jordan (a graduate from North Carolina), for example, always wore his old blue North Carolina shorts under his actual NBA uniform for good luck. Similar, the famous tennis player Bjorn Borg would not shave if he was winning during a tournament. Golf pro Tiger Woods tries to gain the extra bit of good fortune by wearing a red shirt on Sundays, which is usually the last day

of a tournament. Superstitions also are observed among many people outside of the public view. Thus, it is not uncommon for people to carry lucky charms (Epstein, 1993; Wiseman & Watt, 2004), knock on wood (Blum & Blum, 1974; Keinan, 2002), keep their fingers crossed (Vyse, 1997), or avoid walking under ladders (Blum & Blum, 1974; Pole, Berenson, Sass, Young, & Blass, 1974).

Previous research on superstitious thinking and behavior has examined various factors that contribute to this phenomenon. Much of the work focused on the following three questions: What kinds of superstitious and magical thinking exist? Who are the people that are especially prone to superstitions? Which circumstances are especially likely to elicit superstitious thinking and acting? However, despite the ubiquity of this phenomenon, little is known yet about the psychological function of superstitions in performance-related situations. To remedy this shortcoming, the present thesis attempts to specify the actual consequences of superstitions on performance outcomes as well as the mechanisms underlying these effects.

# THEORETICAL PART

## The prevalence of superstitions

### *Incidence of superstition*

Despite the fact that superstitious beliefs and behaviors are widespread, research on this phenomenon can still be described as rather rare. One reason might be that superstitious and magical thinking is perceived as an extremely discouraging research topic (Scheibe & Sarbin, 1965). For Campbell (1996), superstitious belief and practice represents a problem with no ready solution. Others even perceive superstitious and magical thinking as “a label for a residual category – a garbage bin filled with various odds and ends that we do not otherwise know what to do with” (Nemeroff & Rozin, 2000, p. 1). Another reason why to date there is only a limited amount of empirical research on superstitions could be that these behaviors are often associated with embarrassment (Van Raalte, Brewer, Nemeroff, & Linder, 1991; Vyse, 1997) and thus are difficult to assess. Undoubtedly, many people are reluctant to confess their superstitions, which are typically exercised in private, for fear of negative evaluation (Vyse, 1997). Nevertheless, there is some existing data, that suggests a wide spreading of this phenomenon over various times and cultures (for reviews see Jahoda, 1969; Vyse, 1997; Zusne & Jones, 1989). Thus, about 30 years ago, surveys in Britain (Abercrombie, Baker, Brett, & Foster, 1970) as well as in the U.S. (Gallup, 1984) reported that about one third of the respondents indicated that they were at least a little superstitious. But how about today?

### *Change of prevalence over time*

Instead of gradually fading as some theorists would have expected (Campbell, 1996), superstitious thinking actually seems to have increased over the last few decades. Indeed, a more recent Gallup poll (Newport & Strausberg, 2001) reported that now more than half (53%) of the American population admits to being at least somewhat superstitious. In a recent poll in Great Britain (Wiseman, 2003), it is even more than three quarters (77%) of the respondents who reportedly are somewhat superstitious. Similar degrees of superstitions have been observed in the German population with 51% of the interviewees holding superstitious beliefs (Lachmann, 2005).

## *Superstitious half-beliefs*

Interestingly, here as well as in most of the previously reported surveys, the percentage of people who report to engage in a certain superstitious behavior (e.g. touching wood, avoid ladders, fingers crossed) surpasses the amount of professed beliefs (Abercrombie et al., 1970; Institut für Demoskopie Allensbach, 2000; Gallup, 1984). Moreover, in many other studies people admit to engaging in manifold superstitious behaviors but at the same time rate them as not necessarily very effective (Bleak & Frederick, 1998; Rudski & Edwards, 2007). Thus, it seems that superstitions and magical thinking involve “half beliefs” (Campbell, 1996; McKellar, 1952) which are held by people even though they are aware that such thoughts are irrational (Pronin, Wegner, McCarthy, & Rodriguez, 2006; Risen & Gilovich, 2007). Why would so many people engage in superstitious behaviors even though they deny truly believing in them? One answer could be that people act on the principle of Pascal’s wager. Blaise Pascal, a seventeenth-century French philosopher and mathematician reasoned that even if there only is a small possibility concerning the existence of heaven and hell, it might be the safest strategy to protect against the risk of damnation by living a Christian life. Applying this notion to superstitions, it seems that people think they should perform the superstitious behavior – just in case it might help (Jahoda, 2007; Killeen, 1977). Another possibility is that engaging in superstitious behavior has a function on its own (Keiran, 2002; Neil, 1980). To explore this function more extensively, it might be helpful to first have a look at the findings concerning the demographics and emergence of superstitions.

## The superstitious personality

### *Demographics of superstition*

Existing research on superstitions goes much farther than simply documenting its existence. Rather, numerous correlations between superstitions and demographic factors or personality traits have been identified (Blum & Blum, 1974; Epstein, 1991; Killeen, Wildman, & Wildman, 1974; Tobacyk & Shrader, 1991; Tobacyk, Nagot, & Miller, 1988). Whereas some of these findings are very consistent, others vary across studies.

### *Superstition and gender*

Many findings suggest that women are more superstitious than men (Blum & Blum, 1974; Buhrmann & Zaugg, 1981; Conklin, 1919). In a study conducted during the 1972

Olympic Games in Munich, for example, Burn (1975) found that of all German athletes who possessed a mascot, 72 percent were females. Contradicting these findings, however, are the results of Buhrmann and colleagues (Buhrmann, Brown, & Zaugg, 1982), which revealed no differences between male and female basketball players in neither the total amount of superstitions held, nor the overall degree of superstitiousness. Another study even found that male hockey players held more superstitious beliefs and practices than female players (Neil, Anderson, & Sheppard, 1981).

### *Superstition and age*

Also inconsistent are the findings on the relationship between age and superstitions. Again, whereas some work suggests that younger adults are more superstitious than older age groups (Corrigan, Pattison, & Lester, 1980; Gallup & Newport, 1990), other studies suggest an increase of superstitious beliefs with increasing age (Epstein, 1993).

### *Superstition and level of education*

An almost identical picture appears upon inspection of the association between the formal level of education and the acceptance of superstitious beliefs. While some researcher concluded that there was no effect of education on paranormal beliefs (Jahoda, 1968; Salter & Routledge, 1971), others found evidence for a negative relation between superstitious beliefs and years of study (Blum & Blum, 1974; Otis & Alcock, 1982).

Taken together, these contradictory findings make it difficult to draw valid inferences from demographic factors on the appearance of superstitious thinking and practicing.

### *Superstition and personality traits*

In contrast to the results concerning the prevalence of superstitions depending on demographic factors, previous findings on the relationship between certain personality characteristics and superstitions seem to be much clearer. Thus, for example, numerous studies reported more superstitions and irrational beliefs among people with lowered capacity for critical thinking, less-skilled logical reasoning, and lower IQs (Alcock & Otis, 1980; Killen et al., 1974; Wierzbicki, 1985). Furthermore, it has been suggested that higher levels of superstition correlate with higher levels of conservatism (Boshier, 1973a; 1973b), higher levels of trait anxiety (Epstein, 1991; Wolfradt, 1997), lower levels of self-efficacy (Tobacyk & Shrader, 1991), and an external locus of control (Dag, 1999; Peterson, 1978; Schippers & Van Lange, 2006; Tobacyk et al., 1988).

Taken together, these findings suggest that the tendency to develop superstitious thoughts and behaviors is primarily associated with rather poor psychological adjustment. However, even though these findings seem to be rather consistent, they should still be viewed carefully. In most of these studies, superstitious beliefs were assessed by using the superstition subscale of the Paranormal Belief Scale (Tobacyk, 2004; Tobacyk & Milford, 1983). This instrument, however, only consists of items assessing so-called “negative” superstition which refer to “bad luck” (e.g. breaking a mirror, the number 13, black cats) and neglects “positive” superstitions which refer to lucky events (e.g. carry a charm, crossing fingers, touching wood). Wiseman and Watt (2004) conducted an empirical study demonstrating that these positive superstitions matter too. Overall, superstitions related to “good luck” were endorsed more often and revealed a more favorable pattern on several individual difference measures (e.g. life satisfaction, neuroticism) than did superstitions related to “bad luck”. This finding suggests that the maladaptive nature of superstitions, which has often been suggested (Alcock, 1981; Dag, 1999), might not be the whole truth. Rather, some researchers have begun to reevaluate the functions of superstitious beliefs and behavior and argue that superstitions may just as well be adaptive (Becker, 1975; Neil, 1980, 1982; Keinan, 2002; Rudski, 2001; Rudski & Edwards, 2007; Vyse, 1997; Wiseman, 2004). This perspective seems especially plausible if one has a look at the groups of people who are traditionally and particularly attracted by superstitions (Vyse, 1997).

## Superstitious groups

So who are the people that seem to be especially likely to exhibit superstitions? Next to gamblers, sailors, financial investors, and soldiers (Hayano, 1978; Henslin, 1967; Stouffer et al., 1949; Vyse, 1997), two groups particularly susceptible to superstitions are athletes (Becker, 1975; Neil, 1980; Todd & Brown, 2003; Womack, 1992) and students (Albas & Albas, 1989; Blum & Blum, 1974; Vyse, 1997).

### *Superstitious students*

Assessing the level of superstitions in student populations, Gmelch and Felson (1980) as well as Gallagher and Lewis (2001) reported that nearly 70% of the students who participated in their studies had engaged in superstitious rituals. Similar results were reported by Saenko (2004) for Russian students. An additional interesting finding was reported by Albas and Albas (1989), who demonstrated that the great majority of superstitions held by students were intended to bring “good luck” rather than ward off “bad luck.” The authors also reported that the superstitions exhibited were highly private and idiosyncratic instead of

socially and culturally shared. The specific behaviors ranged from wearing particular pieces of clothes, jewelry, or perfume to using special pens or eating certain kinds of food. An especially compelling anecdote tells of one student who was reluctant to take an exam until he had found a “lucky” coin around the bus stop, even at the risk of being late.

### *Superstitious athletes*

Despite the high prevalence of superstitions in the context of exams, students seem to engage in behavioral rituals even more extensively when it comes to athletic competitions (Rudski & Edwards, 2007). Several studies on high school, college, or university athletic teams reveal a similar high level of superstitions across different types of sport such as baseball (Ciborowski, 1997), basketball (Buhrmann & Zaugg, 1981, 1983), hockey (Neil et al., 1981), gymnastics, track, and American football (Bleak & Frederick, 1998), or volleyball, swimming, and tennis (Gregory & Petrie, 1975). However, not just student athletes but also professional baseball players (Burger & Lynn, 2005; Gmelch, 1974) as well as football, volleyball, and hockey players (Schippers & Van Lange, 2006) frequently exercise superstitious practices. Some differences across diverse types of sport appear in the kind of superstitions that are engaged (Bleak & Frederick, 1998). Gregory and Petrie (1975), for example, report different superstitions for team sport athletes than for individual sport athletes. Whereas the former exhibited more superstitions related to equipment, for example, the latter exhibited more superstitions related to wearing lucky charms.

In sum, these findings indicate that superstitions seem to play an especially important role in the worlds of athletes and students. What are the reasons for the high prevalence of superstitious thoughts and practices among these particular populations? In order to answer this question it might be helpful to have a closer look at characteristics that are shared by both groups.

### *Similarities of students and athletes*

Taken together, when having a look at athletes and students as the people particularly likely to execute superstitions, it is interesting to note two things: First, despite the fact that superstitions apparently are associated with rather poor personality characteristics, these people actually seem to be especially well adjusted and skillful in coping with required tasks. In fact, the majority of athletes as well as students seem to do rather well in arranging their living conditions and adjusting to specific life circumstances. Moreover, in order to be a successful athlete or student, existing coping strategies seem to be necessarily required.



From this perspective it seems possible that the frequently observed superstitions in these specific populations are helpful rather than solely maladaptive.

Second, a main similarity shared by athletes and students is that both often face situations in a performance context. No matter whether it is about an exam or a sporting event, the achieved performance is considered very important. In fact, next to perceived importance, these performance-related situations of students and athletes seem to share several additional characteristics. In both cases, the achieved outcomes are subject to external evaluations by experts such as teachers, professors, or athletic judges. Furthermore, in most cases, students and athletes only have a limited number of opportunities to demonstrate their performance. Thus, students usually are allowed only one attempt to express their answer to a question or to take a specific exam. Similarly, within one competition an athlete only gets once the chance to present a performance or to run a race. The outcome of this single event might then have important consequences and may determine one's future. Depending on the achievement in the specific test or exam, a student may or may not be permitted to visit an advanced class. Similarly, an athlete may or may not stay on the team or become qualified for a more prestigious competition depending on the achieved performance. In light of these characteristics and the resulting pressure, physiological tension, and feelings of anxiety (Schippers & Van Lange, 1996; Treasure, Monson, & Lox, 1996) they produce, it may not be surprising that students and athletes seek help from external sources such as superstitions. In fact, additional research on the development of superstition revealed that these seemingly irrational thoughts and practices most likely occur in situations that are very similar to the performance-related situations faced by students and athletes. The following paragraphs will examine specific situational circumstances under which superstitions seem to arise and focus on potential beneficial functions of superstitious thoughts and practices.

## The “superstitious situation”

In many views, situational and environmental variables may be even more important to understanding the mechanisms and functions of superstition than the personality variables summarized above. Several researchers have examined specific circumstances under which the endorsement of superstitions becomes more or less likely (Jahoda, 1969; Vyse, 1997). Their findings indicate that superstitions appear most often under conditions of psychological stress, uncertainty, and low control (Case, Fitness, Cairns, & Stevenson, 2004; Malinowski, 1954; Keinan, 1994; Rudski & Edwards, 2007; Vyse, 1997), which are similar to those characteristics used to describe performance situations for students and athletes. One

of the first pieces of evidence for this notion comes from Malinowski's (1954) observations, who found that Trobriand islanders did not exhibit superstitious behavior when fishing in the safe lagoon where they had a high rate of success. However, when the very same islanders fished in the open sea, where there were more dangers and a lower success rate, superstitious behaviors were observed. Similar, Padgett and Jorgenson (1982) reported a direct relationship between the appearance of magical thinking and the severity of economic threat in Germany between the two World Wars. More examples of the close relationship between the appearance of superstitions and uncertain, uncontrollable, and highly stressful demands are found in the realm of sports.

### *Superstitious situations in sports*

Comparable to the observations above, superstitions in sport also tend to arise when the outcome of an event seems to depend on external factors that are outside of the athletes' control. In his analysis of baseball-related superstitions, Gmelch (1971) found that superstitions hardly occur in fielding, where the success rate is close to 98 percent. However, when it comes to hitting and pitching, where the rate of success is much lower and seems to depend on luck and other external circumstances, superstitions are frequently exhibited. Professional athletes in a scenario study indicated higher commitment to superstitious rituals the more important the game was perceived and the more uncertainty was experienced prior to the game (Schippers & Van Lange, 2006). Similar, Ciborowski (1997) reported a high rate of superstitious practices when games were close or when a team was about to lose, but not when a team was leading comfortably. Additionally, evidence has been gathered demonstrating that athletes for whom the stakes are highest are most likely to engage in superstitious behavior (Buhrmann & Zaugg, 1981; Neil et al., 1981). Thus, superstitions are more prevalent the higher the competitive level, the greater the personal involvement, and the longer athletes had trained in their sports. For example, hockey players who practiced or played six times a week exhibited almost twice as many superstitions as players who only practiced once or twice a week and played in a lower league (Neil et al., 1981). Furthermore, superior teams as well as better individual athletes within a team exhibited more superstitious behavior than inferior teams or poorly performing individual athletes (Buhrmann & Zaugg, 1981).

In sum, one can conclude from these analyses that athletes are most likely to engage in superstitions when the stakes are highest and when they have the most to lose. That is, superstitions are most often observed when the outcome of their athletic performance is highly important for the athletes themselves and may have an influence on future aspects of

their athletic career. As demonstrated above, these kinds of situations often come with a sense of low control and perceived psychological stress (Treasure et al., 1996), which are exactly those variables that have been demonstrated to elicit superstitions in other domains of life.

### *Superstition and experienced psychological stress*

In fact, in a different line of research outside the world of sport, Keinan (1994) presented results indicating that psychological stress and conditions of uncertainty are main predictors of superstitions. He demonstrated that during the Gulf War, Israeli citizens who lived in cities with high exposure to missile attacks, thus living in highly stressful conditions, engaged more frequently in magical thinking than citizens who lived in cities with no exposure to missile attacks. This finding was later replicated in a controlled study (Keinan, 2002). Here, students of the Tel Aviv University were approached either half an hour prior to an exam (high stress condition) or on a regular study day (low stress condition). Participants were interviewed with several questions, some of which were especially designed to elicit the superstitious behavior “knocking on wood”. For example, participants were asked whether they had ever been involved in a fatal road accident. The experimenter recorded whether the participants then knocked on wood. As predicted, Keinan (2002) found that participants in the high stress condition knocked on wood more often than those in the low stress condition. Another string of evidence that points in a similar direction stems from studies in which superstitious behavior was experimentally induced by creating environments of uncontrollability.

### *Superstition and experienced uncontrollability*

The previous findings demonstrated that superstitions often occur naturally in situations of psychological stress and under circumstances that are inherently perceived as uncontrollable (Jahoda, 1969; Vyse, 1997). Additional evidence suggests that superstitious behavior can also be induced experimentally by creating exactly these kinds of situational circumstances (Catania & Cutts, 1963; Ono, 1987). In his seminal study, Skinner (1948) demonstrated that in uncontrollable reinforcement situations, even pigeons develop superstitions. In his investigations, Skinner provided food reinforcement to pigeons in intervals of 15 seconds. After a few minutes, the pigeons started to execute distinctive stereotypic rituals even though reinforcement was completely independent of the pigeons' behavior. These rituals consisted exactly of those behaviors that were temporally contiguous with the application of the food reinforcement. Thus, one pigeon walked around in circles,

another jumped from one side of the cage to another, and so on. Superstitious behavior in humans as a result of uncontrollable reinforcement has since been replicated several times (Catania & Cutts, 1963; Ono, 1987; Rudski, Lischer, & Alert, 1999; Wright, 1962).

Further findings demonstrate that superstitions not only develop as results of uncontrollability within a given situation but also because personal factors such as a strong desire for control (Burger, 1986, 1989). Thus, Van Raalte and her colleagues (1991), for example, demonstrated that those students who believed that their own actions exert some control over chance events were most likely to exhibit superstitious behavior. Specifically, participants in this study performed 50 trials of a golf putting task in which they chose one of four different colored golf balls for each putt. Each time a participant successfully hit the ball into the hole and then selected the same color ball for the subsequent putt, their behavior was defined as superstitious. As indicated above, this experimental setting with clearly uncontrollable outcomes – all participants were without experience in the golf task – generated superstitious behavior. This was especially true for those students who most strongly believed that choosing the „lucky ball” actually allowed them to regain some control over the event.

In sum, the presented findings provide sufficient evidence for the assumption that superstitions are especially likely to occur under circumstances of low controllability, high psychological stress and feelings of uncertainty. From this perspective, it seems natural to argue that these seemingly irrational thoughts and behaviors actually serve a specific benefit. Clearly, not only for students and athletes but for everyone in a demanding performance context, the most beneficial functioning of superstitious thoughts and behaviors would be a direct effect of superstitions on performance enhancement. This notion will be debated more detailed in the following paragraph.

## The benefits of superstitions

### *The influence of superstition on performance enhancement*

Given that students and athletes more often than other groups engage in performance-related situations and that both groups more often than other groups engage in superstitious beliefs and behaviors, the question arises whether these superstitions actually exert an influence on achieved performance. In fact, when asked for the reasons for their superstitions, many of the students (Albas & Albas, 1989; Vyse, 1997) as well as the athletes (Ciborowski, 1997; Womack, 1981) reported engaging in superstitious thoughts and

practices in order to improve their performance. By far, they are not the only ones to propose this assumption. Neil (1980) argued that superstitions function as a “psychological placebo.” That is, similar to findings in pharmacology (Macedo, Banos, & Farre, 2008) and clinical psychology (Rosenthal & Frank, 1956; Shapiro, 1960), the execution of superstitions may indeed lead to superior performance simply because one believes in the effect. Keinan (1994, 2002) explains his findings in a similar way. He suggests that superstitions and magical thinking might help the individual to reduce the experienced stress. On a more theoretical but not empirically tested level, he also suggests that superstitious thinking can create a self-fulfilling prophecy: A practiced superstition might increase optimism, decrease stress, and thus improve task performance.

This notion also seems to make sense from a broader point of view. Arguing from an evolutionary perspective, which reasons that any kind of behavior will prevail as long as it is adaptive (Buss, 2000), one can contend that in order to maintain them, a beneficial function of superstitious behaviors seems to be inevitable. The question remains, of course, as to whether this benefit manifests itself as an improvement in performance. In fact, apart from anecdotal evidence on the part of students or athletes, and speculations similar to those by Neil (1980) and Keinan (2002), empirical evidence concerning the effect of superstitions on performance enhancement does not exist. Rather, despite the high prevalence of superstitions and the knowledge that these behaviors are especially likely to emerge in the context of performance tasks, little empirical attention has focused on the relationship between superstition and performance at all.

### *The prevention of performance impairment by superstitions*

As an exception, the only initial empirical evidence supporting the presented perspective arises from the work of Helen Matute (1994, 1995) and Thomas Dudley (1999), both of whom examined the consequences of superstitions on performance in the face of uncontrollable outcomes. While previous research reported the development of learned helplessness in response to perceived uncontrollability (Abramson et al., 1978; Hiroto & Seligman, 1975; Seligman, Meier, & Solomon, 1971), Matute (1994) and Dudley (1999) presented an alternative perspective. They both demonstrated that participants faced with uncontrollable tasks tended to exhibit superstitions, which subsequently prevented the development of learned helplessness and thus performance impairment. Specifically, Matute (1994) found that participants did not develop superstitions if they had control over a loud tone. However, yoked subjects in a control condition tended toward superstitious behavior during the exposure to the uncontrollable noise. In a subsequent anagram task, the cognitive

performance of those participants who had developed superstitions was neither facilitated nor impaired in comparison to those who had control over the tone in the first place. Dudley (1999) reported similar results. In one of his experiments, he assessed the level of superstitious beliefs both before and after exposure to a solvable or unsolvable word puzzle. Subsequent to working on an unsolvable task, participants reported an increased level of superstition. This was not the case after exposure to a solvable problem. In this regard, this finding supports earlier notions arguing that superstitions arise most often in performance-related situations that include high levels of psychological stress and perceived uncontrollability (Rudski et al., 1999; Vyse, 1997). In another study, Dudley (1999) assessed participant's level of superstitious beliefs one week prior to the actual experiment and divided them in low and high believers. Similar to the previous study, participants were exposed to either a solvable or unsolvable word puzzle. Subsequently, participants were given ten solvable anagrams and were given two minutes to solve as many of them as possible. Results showed that following the unsolvable problem, those participants with a comparatively high level of superstitious beliefs solved more anagrams than those with a lower level of superstitious beliefs. Similar to Matute (1994), Dudley concluded that superstitions might help prevent the development of learned helplessness following instances of uncontrollability, which in turn prevents performance decline. However, both Matute's and Dudley's studies have limitations. For example, it has been claimed that superstitions that are experimentally induced are qualitatively different from more traditionally superstitions (Rudski, 2001). Basically, what is called a superstition in Matute's study is the incorrect belief that a meaningless behavior (e.g. pressing a certain key combination) is responsible for the offset of loud tones. However, if participants are made to believe they have control over this unknown task, it is not surprising that their subsequent psychological state and performance in another task is not impaired in comparison to those participants whose key combination had a real effect on the tones. Moreover, the illusory belief developed in regard to the acoustic task and was not related whatsoever to the subsequent anagram task in which the "superstitious behavior" of pressing certain key combinations was not required. Traditional superstitions, however, usually are targeted on a specific task and are performed prior to that task. A fisherman exhibits superstitions in order to be fortunate in fishing. A student's superstition is aimed at the exam. It is thus questionable whether the experimentally induced superstition in Matute's study can actually be compared to traditional superstitious behavior. Similarly, in Dudley's studies, the level of superstition that was assessed prior to and/or after the unsolvable word-puzzle task seems to have no specific relation to the subsequent anagram-task for which performance was assessed. Furthermore,

Dudley's studies utilize a quasi-experimental design, which makes it difficult to distinguish the effects of superstitions from other personality variables.

In sum, despite their limitations, the presented findings provide initial evidence for a causal relationship between superstition and performance. Specifically, these studies demonstrate that the adoption of superstitions in the face of uncontrollable achievement tasks prevent the impairment of task performance.

## First research question

Looking back at the laboratory studies in which superstitions were generated (Catania & Cutts, 1963; Keinan, 2002; Ono, 1987; Rudski et al., 1999; Van Raalte et al., 1991) it is interesting to note that most of them were conducted in a performance context. In the reinforcement studies as well as in the golf putting study, participants were prompted to try their best, however, without experiencing control of how to reach that goal. While all of these studies find that superstitions indeed develop under conditions of uncontrollability or among people with a strong desire for control, none of them included an objective performance measure subsequent to the emergence of the superstition. This seems to be a shortcoming, especially since many authors conclude by pointing out the importance of explicitly examining the influence of superstition on performance (Bleak & Frederick, 1998; Schippers & Van Lange, 2006; Van Raalte et al., 1991). Despite these reasonable arguments and manifold requests for further investigations, existing empirical evidence for a causal relationship between superstitions and superior performance is exceedingly small. The only exception is the series of studies that suggest that superstition may prevent the impairment of performance outcomes (Matute, 1994; Dudley, 1999).

On the other hand, it has been demonstrated that most people report exhibiting superstitious behavior not only to prevent performance impairment but also to reach an actual performance improvement (Albas & Albas, 1989; Lobmeyer & Wasserman, 1986). Could it be that superstitions engaged in performance-related contexts do not only hinder the development of learned helplessness and thus performance impairment but moreover cause an increase in performance? In fact, several researchers have suggested such a beneficial function of superstition as an explanation for the high prevalence and maintenance of superstitions in sport and academics. The present research set out to fill the gap in empirical evidence supporting the notion that superstitions can indeed have an effect on performance outcome. The main purpose of the present research was to find an answer to the question of whether superstitious behaviors and beliefs indeed yield an advantage for those who hold



them. Specifically, the research was conducted to find empirical evidence for a causal relationship between superstition and superior performance.

## The mechanism of performance influence

If the improvement of a performance indeed results from the presence of superstitious thoughts and behaviors prior to that task and thus may account for the high maintenance of superstitions in performance contexts, the inevitable question for the mediating process of this effect arises. What are the psychological mechanisms that might account for the potential effect of superstitions on subsequent performance enhancement?

To answer this question it might be helpful to look at factors that are known to influence task performance in general. Next to general abilities and skills, which are among the most well-established influences on performance (Schmidt & Hunter, 1998), a host of variables have been connected to performance outcomes in intellectual or athletic tasks. Many of them, such as motivational influences (Linnenbrink & Pintrich, 2002), personality characteristics (Barrick & Mount, 1991; Day & Silverman, 1989; George, 1992), goal setting (Locke & Latham, 1990), prior experience (Schmidt, Hunter, & Outerbridge, 1986; Seta & Hassan, 1980; Weekley & Ployhart, 2005), mood (Clare, Schwarz, & Conway, 1994), and emotions (Baron, 1990; Eysenck, 1985; Murray & Janelle, 2003) are factors within a person that have been shown to influence task performance. Other factors, such as the presence or absence of other people (Bond & Titus, 1983; Karau & Williams, 1993; Zajonc, 1965), noise (Glass & Singer, 1973; Nagar & Pandey, 1987), or time pressure (Freedman & Edwards, 1988), for example, represent variables that may shape one's environmental and situational conditions in the context of a performance task. However, one of the most important factors that has been proven to be a highly consistent predictor of performance outcomes is Bandura's (1977, 1997, 2001) prominent concept of self-efficacy beliefs. In fact, many of the variables described above such as human motivation, goal setting, attribution styles, general well-being, affective processes, or prior experiences are actually influenced by people's self-efficacy beliefs themselves (Bandura, 1977, 1986, 1989, 1994). Furthermore, the findings of numerous studies examining the relationship between self-efficacy beliefs and achievement outcomes leads to the conclusion that the contribution of self-efficacy oftentimes even overrides the effect of abilities and skills (Bouffard-Bouchard, 1990; Graham & Weiner, 1996; Zimmerman & Cleary, 2006). Given the importance of Bandura's (1997) self-efficacy concept concerning the prediction of performance outcomes, the concept as well as its contribution to performance outcomes will be described in more detail throughout the following paragraphs.



## Self-efficacy

### *Description of the self-efficacy concept*

Self-efficacy is the key concept in Bandura's social cognitive theory (Bandura, 1977, 1986) and refers to one's perceived capability to produce results and to attain designated types of performance (Bandura, 1977, 1997). In other words, self-efficacy judgments concern the confidence people have in their abilities to do the things they are trying to do (Pajares, 1996). According to Bandura, self-efficacy beliefs touch virtually every aspect of people's lives. In fact, with regard to the role of self-efficacy beliefs in human functioning, Bandura (1997) states that "people's level of motivation, affective states, and action are based more on what they believe than on what is objectively true" (p. 2). Therefore, the beliefs people hold about their capabilities can often be a better predictor of their behavioral outcomes than what they are actually capable of accomplishing. Indeed, abundant research within the last three decades provides empirical support for a powerful influence of self-efficacy beliefs on various types of attainment (see Stajkovic & Luthand, 1998, for meta-analysis of research on the relationship between self-efficacy beliefs and achievement outcomes). Thus, self-efficacy beliefs have been found to predict performance measures in many different areas, such as educational attainments (Schunk & Pajares, 2004), work-related performance (Judge, Jackson, Shaw, Scott, & Rich, 2007), managerial performance (Gist, 1989; Wood, Bandura, & Bailey, 1990), social behavior (Gist, Stevens, & Bavetta, 1991; Saks, 1995), cognitive and memory tasks (Bandura, Cioffi, Taylor, & Brouillard, 1988; Berry, 1999; Berry & West, 1993), academic achievements (Bandura, 1997; Multon, Brown, & Lent, 1991), and athletic performance (Feltz & Chase, 1998; Moritz, Feltz, Fahrback & Mack, 2000). Moreover, it has been revealed that self-efficacy is a more consistent predictor of behavioral outcomes than any other motivation construct (Graham & Weiner, 1996). Thus, efficacy beliefs contribute more strongly to future task performance than ability or past performance (Bandura, 1982, 1993; Cervone, Jiwani, & Wood, 1991). With these findings at hand, it is possible to derive the assumption that self-efficacy beliefs play a mediating role for the effect of superstition on superior performance. Indeed, this reasoning is reminiscent of the suggestions by Neil (1980) or Keinan (2002), who described the functioning of superstitions in a similar way. Given that superstitions are most likely to be engaged by athletes and students, the following paragraphs will shed a more detailed light on findings that demonstrate the effects of self-efficacy beliefs on performance in the athletic as well as the intellectual context.

## *Influence of self-efficacy beliefs on intellectual achievement*

Numerous findings in recent research indicate that perceived efficacy beliefs contribute independently to intellectual performance across different academic domains such as writing (Shell, Murphy, & Bruning, 1989; Zimmerman & Bandura, 1994), reading (Schunk, 2003; Schunk & Swartz, 1993), mathematics (Collins, 1982; Pajares & Miller, 1994), and problem solving (Bouffard-Bouchard, 1990). These studies repeatedly demonstrate that those who hold stronger efficacy beliefs have a higher probability of succeeding and mastering various intellectual activities better than those with weaker efficacy beliefs, even if the latter have the same inherent ability or skill level (Zimmerman & Cleary, 2006). Collins (1982), for example, selected students who judged themselves to be of high or low math self-efficacy within each of three levels of mathematical ability (high, intermediate, low). Participants were then asked to solve difficult mathematical problems that were presented to them. At each level of math ability, students who had the stronger belief in their efficacy solved more problems, were quicker to discard faulty strategies, and reworked more failed problems than did students of equal ability who were lower in their sense of self-efficacy. Similar results were presented by Bouffard-Bouchard (1990), who showed the causal contribution of efficacy beliefs to intellectual performance even more directly. Specifically, in this study, high or low efficacy beliefs were experimentally manipulated at two levels of ability on a novel problem-solving task. To do so, participants received arbitrary feedback about their performance as compared to fictitious peer norms. Regardless of students' pretest level of ability, those whose sense of efficacy was raised were more successful in their problem solving and were more flexible in their strategic search for effective solutions than those students whose self-efficacy was lowered.

A different approach that sheds further light on the direct effect of self-efficacy beliefs on intellectual performance stems from studies that include path analyses (Pajares & Miller, 1994; Schunk, 1981, 1984; Zimmerman & Bandura, 1994). Pajares and Kranzler (1995), for example, examined the unique contribution made by efficacy beliefs to the prediction of mathematics achievements when a measure of general intelligence was included in the model. Next to mathematics self-efficacy and general mental ability, the path model also included math anxiety, high school math level, and gender. Results revealed that even when the effects of general mental ability were controlled, participants' perceived math self-efficacy accounted for unique variance in intellectual performance. In fact, self-efficacy and general cognitive ability on student's math problem-solving achievement were about equally strong predictors of students' math problem-solving achievement.

In sum, research has repeatedly demonstrated the unique predictive influence of self-efficacy beliefs on intellectual performance. Independent of their general or task specific skills, people achieve higher intellectual performance when they experience a high level of self-efficacy rather than a low level.

### *Influence of self-efficacy beliefs on athletic achievement*

Similar to the presented findings on intellectual achievements, many studies in the field of sports demonstrate the impact of perceived self-efficacy on athletic task performance (see Moritz et al., 2000, for a meta-analysis on the relationship between self-efficacy beliefs and athletic performance). Initial evidence for the positive relationship between perceived efficacy and athletic performance stems from the many correlational and regression studies in numerous fields of sport such as tennis (Barling & Abel, 1983), golf (Beauchamp, Bray, & Albinson, 2002; Bond, Biddle, & Ntoumanis, 2001), gymnastics (Lee, 1982; Weiss, Wiese, & Klint, 1989), springboard-diving (Feltz, Landers, & Raeder, 1979; Slobounov, Yukelson, & O'Brien, 1997), basketball (Kavussanu, Crews, & Gill, 1998), baseball (Watkins, Garcia, & Turek, 1994), hockey (Feltz & Lirgg, 1998), volleyball (Kitsantas & Zimmerman, 2002), wrestling (Treasure et al., 1996), and triathlon (Burke & Jin, 1996). Although most of these studies suggest that self-efficacy is the strongest or even the only factor that predicts athletic outcomes, the results should be interpreted carefully because they are correlational in nature. More direct evidence for the causal relationship between self-efficacy and athletic performance can be drawn from experimental studies in which the level of perceived efficacy was manipulated (Boyce & Bingham, 1997; Wells, Collins, & Hale, 1993) or from studies using path analyses (Feltz, Chow, & Hepler, 2006; Fitzsimmons, Landers, Thomas, & Van der Mars, 1991; George, 1994; Theodorakis, 1995). In particular, a series of experiments by Weinberg and his colleagues (Weinberg, 1985; Weinberg, Gould, & Jackson, 1979; Weinberg, Gould, Yukelson, & Jackson, 1981; Weinberg, Yukelson, & Jackson, 1980) verifies Bandura's (1977) claim that perceived self-efficacy independently contributes to the prediction of future athletic performance. To examine the effect of self-efficacy on muscular endurance performance, participants were randomly assigned to either a high or a low self-efficacy condition (Weinberg, 1985; Weinberg et al., 1979; Weinberg et al., 1981). Specifically, participants in the high efficacy condition were led to believe that they were to perform against a person with weak ligaments and a knee injury who previously had performed poorly on a similar leg-strength task. Participants in the low efficacy condition thought that they were performing against a well-trained track athlete who ostensibly had outperformed participants in a previous leg strength-task. While all participants lost to the confederate in the experimental trials of the endurance task, participants of the high efficacy

group held their legs out longer than those in the low efficacy group (Weinberg, 1985; Weinberg et al., 1979). Additionally, compared to the first trial, high self-efficacious participants exhibited increased muscular endurance performance on the second trial, whereas those in the low self-efficacy group displayed lower performance times on the second trial (Weinberg et al., 1979). Moreover, Weinberg and colleagues (Weinberg et al., 1981) examined the differential effects of preexisting self-efficacy beliefs and manipulated self-efficacy beliefs on muscular endurance performance. Results indicated that preexisting efficacy expectations primarily influenced endurance performance on the first trial. Experimentally manipulated self-efficacy beliefs, however, exerted greater influence on the performance times in the second trial.

Taken together, the results of these studies provide strong evidence in support of a causal relationship between self-efficacy beliefs and performance in the athletic domain. Specifically, it has been repeatedly shown that individuals with a high sense of self-efficacy display higher athletic performance than individuals with a lower level of self-efficacy beliefs. Moreover, the contribution of experimentally manipulated task-specific efficacy expectations on the prediction of an athletic performance seems to override the influence of preexisting self-efficacy beliefs, at least under some conditions.

In this regard, performance enhancement can be expected to be apparent whenever it is possible to raise people's task-specific self-efficacy beliefs. Applying this idea to the topic of the present research, one can argue that the expected effect of superstition on superior performance may be mediated by self-efficacy beliefs. This should only be the case, however, if the activation or execution of superstitions indeed leads to the presumed raise in perceived self-efficacy. A closer look on further aspects and dimensions of the concept of self-efficacy beliefs may shed light on this perspective.

### *Dimension and characteristics of self-efficacy beliefs*

According to Bandura (1977, 1997), self-efficacy beliefs vary across the three dimensions of level, strength, and generality. The level of self-efficacy refers to people's expected performance attainments at different levels of difficulty, such as anagram problems of increasing difficulty. The strength of self-efficacy judgments refers to the certainty of people's beliefs that they can attain these different levels of performance, ranging from complete uncertainty to complete certainty. Thus, two individuals may believe that they can solve the same amount of anagram tasks, however, one may be more certain about this belief than the other. The generality of self-efficacy beliefs refers to the transferability of one's

efficacy judgments across different tasks or activities, such as different word tasks (Feltz, Short, & Sullivan, 2008).

Instead of focusing on personality traits and psychological characteristics, self-efficacy beliefs refer to people's perceived capabilities to perform specific activities (Zimmerman, 1995). Thus, self-efficacy beliefs refer to beliefs about what people can do with their skills rather than what skills or attributes they have (Feltz et al., 2008; Zimmerman & Cleary, 2006). Additionally, self-efficacy beliefs are specific to distinct domains. A student, for example, might feel efficacious in regard of academic activities but may lack confidence in parental tasks. Moreover, even within a particular domain, self-efficacy beliefs may vary depending on the context or the specific task. In terms of context-specificity, an athlete may express a higher sense of efficacy about performing a routine in a training session than in a public competition. Similarly, in terms of task-specificity, a student's efficacy beliefs concerning academic activities may be low for problem solving tasks but high for writing activities or presentation tasks (Bandura, 1997; Cleary & Zimmerman, 2004). The specificity of the self-efficacy construct has important implications.

### *Implication of self-efficacy specificity*

The first implication refers to the measurement of the construct. According to Bandura (1997, 2006), scales of perceived self-efficacy must be tailored to the particular domain of functioning one wishes to assess. Moreover, the degree of specificity at which self-efficacy is measured should be determined by the nature of the situation at hand and the nature of the situation or task to which one wishes to generalize or predict. A second implication refers to the context-specificity of self-efficacy beliefs. If people's perceived self-efficacy depends on specific context features then it should be possible to shape people's self-efficacy beliefs by varying the context. This is exactly what has been found. Throughout the extensive research on self-efficacy beliefs, manifold methods such as false feedback (Klein, Loftus, & Fricker, 1994; Sanna, 1997; Weinberg et al., 1979), verbal messages (Wise & Trunnell, 2001), modeling (Lirgg & Feltz, 1991; Gould & Weiss, 1981), or manipulation of prior task difficulty and thus experience (Wells et al., 1993; Yan & Gill, 1984) have been used to influence participants' perceived level of efficacy in experimental or applied settings. Furthermore, additional factors that have been found to affect self-efficacy are cognitive strategies such as self-talk (Vargas-Tonsing, Myers, & Feltz, 2004), emotional and physiological states (Chase, Feltz, & Lirgg, 2003; Maddux & Meier, 1995), imagined experiences (Maddux, 1995), and social support (Vealey, Hayashi, Garner-Holman, &

Giacobbi, 1998). From this perspective, it also seems possible that self-efficacy beliefs may increase in the context of activated or exhibited good luck superstitions compared to situations where superstitions are lacking. As Bandura (1997) notes, people can judge their degree of confidence by the emotional state they experience while preparing for an action. Thus, one way to enhance self-efficacy is to improve people's physical and emotional well-being. This mode of functioning might come into play when people engage in superstitious behavior prior to a performance task. From this perspective it seems reasonable that the mere activation of a superstition associated with the positive concept of good luck (Teigen, 1995, 2005) in the context of a performance task may enhance people's positive emotional reactions toward the designated task and thus may provide cues about the anticipated success or failure of the outcome. In fact, several non-empirical speculations as well as prior empirical findings on research examining psychological consequences of superstitious thoughts and actions support this reasoning.

## Psychological benefits of superstition

As described earlier, superstitions are particularly likely to arise in situations of high psychological stress, perceived uncertainty and low controllability. Moreover, the prevalence and maintenance of superstitions seems to be especially high among students and athletes, who face performance situations containing these characteristics more often than other populations. With this in mind, it seems natural to conclude that superstitions actually help those who hold these beliefs to deal with pressure and to overcome mental and physical obstacles. Even though empirical research on beneficial functions of superstitions is scarce, several authors have suggested such a positive influence of superstitious beliefs on psychological well-being. Thus, it has been speculated that athletes use superstitions to reduce anxiety, build confidence, and cope with uncertainty (Dunleavy & Miracle, 1979; Neil, 1980; Neil et al., 1981; Womack, 1979). Schippers and Van Lange (2006) claimed that the benefit of superstitions might stem from reducing psychological tension in athletes, thus enhancing the probability of reaching the *ideal performance state* (IPS, Garfield & Bennet, 1984; Williams, 1986). Becker (1975) noted, that athletes practice superstitions to “keep things constant and minimize disruption” (p. 151 f).

In sum, all of these speculations are consistent with the notion that the execution of superstitions bears some kind of psychological benefit for the individual holding the superstition. In fact, some of these suggestions, such as an increased level of perceived confidence in a specific performance setting, seem to come rather close to the proposed

influence of superstitions on self-efficacy beliefs. Beside these unevaluated arguments, a small body of empirical findings provides further support for this perspective.

### *Correlates of belief in good luck*

One line of empirical studies examining the potential effect of superstition on enhanced feelings of confidence stems from research on *belief in good luck* (Darke & Freedman, 1997a, 1997b; Day & Maltby, 2003, 2005). As the attempt to control luck presumably is the purpose of most superstitions (Darke & Freedman, 1997a, Vyse, 1997), these findings clearly contribute to research on superstitions in general. While Darke and Freedman (1997a) developed a scale to measure the belief in good luck as a stable personality attribute, Day and Maltby (2003, 2005) demonstrated that this nevertheless irrational belief might be adaptive with respect to several psychological variables. Thus, they found that a belief in good luck is significantly related to optimism and shares a significant negative correlation with depression and anxiety (Day & Maltby, 2003), which together lead to greater psychological well-being (Scheier & Carver, 1985; Taylor & Brown, 1988). In a separate set of studies, the same authors demonstrated a positive relationship between belief in good luck and hope (Day & Maltby, 2005), and suggested that belief in good luck can be viewed as an important component in goal planning cognitions. Assuming that psychological variables such as optimism, hope, and reduced anxiety share several characteristics with the concept of self-efficacy, these findings can be viewed as the first support for the idea that superstitious beliefs are related to self-efficacy beliefs. However, the limitations of these studies clearly can be seen in their methodologies, as the observed correlations do not allow the interpretation of the results in a causal manner. Thus, it remains unclear whether superstitious behavior elicits hope, optimism, and psychological well-being or whether superstitions are the result of those psychological states.

Using an experimental design, Darke and Freedman (1997b) examined the effects of believing in good luck on confidence and risk-taking in a future unrelated event, thus coming even closer to the concept of self-efficacy than previous studies. In this study, several weeks after participants' belief in good luck was measured, participants either experienced a lucky event (winning \$5 in an ostensible lottery) or no lucky event (\$5 simply given to them, without winning the money) prior to a decision task. In this task, participants had to decide which of two stimuli that were flashed on the computer screen very briefly outnumbered the other one. Participants' confidence as well as their risk-taking (i.e., betting real money on their decision) were assessed. Interestingly, after the lucky event, those who indicated a belief in luck rated their confidence higher and placed higher bets on their decisions, whereas



those who indicated they did not believe in luck rated their confidence lower and placed lower bets. The authors suggested that these findings indicate some support for the notion that belief in good luck can serve as a source of confidence for future events, thus exerting a beneficial functioning. However, similar to the studies presented above, this study also has some shortcomings regarding the possible interpretation of its results in terms of the superstitious benefits. First, while the lucky event was experimentally manipulated, the second variable – belief in good luck - was not. In this regard, the presented study is only a semi-experimental design, thus limiting the causal interpretation of the obtained results. Second, the manipulation of the lucky event might differ from superstitious behaviors in their traditional meaning. While the lucky event in this study was something that simply happened to the participants rather accidentally, superstitious behaviors usually are deliberately engaged by individuals who actively seek out luck. Furthermore, the lucky event in the present study was completely unrelated to the subsequent task. Typically, superstitions for good luck bear some relation to the situation in which they are exhibited in that the superstitious behavior is meant to help in this very same situation. Thus, a student, for example, may deliberately wear a lucky charm to an exam because she believes that this object might be helpful for exactly this exam. Despite these limitations and differences, the presented findings on the belief in good luck might contribute to a better understanding of superstitious consequences, and suggest that this irrational belief may serve the benefit of increasing feelings of confidence.

### *Illusion of control*

In another line of research, superstitious behavior has been related to the concept of the *illusion of control* (Langer, 1975). This term describes people's erroneous belief that they can influence the outcomes of situations that are determined entirely by chance. In a series of experiments, Langer (1975) demonstrated that participants' confidence increased when they were given the feeling that they had control over the outcome. To manipulate illusory control, features that were likely to improve performance in skill-related tasks were included in the chance-determined tasks. For instance, participants gave higher confidence ratings for a task with randomly distributed outcomes if they had been given the opportunity to practice, in comparison to those who received no practice at all. Another way rather than focusing on skill related aspects of the task in order to meet the strong desire for control over important events (Burger, 1986) might be to rely on irrational beliefs about luck (Darke & Freedman, 1997a, 1997b). Rothbaum, Weisz, and Snyder (1982) suggested that people engage in irrational beliefs about luck to remain confident and optimistic in situations when it is difficult or impossible to control the outcome through direct action. This perspective is well



in line with earlier presented research demonstrating that people become more superstitious when they are exposed to seemingly uncontrollable threats (Keinan, 1994, 2002; Malinowski, 1954). Evidence pointing in the same direction stems from a study by Rudski (2004) who demonstrated that people exhibiting an illusion of control indicated greater levels of overall paranormal beliefs. This correlation was mainly based on the relation between the illusion of control and socially shared superstitions. However, from this correlative evidence it is impossible to conclude that an increased sense of control actually follows from acting on a superstition.

Without a doubt, the clearest finding concerning the relationship between superstition and self-efficacy was reported in an additional study by Rudski (2001). In this reinforcement study, participants exhibited superstitious beliefs and behaviors concerning the activity and importance of lever presses in order to control the onset of a tone. Subsequently, participants' perceived self-efficacy toward the experimental task was assessed by asking them about their belief in improved future performance. Rudski found that this measure was positively correlated with the degree of experimentally induced superstitious beliefs, and interpreted his findings as evidence for a positive correlation between superstition and self-efficacy. However, Rudski concedes himself that the experimentally created superstitions should be differentiated from commonly held superstitions. While a lucky charm or crossed fingers do not contain a guidance on how to perform a task, the experimentally induced superstition reflects participants' conviction that they had discovered the connection between their lever pressing and the tone. Thus, it is not too surprising that participants predicted improved performance on a second trial – now that they had figured out how the game worked.

Further empirical evidence supporting an effect of superstition on enhanced efficacy or illusion of control can be drawn from the previously discussed work of Matute (1994) and Dudley (1999). However, while both authors concluded from their findings that the prevention of performance impairment in the presence of superstitious thoughts was based upon an illusion of control, only Matute actually presented empirical data supporting this reasoning. Specifically, she demonstrated that the tendency to develop superstitious behavior during the exposure to the uncontrollable noise provided an illusion of control as participants indicated no perception of uncontrollability.

Taken together, several lines of reasoning as well as a few empirical findings provide evidence for a beneficial function of superstitions with regard to favorable psychological variables. Even though only one of these studies directly examined the effect of superstitious thoughts and behaviors on self-efficacy beliefs, many findings seem to point in this very

same direction. In combination, the suggested beneficial consequences of superstitions described above, such as increased optimism, enhanced confidence for a specific task, and feelings of control in given situations, indeed seem related to the prominent construct of self-efficacy beliefs (Bandura, 1977, 1997, 2001). Therefore, does it not seem very likely that people's perceived level of self-efficacy subsequent to the execution or activation of a good luck-oriented superstition may serve as mediating factor for the predicted performance enhancement in this context?

## Second research question

Expecting a causal effect of superstition on superior performance, it only seems natural to ask how this influence could come into existence. Researchers like Keinan (2002), for example, have speculated about the answer to this question and suggested a raised sense of confidence as a mediating factor. Indeed, the study of literature on performance influences reveals that one of the most contributing factors to performance outcome is the construct of perceived self-efficacy beliefs (Bandura, 1986; 1997). Numerous findings demonstrate that people's beliefs about their capabilities to attain required outcomes oftentimes are the most consistent predictors of achievements in academic and athletic settings. Specifically, regardless of their skills or knowledge, people who perceive a high level of preexisting or experimentally manipulated self-efficacy typically achieve higher task performance than those who perceive lower levels of efficacy expectations. Next to the repeatedly demonstrated strong causality of this effect, it is interesting to note that self-efficacy beliefs are subject to experimental manipulations. Specifically, these findings suggest that people's self-efficacy beliefs are sensitive to contextual factors that yield information concerning their specific task abilities. This information may be drawn from feedback, social comparisons, or verbal persuasion (Bandura, 1997), but might just as well be retrieved from external help such as social supporters or exhibited superstitions. In fact, the latter assumption concerning an influence of superstitions on perceived efficacy beliefs finds initial support from several studies examining the consequences of superstition on psychological variables. Driven by the assumption that superstitions might serve beneficial functions by helping the individual to overcome mental obstacles in performance-related situations, several authors present results that point to an effect of superstition on people's efficacy. For example, the superstitious belief in good luck has been demonstrated to relate to optimism, hope, and confidence. Furthermore, it has been suggested that the adoption of superstitions in the face of uncontrollability provides an illusion of control and leads to beliefs in improved future performance.

Assuming that activated superstitions indeed lead to performance enhancement, the second purpose of the present research was to describe its underlying mechanism. Which underlying process can account for the effect? To answer this question, the present line of research focused on the concept of self-efficacy beliefs. Combining the knowledge that self-efficacy exerts one of the most important influences on task performance with the presented idea self-efficacy may be enhanced in the presence of superstitions, the present research was designed to examine whether the predicted effect of superstition on superior performance is indeed mediated by self-efficacy beliefs.

## Summary

Inspection of existing research on superstitions revealed that, despite their seeming irrationality, superstitious beliefs and behaviors are very common. This is especially true in situations characterized by high stress, perceived uncertainty, and unpredictable outcomes. Interestingly, superstitious beliefs especially abound in the world of sports as well as academia. At a closer look, however, it becomes apparent that both athletes and students regularly engage in performance-related tasks such as competitions or exams. In fact, these events share many characteristics with situations that have been shown to elicit superstitions. These findings at hand, some researchers started to speculate about potential beneficial functions of superstitious behaviors. Clearly, the most influential benefit of superstitions for people in an achievement setting would be a direct effect of the exhibited superstition on their performance. Such an influence of superstition on performance could not only explain the high prevalence of superstitious thoughts and behaviors among athletes and students but also their continuous maintenance. Despite the plausibility of this perspective, the empirically conducted research concerning the effects of superstition on performance is exceedingly small. Existing findings, however, do support the notion of a superstition-performance link by demonstrating that performance impairment can be prevented by superstitions. Support for an actual performance enhancement through superstition, however, has not yet been demonstrated. Even if such an effect seems plausible, the question one might ask, of course, is how this influence could be explained. Studying the extensive literature on performance influences in general, it becomes apparent that one of the most influential factors affecting task performance is self-efficacy (Bandura, 1997).

Abundant research on this concept, which refers to people's perceived confidence to master an activity, confirms that efficacy expectations importantly contribute to the prediction of performance. Thus, in intellectual as well as in athletic settings, high self-efficacy beliefs lead to better performance than low perceived self-efficacy. However, if self-

efficacy beliefs should account for the underlying mechanism of superstition on superior performance, self-efficacy must not only influence performance but must be influenced by superstitions itself. As self-efficacy is a context-specific construct, it has repeatedly been demonstrated that people's perceived self-efficacy toward a task indeed can be raised or lowered by varying the context. Furthermore, several researchers have speculated that such a change in self-efficacy could also be the result of executed superstitions prior to a performance task. Indeed, research on psychological consequences of superstitions suggests several beneficial psychological functions of superstitions that point in the very same direction. Thus, it has been demonstrated that superstitions are related to enhanced feelings of optimism, hope, and confidence, as well as feelings of control.

Together, the outlined theoretical perspectives as well as the demonstrated lack of empirical findings on these important questions inspired the present line of research.

## The present research

According to natural and evolutionary plausibility, behaviors that are maintained over a long period of time and exhibited in particularly difficult situations are thought to yield a specific beneficial function. The subjects of the present work are superstitious behaviors and thoughts that seem to arise in important performance settings.

The present research was designed to provide empirical support for two particular claims. First, I aimed to find empirical evidence of a causal relationship between superstition and superior performance in both motor and cognitive tasks. The second purpose of this research was to describe the mediating mechanism for such a superstition-performance link. Specifically, I attempted to verify the claim that increased self-efficacy beliefs as consequences of the activation of a superstition mediate the effect of superstition on performance enhancement.

Study 1 was conducted to explore the prevalence of several superstitious beliefs within the present population. Specifically, the aim was to get a sense as to how widespread superstitions are among students of the University of Cologne and also to detect specific superstitions that are shared by many students and thus could be used for later experiments.

Studies 2 through 4 were designed to demonstrate a causal effect between the implementation of a superstition and the outcome of a performance task. In contrast to previous studies that attempted to examine the consequences of superstitions, a new methodological approach was applied in the present studies. Instead of measuring a superstitious trait, as had been done by Dudley (1999) and Rudski (2004), for example, or

having participants learn a new superstition in the laboratory (Matute, 1994, 1995), the present experimental designs used specific superstitious beliefs that are widely shared by the participating students. Based on the results of Study 1, I activated the most prominent superstitions within the present population prior to a performance task. Subsequently, performance was measured. In the course of these studies, both the method of superstition activation and the performance measure varied. Specifically, in Studies 2 and 3, the widely believed superstitious concepts of good and bad luck were linked to the equipment participants used while engaging in the performance task. That is, participants had to perform a golf-putting task using either an ostensibly “lucky ball” or an ostensibly “unlucky ball.” As an index of performance, the number of successful putts was assessed. As an extension of Study 2, a neutral condition in which the status of the ball was not mentioned was included in the experimental design of Study 3 to explore the direction of the superstitious influence on performance. In Study 4, participants’ performance in a motor dexterity task was assessed after the experimenter applied either the good luck-related and commonly known superstition of keeping one’s fingers crossed or an equivalent but non-superstitious saying prior to the task.

Studies 5 and 6 were designed to replicate the findings of the former studies and to shed light on the presumed underlying process. Here, I examined whether self-efficacy judgments are indeed higher after the implementation of a good luck-related superstition in comparison to either a bad luck-related superstition or the withdrawal of the positive superstition. Therefore, the design of both studies included several judgments of participants’ perceived task-specific self-efficacy, which were assessed in between the superstition manipulation and the performance measure. In Study 5, the superstitious concepts of good versus bad luck were presented outside of participant’s conscious awareness by using a subliminal priming method and performance was measured in a Tetris-game. For participants in Study 6, a personal lucky charm was either present or absent while engaging in a memory task. For both of the studies, mediation analyses were conducted to examine whether changes in self-efficacy judgments indeed mediate the effect of superstition on performance.

Across Studies 2 through 6, I used multiple methods to implement a superstition in an attempt to extend the degree to which the results can be generalized to a variety of different superstitions. Furthermore, knowing that superstitions are most likely to occur among athletes and students, the present studies were designed to ensure the applicability of their results to both motor and cognitive tasks.

# EMPIRICAL PART

## Study 1

The purpose of the first study was to explore the prevalence of several superstitious beliefs within a particular population. Specifically, I aimed to get a general overview whether University students exhibit superstitions as frequently as reported in former studies (Albas & Albas, 1989; Gallagher & Lewis, 2001). I also wished to detect specific superstitious thoughts and practices that are shared by many students and thus could be used for later experiments. Therefore, I constructed a questionnaire on superstitious beliefs and administered it to students of the University of Cologne.

### *Methods*

Participants. 173 undergraduate students at the University of Cologne majoring in different educational disciplines were asked to participate in the study. The study took place during their introduction to social psychology class. The mean age of participants was 24 years and about 93 percent of all participants indicated German as their mother tongue. Participants were offered a chocolate bar as compensation.

Materials and Procedure. Participants were handed a pack of paper and pencil materials containing several unrelated studies on different topics including the explorative superstition questionnaire, which was positioned as second study within the stack. On the first page of the questionnaire, participants were informed that the purpose of the study was to assess the prevalence of superstitions, situations in which superstition occurs, and specific forms of superstitious practices that are common among students. To minimize participants' feelings of embarrassment or fear of negative evaluation, which has often been reported in research on superstition (Van Raalte et al., 1991; Vyse, 1997), participants were given several examples of well known persons in the world of sport who reportedly exhibited superstitious practices. Moreover, it was emphasized that all data would be analyzed in an anonymous manner. The next three pages contained 20 questions concerning participants' superstitions. First, they were asked to rate on a 9-point scale how superstitious they would consider themselves to be (1 = "not at all superstitious"; 9 = "very superstitious"). They were then asked to name those superstitious practices that they know from their daily life and to depict specific situations in which these practices occur. Next, participants had to rate on another 9-

point scale the believed effectiveness of the named superstitious behaviors (1 = “not at all effective”; 9 = “very effective”). After describing potential mechanisms of these superstitious practices, consequences in cases where the superstition could not be performed, and the development of the superstitions, participants were asked to indicate on 9-point scales for several specific superstitious behaviors to what extent they believed in their effectiveness (1 = “not at all”; 9 = “very much”). Among others, these specific superstitions included practices like keeping one’s fingers crossed, carrying a lucky charm, breaking a mirror, and knocking on wood. Finally, participants were asked to indicate whether they considered a specific day as their lucky day or a specific number as their lucky number. At the very end of the packet of all studies, a questionnaire was included asking for participants’ sex, age, field of study, current semester, and native language. Finally, participants were thanked for their participation and given their compensation.

## *Results*

The data were analyzed in a descriptive manner to obtain some first impressions concerning the extent of superstitious behavior within this student population. That is, for all 9-point scale judgments the mean and standard deviation was calculated. Furthermore, the frequency of entries was indicated by creating three categories: Ratings at the lower end of the 9-point scale (1-3) were integrated into the category “not at all/somewhat” (e.g. not at all superstitious/somewhat superstitious). Ratings at the middle part of the 9-point scale (4-6) were integrated into the category “moderate” (e.g. moderate superstitious). Finally, ratings at the upper end of the 9-point scale (7-9) were integrated into the category “fairly/very much” (e.g. fairly superstitious/very superstitious). For judgments in an open response format frequencies of entries were calculated allowing multiple responses.

The detailed results are depicted in Tables 1-5 (see Appendix A2). As depicted in Table 1, the prevalence of superstitions within undergraduate students of the University of Cologne is comparable to reports of other student populations (Albas & Albas, 1989), thus indicating a widespread existence of superstitious behaviors. Specifically, about 47 percent of all participants reported being at least moderately superstitious and 58 percent rated the effectiveness of their practiced superstitions at least on a moderate level. Inspection of Table 2 reveals the same bias as reported in former studies (Abercrombie et al., 1970) in that the number of people listing at least one specific superstitious behavior they enact (n = 157) by far surpasses the number of people who admit being at least moderately superstitious (n = 82). Taken together, the 173 participants named 319 superstitions (allowing for repeated response) that they know from their daily life. Moreover, these open responses concerning



participants' specific superstitions reveal that wearing lucky charms and knocking on wood are the most frequently observed superstitions within the current population. When asked for specific situations in which the named superstitions occur, verbal exams or written tests clearly are the most frequent answer ( $n = 101$ ), (see Table 3). Participants also reported exhibiting superstitious behavior in the context of athletic competitions or public performance ( $n = 26$ ), while traveling or in the car ( $n = 12$ ), in severe or important situations ( $n = 28$ ), or in everyday life in general ( $n = 33$ ). Table 4a depicts participants' ratings concerning the effectiveness of several specific superstitions ordered by the amount of people who rated them at least moderately effective. As demonstrated, only 15 percent of the participants report believing not at all or only somewhat in the concepts of good luck and bad luck. In contrast, 36 percent report believing in these superstitious concepts on a moderate level, and almost half of the participants (48.8%) even rated their belief as fairly strong. More than 60 percent of the students rated both the superstition keeping one's fingers crossed and wearing a lucky charm as at least moderately helpful. Inspection of Table 4b reveals that more participants report the existence of a personal lucky number ( $n = 71$ ) than a specific lucky day ( $n = 21$ ). Moreover, when asked about the underlying mechanism for the supposed effectiveness of superstitions, most participants indicated that the superstitious practice would yield a feeling of security, confidence, and reassurance (see Table 5a). Conversely, a superstition that for some reason could not be performed was thought to yield feelings of insecurity, concern, and anxiety (see Table 5b).

In sum, the present findings clearly support the expectation that superstitions are frequently practiced among students at the University of Cologne and that these superstitions are thought to be effective in terms of "helping in important situations." The most frequently observed superstitions were the general belief in the concepts of good and bad luck, keeping one's fingers crossed, and carrying a lucky charm. Based on these results, I decided to work with exactly these most popular superstitions in the following studies. Specifically, for each study, the activation of one of the superstitions was manipulated using various methods. Subsequently, participants' performance and related judgments were assessed.

## Study 2

In this study, I selected the most frequently observed superstition among the students of the University of Cologne - the general belief in the concepts of good or bad luck. I aimed to examine whether the activation of this superstition prior to a performance task would influence the outcome of this task. Specifically, inspired by studies on stereotype threat (Beilock, Jellison, Rydell, McConnell, & Carr, 2006) and the phenomenon of choking under



pressure (Beilock & Carr, 2001; Gucciardi & Dimmock, 2008), participants were asked to engage in a golf-putting task in order to assess their motor performance. Prior to the putting task, the superstitious concepts of good versus bad luck were activated by linking them to the ball participants used. In other words, half of the participants were led to think of the ball as a “lucky ball,” whereas the other half thought of it as an “unlucky ball.” Research in the field (Albas & Albas, 1979; Becker, 1975; Gregory & Petrie, 1975) as well as in the laboratory (Van Raalte, et al., 1991) has shown that applying the concepts of good or bad luck to equipment like a racket or a ball is a kind of superstition that oftentimes occurs naturally, but can also be generated in a controlled setting. Applying the findings of Van Raalte and colleagues (1991), in the present study a ball was labeled “lucky ball” if a demonstration putt with that ball was successful. A ball was labeled “unlucky ball,” however, if a demonstration putt with that ball was unsuccessful. The number of successful putts in the putting task was taken as an index of motor performance. Participants for whom the concept of good luck was activated were expected to outperform those for whom the concept of bad luck was activated.

## *Methods*

Participants. 26 female and male undergraduates of the University of Cologne were recruited as participants and were randomly assigned to one of two experimental conditions. They were contacted at the university cafeteria and asked to participate in a short study that would last about ten minutes. Participants were offered a chocolate bar as compensation.

Materials and Procedure. Participants were run individually by a female experimenter who was the same for all participants. Upon agreeing to take part in the study, participants were led to the laboratory and greeted by the experimenter. Participants were informed that they were about to take part in a study on fine motor skills. Therefore, they were asked to perform a golf-putting task. All participants performed the same putting task on the carpeted ground of the laboratory using a standard golf putter, a ball, and a horseshoe-like target serving as the hole. At a distance of 100 cm from the target, a green cross on the floor indicated the location from which participants were to take their putts. Before participants started with the putting task, however, the experimenter demonstrated how to perform the putt. Specifically, she demonstrated the technically correct position of the legs, the hands, and with how much force to hit the ball. Most important, however, was the outcome of this demonstration. For one half of the participants, the experimenter successfully completed the demonstration by putting the ball into the horseshoe-shaped hole. For the other half, the

experimenter failed by missing the target<sup>1</sup>. In both cases, the experimenter commented the outcome of her demonstration, thereby manipulating the independent variable. Specifically, each hit was accompanied by the experimenter's comment: "Oh, this seems to be a lucky ball (*Glücksball*).” Each miss, on the other hand, was followed by the statement: "Oh, this seems to be an unlucky ball (*Pechball*).” Subsequently, the ball was handed over to the participants who were instructed to perform 10 putts as accurately as possible. For each putt, the experimenter recorded whether the putt was successful or missed the hole. After the final putt, participants' judgments concerning their perceived performance, as well as their mood, their nervousness, and their calmness at the time of the putting task were assessed for explorative purposes on a 9-point rating scale ranging from 1 ("not at all") to 9 ("very much") at the computer. Finally, some self-descriptive information, including participants' sex, age, field of study, and current semester was assessed before participants were thanked for their participation and offered their compensation.

In sum, Study 2 is based on a single factor design consisting of two conditions ("lucky ball" vs. "unlucky ball").

## *Results*

The central dependent measure in this study is the number of successful putts participants achieved in the putting task.

As expected, inspection of Figure 1 reveals that the performance in the putting task indeed depends on whether a superstition associated with good luck or a superstition associated with bad luck had been activated beforehand. Specifically, participants performing the putting task with a ball that had been labeled a "lucky ball" hit the hole more often ( $M = 5.85$ ) than participants who performed the task with an "unlucky ball" ( $M = 4.08$ ),  $t(24) = 2.40$ ,  $p < .03$ . Interestingly, participants themselves did not notice this difference in performance. More specifically, performance judgments in the "lucky ball" condition ( $M = 6.15$ ) did not differ from the judgments in the "unlucky ball" condition ( $M = 6.0$ ),  $t < 1$ , ns. The same is true for mood judgments ("lucky ball":  $M = 7.15$ ; "unlucky ball":  $M = 6.85$ ), for judgments of participants' nervousness ("lucky ball":  $M = 3.31$ ; "unlucky ball":  $M = 2.77$ ), as well as for their calmness ("lucky ball":  $M = 6.23$ ; "unlucky ball":  $M = 6.15$ ), all  $t < 1$ , ns.

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<sup>1</sup> The experimenter was well practiced in the putting task, achieving a hit rate of approximately 90 percent, thus allowing for a reliable random assignment of participants into the experimental conditions.

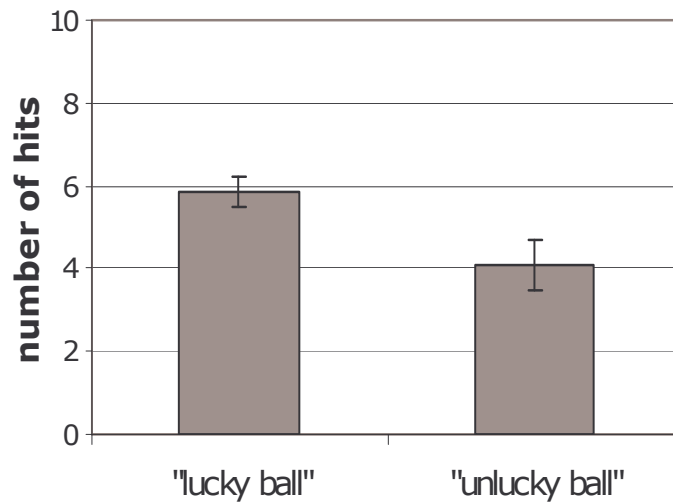


Figure 1. Mean number of successful hits in the putting task for “lucky ball” vs. “unlucky ball” manipulation. Error bars represent one standard error from the mean.

## Discussion

The obtained effect is consistent with the prediction that the activation of a superstition prior to a performance task indeed affects the outcome of this task. As hypothesized, participants were more often successful in a putting task if prior to the task a superstition associated with good luck rather than bad luck was activated. Thus, performing with a “lucky ball” led to more hits than performing with an “unlucky ball”.

One alternative explanation for the effect found in the present study concerns the possibility that it derives not from the ball’s label (“lucky” vs. “unlucky”), but rather depicts an observational learning effect (Bandura, 1977; 2006). Many behaviors and new motor skills in particular are likely to be learned by observing and imitating a model demonstrating that skill (Bandura, 1977; Meltzoff & Moore, 1977; Scully & Newell, 1985). For outcome-oriented tasks such as the putting task in Study 2, it has been suggested, specifically, that the demonstrated end-goal of the task (e.g. hitting the ball in the hole) instead of the observed movement pattern is imitated (Bekkering, Wohlschläger, & Gattis, 2000; Hayes, Ashford, & Bennett, 2007; Hodges, Hayes, Breslin, & Williams, 2005). Thus, it seems possible that engaging in the putting task after the observation of a successful model enhances performance compared to an observation of an unsuccessful model. In the present study, it remains unclear whether the manipulation of the superstition or the concomitant manipulation of the experimenter’s performance is responsible for the obtained results. Study 3 was conducted to address this shortcoming.

## Study 3

The general design of Study 3 was similar to that of the previous study, except for two changes. Again, participants had to engage in a 10-trial golf-putting task in which their performance was measured. Prior to the task, the superstitious concepts of good versus bad luck were activated by linking them to the ball participants used. The aim of Study 3 was to replicate the finding of Study 2 while ruling out the alternative explanation of the modeling effect. Therefore, the manipulation of the superstitious concepts was altered such that only the superstition but not the model of success or failure could account for subsequent differences in the performance task. This was achieved by eliminating the demonstration of a successful versus an unsuccessful putt, and solely focusing on the verbal manipulation.

The second modification of the experimental design compared to Study 2 concerns the addition of a third condition serving as a neutral control condition. The purpose of this control condition, in which no superstitious concept was activated prior to the putting task, was to get at the question of which of the two opposing superstitious concepts drives the effect on performance. Specifically, performance enhancement in the context of a good luck-superstition, performance impairment in the context of a bad luck-superstition, as well as the simultaneous influence of both superstitions on performance seemed to be possible hypotheses that were tested in Study 3.

### *Methods*

Participants. 42 students of the University of Cologne were recruited as participants and were randomly assigned to one of three experimental conditions. As in the previous study, they were contacted at the university cafeteria and asked to participate in a short study that would last about ten minutes. Participants were offered a chocolate bar as compensation.

Materials and Procedure. The general procedure was very similar to that of Study 2. Again, participants were run individually by the experimenter who informed them that they would engage in a ten trial putting task as part of a study on psychomotor skills. However, in contrast to the previous study, the experimenter did not demonstrate the putting task but simply handed the ball over to the participants. In order to activate the concept of good luck, to about one third of the participants the experimenter announced: “Here is your ball. So far it had turned out as a lucky ball.” For another third of the participants, the concept of bad luck was activated by exchanging the label “lucky ball” for the label “unlucky ball.” In the third condition, which served as the control condition, no superstitious concept was activated at all. Here, the experimenter handed the ball over to the participants, saying: “Here is your

ball. So far, everyone has used this one.” Subsequently, participants performed the required 10 putts from the same distance as in the previous study (100 cm) while the experimenter recorded the result for every trial. Finally, participants answered some demographic questions at the computer including their sex, age, field of study, and current semester. Upon completion, participants were thanked and offered their compensation.

In sum, Study 3 is based on a single-factor design consisting of three conditions (“lucky ball” vs. “unlucky ball” vs. control).

## Results

Again, the number of trials in which participants successfully putted the ball into the hole served as the dependent measure. Thus, a higher score indicates a better performance in the required motor task.

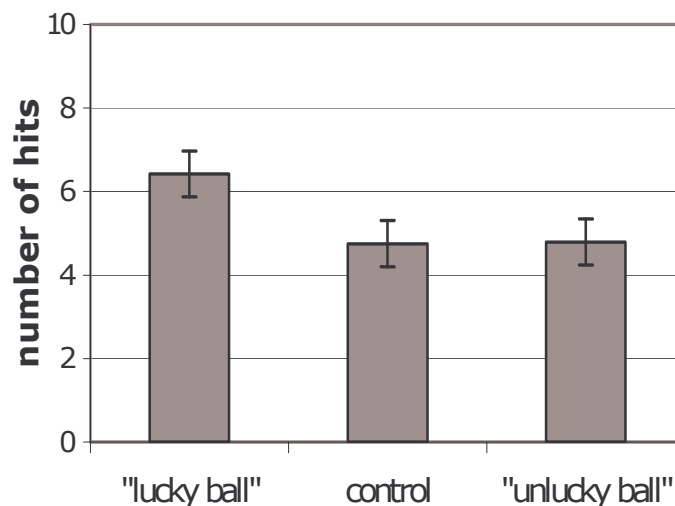


Figure 2. Mean number of successful hits in the putting task for “lucky ball” vs. control condition vs. “unlucky ball.” Error bars represent one standard error from the mean.

As predicted, inspection of Figure 2 reveals that the performance in the putting task indeed depends on which superstitious concept had been activated prior to the task. Using participants’ performance index as dependent measure, a single factor ANOVA revealed that performance differed depending on the experimental condition,  $F(2, 39) = 3.34, p < .05$ . More specifically, planned contrasts between conditions revealed that participants hit the ball into the hole more often if they had engaged in the putting task with a “lucky ball” ( $M = 6.42$ ) rather with an “unlucky ball” ( $M = 4.79$ ),  $t(39) = 2.22, p < .04$ . Participants putting with a “lucky ball” also successfully completed a putt more often than participants in the

control condition ( $M = 4.75$ ),  $t(39) = 2.34$ ,  $p < .03$ . However, the performance of participants in the “unlucky ball” condition did not differ from the performance of participants in the control condition,  $t < 1$ , ns.

## *Discussion*

The present findings demonstrate that the outcome of a performance task indeed is influenced by the prior activation of a superstitious concept. In line with the presented hypothesis, the activation of a superstition associated with the concept of “good luck” prior to the motor task leads to a better performance than the activation of a superstition associated with the concept of “bad luck.” Thus, the obtained effect replicates the finding of Study 2 while ruling out the alternative explanation of the modeling effect. Because in the present study the experimenter did not demonstrate the task and therefore did not serve as a model of success or failure for the participants, imitation of or assimilation to such a model cannot be responsible for the obtained differences in performance.

The present findings also help to answer the question of whether both kinds of superstitious concepts (“good luck” vs. “bad luck”) equally strong affect performance or whether the impact of just one accounts for the obtained results. The findings clearly support the notion that the difference in performance results from an increase in performance subsequent to the activation of the “good luck” superstition compared to a neutral condition, but not from a decrease in performance subsequent to the activation of a “bad luck” superstition. Specifically, the number of hits in the putting task increased if participants had been given a “lucky ball” compared to the control condition in which participants had been given a ball “everyone had been playing with.” However, the number of hits in the putting task did not differ from the baseline (control condition) if participants were given an “unlucky ball”. Thus, it seems that superstitions associated with “good luck” are more effective than superstitions associated with “bad luck,” at least in a performance context. In fact, this finding may explain previous results (Albas & Albas, 1989; Wiseman and Watt, 2004) demonstrating that in general good luck superstitions are more common than bad luck superstitions.

Taken together, Studies 2 and 3 demonstrate that activating a superstition prior to a motor task affects how well people perform in that task. Specifically, activating the concept of “good luck” increases performance compared to situations in which no superstition or the superstitious concept of “bad luck” has been activated.

## Study 4

In both Studies 2 and 3, I manipulated the activation of a superstition by linking the concepts of good versus bad luck to the equipment participants used while engaging in the performance task. Further, in both studies, participants' performance was assessed via a motor task related to the field of sports, namely a golf-putting task. The aim of Study 4 was to replicate and, more importantly, to generalize the previous findings. Therefore, I altered the activated superstition as well as the performance task from that of Studies 2 and 3. Specifically, in order to assess performance, a motor dexterity game was used. Furthermore, I used the very specific superstitious behavior of "keeping one's fingers crossed" to manipulate the activation of a superstition prior to the motor skill task. Both previous research (Rudski, 2003) and Study 1 of the present research indicated that "keeping one's fingers crossed" is one of the most commonly known and practiced superstitious acts, with the purpose of wishing another person "good luck" for an upcoming task or situation. Thus, it is clearly associated with the concept of "good luck." In the experimental condition of the present study, the experimenter activated this good luck superstition by saying it aloud and making the gesture as a starting signal for the motor skill task. In the neutral control condition, a common starting signal with no superstitious connotation was given to the participants. In order to control for a similar amount of encouragement between conditions and to demonstrate the specificity of the activated superstition a third condition was included. Here, the phrasing of the starting signal was identical to that in the experimental condition apart from one word, thus losing its superstitious meaning but sounding equally encouraging. Participants for whom the superstition associated with the concept of "good luck" was activated prior to the motor skill task were expected to outperform participants in both control conditions.

### *Methods*

Participants. 51 female undergraduates of the University of Cologne were recruited as participants and randomly assigned to one of three experimental conditions. They were approached on the University campus and asked to participate in a short study on psychomotor skills for which they would receive candy as compensation.

Materials and Procedure. Participants were run individually by a female experimenter who was the same for all participants. Upon agreement to take part in the study, participants were informed that they would engage in a motor dexterity task and then fill in a short questionnaire. The experimenter then explained the motor skill task in more detail. The task was performed with a transparent plastic cube (about 4 x 4 x 4 cm). Diagonally within the

cube was a fixed slab containing 36 little holes. Also within the cube were 36 little balls. The task for participants was to place each ball into one of these holes by carefully tilting the cube in different directions. The task was accomplished when all of the balls had made their way into the holes. Participants were instructed to complete the task as quickly as possible. If no questions remained, the experimenter handed the cube over to the participants and gave a starting signal. In doing so, the experimenter also manipulated the experimental conditions. For about one third of the participants, for whom the “good luck” superstition was activated, the experimenter said “Ich drück dir die Daumen” and made this gesture in order to signal the participants to start the task. The verbatim translation of this expression is “I press my thumbs for you” and it is the German equivalent to the English saying, “I keep my fingers crossed for you.” For another third of the participants, the ordinary starting signal “Auf los gehts los” (“On Go you go”) was used by the experimenter, which did not activate a superstitious concept at all. For the remaining participants, the experimenter used the same phrasing as in the experimental condition, except for altering one word. Here, instead of saying “Ich drück dir die Daumen,” she said, “Ich drück dir die Uhr” (“I press the watch for you”), which was similarly encouraging but lost its superstitious meaning.

While participants worked on the motor dexterity task, the experimenter kept quiet in the background, avoiding any conversation with the participants. The time participants needed to accomplish the task was recorded using a stopwatch. Subsequent to the performance task, participants were handed a folder containing a short questionnaire. On 9-point scales, participants were asked to judge their performance in the dexterity task, their well-being during the task (1 = “not good at all”; 9 = “very good”), and how important they believed it was to finish the task as quickly as possible (1 = “not important at all”; 9 = “very important”). The last three questions concerned participants’ demographics, including their age, their occupation or field of study, and their mother tongue. Upon completion, participants were thanked and offered their compensation.

In sum, Study 4 is based on a single-factor design consisting of three conditions (“fingers crossed” vs. “watch pressed” vs. control).

## *Results*

The time participants needed to accomplish the fine motor skill task reflects their performance and thus served as the main dependent measure.



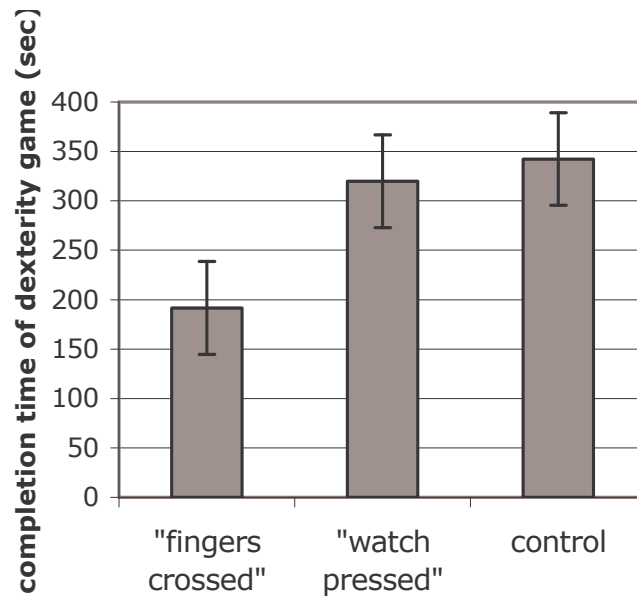


Figure 3. Time needed to complete the motor dexterity task for “fingers crossed” vs. “watch pressed” vs. control condition. Error bars represent one standard error from the mean.

Consistent with expectations, inspection of Figure 3 reveals that the performance in the motor dexterity task indeed depends on whether a specific superstition had been activated prior to the task. Using the time participants needed to complete the task as the dependent measure, a single factor ANOVA revealed that performance differed depending on the experimental condition,  $F(2, 48) = 3.16, p < .05$ . More specifically, planned contrasts between conditions revealed that participants accomplished the task faster if the experimenter had engaged in the “good luck” associated superstition of “keeping one’s fingers crossed” ( $M = 191.5$  sec) rather than the ordinary starting signal ( $M = 342.3$  sec),  $t(48) = 2.36, p < .03$ . Participants in the “fingers crossed” condition also finished the motor task faster than participants for whom the superstitious meaning of the phrasing was taken away (“watch pressed”), ( $M = 319.7$  sec),  $t(48) = 2.0, p < .05$ . However, performance of participants in the “watch pressed” condition did not differ from the performance of participants in the control condition,  $t < 1, ns$ .

Participants’ judgments concerning the importance of finishing the task as quickly as possible also depended on whether the superstitious concept was activated prior to the task. Using this judgment as dependent measure, a single factor ANOVA reveals a significant difference between experimental conditions,  $F(2, 48) = 4.39, p < .02$ . More specifically, planned contrasts between conditions reveal that the task was more important to participants for whom the experimenter kept her fingers crossed ( $M = 6.73$ ) rather than for those who heard the ordinary starting sign (control) ( $M = 4.94$ ),  $t(48) = 2.83, p < .01$ . Consistent with

prior expectations, participants in the “watch pressed” condition also subjectively perceived the task as more important ( $M = 6.22$ ) than participants in the neutral control condition,  $t(48) = 2.12, p < .04$ . However, perceived importance of participants in the “fingers crossed” condition did not differ from performance of participants in the “watch pressed” condition,  $t < 1, ns$ . Participants’ judgments concerning their perceived performance as well as their well-being during the task did not depend on whether the superstitious concept had been activated prior to the task, all  $F < 1, ns$ .

## *Discussion*

The present findings replicate the effects of the earlier studies and demonstrate, again, that activating a superstition prior to a performance task influences the outcome of that task. Moreover, the present findings extend the effect to a different superstition as well as to a different performance task compared to those of Studies 2 and 3. Specifically, instead of linking the concept of “good luck” to an object, here engaging in the commonly known superstitious act of “keeping one’s fingers crossed” led to superior performance. The task with which performance was assessed changed from a golf-putting task in Studies 2 and 3 to a dexterity game involving fine motor skills. Thus, the findings of Study 4 show that the effect can be generalized to different situations.

One might argue that the increased performance in the experimental condition is not a result of the activated superstition per se, but stems from a different level of encouragement by the experimenter. It seems possible that someone saying, “I keep my fingers crossed for you” sounds more personal or more encouraging, and thus makes the task at hand appear more important than when someone simply gives a “go” starting signal. Indeed, the present data suggest, that it felt more important to finish the task as quickly as possible when the experimenter kept her fingers crossed rather than when she simply said, “go.” However, this was not true in the additional control condition. The starting signal, “I press the watch for you,” seems to be just as personal and encouraging as a good performance was just as important for these participants as for those in the experimental superstitious condition. Nevertheless, an effect on performance was found exclusively in the experimental condition in which the specific good luck-associated superstition of “keeping one’s fingers crossed” was activated before the task. This finding rules out the alternative explanation that the demonstrated effect is based on different levels of subjectively experienced importance, but rather demonstrates the specificity of the superstitious influence.

In sum, Studies 2 through 4 repeatedly demonstrate that the outcome of a performance task can be influenced by a superstition that has been activated prior to that task, while using

different methods to manipulate the superstition and different tasks to assess the performance. The results of Study 3 indicate that it is a superstition associated with the concept of “good luck,” specifically, that has the effect of increasing a subsequent performance. Furthermore, the findings of Study 4 suggest that the reported performance enhancement cannot simply be explained by a difference in the perceived importance of performing the task well. Although, these studies consistently support the hypothesis, all three studies used a motor task. In real life, however, people also oftentimes engage in superstitious acts or thoughts in the context of cognitive tasks such as important exams (Albas & Albas, 1989). Therefore, in the following studies I focused on cognitive tasks, examining whether the activation of a superstition prior to the task also influences the outcome of this kind of performance. Another aspect Studies 2 through 4 have in common is the naturalistic but rather blatant manipulation of the activated superstition. In each case the experimenter used words or gestures to manipulate the specific superstition. Even though the experimenter’s behavior was standardized across the experimental conditions, this procedure cannot rule out the possibility of an experimenter’s effect on the measured performance. Study 5 was conducted to resolve that shortcoming. In addition, the purpose of the following studies was to explore the process underlying the causal relationship between the activated superstition and subsequent superior performance.

## Study 5

In Study 5, I used a more subtle method to activate the superstitious concept. According to a study by DeMarree and colleagues (DeMarree, Wheeler, & Petty, 2005) who subliminally primed (Bargh & Pietromonaco, 1982) participants with the lucky or unlucky number 7 versus 13, participants in the present study were subliminally primed with either the concept of “good luck” or the concept of “bad luck” before engaging in the performance task. With the goal of assessing performance on a cognitive task, participants in Study 5 had to engage in a game of Tetris, which requires especially good spatial skills. Again, I expected to replicate the previous findings and to demonstrate that the outcome of the performance task critically depends on the previously activated superstition. Specifically, participants who were subliminally primed with the concept of “good luck” prior to the task were expected to achieve a better result in the Tetris-game than participants who were primed with the concept of “bad luck.” I also collected several judgments concerning participants’ perceived confidence towards the task (self-efficacy beliefs) as well as their general mood in between the priming task and the performance task. The purpose of these judgments was to collect initial evidence for the underlying process of the observed effect.

As described in the introduction to the present research, in literature on the prevalence and development of superstitions it has often been argued that the purpose of superstitions is to regain a feeling of control and raise feelings of optimism and confidence. On a more theoretical level, all of these functions seem related to Bandura's (1977, 1997) concept of self-efficacy beliefs, which refers to people's perceived confidence to master the tasks they are trying to accomplish. On the other hand, numerous empirical findings on the concept of self-efficacy yield convincing evidence for a causal link between the perceived levels of efficacy and performance in various tasks. It has also been demonstrated that efficacy expectations can be influenced by manipulating contextual variables. Accordingly, I contend that activating a superstition associated with the concept of good luck may raise one's perceived level of self-efficacy, in comparison to the activation of a superstition associated with the concept of bad luck. In turn, this heightened self-efficacy is expected to increase performance in a subsequent task. Study 5 was designed to find empirical evidence for this mediating process.

## *Methods*

Participants. 26 undergraduates of the University of Cologne were recruited as participants and were randomly assigned to one of two experimental conditions. They were contacted at the library and asked to participate in a short study that would last about 20 minutes. Participants were offered a chocolate bar as compensation.

Materials and Procedure. Participants were run in small groups of up to three participants simultaneously. Upon agreeing to take part in the study, participants were led to the laboratory, greeted by the experimenter, and guided to a separate booth where they were seated in front of an 85 Hz computer monitor. All parts of this study were administered at the computer. The first screen contained a general introduction and the cover story. Previous research has shown that the prevalence and development of superstitions especially occurs if people experience a high level of ego-involvement for the according task (Buhmann & Zaugg, 1981; Neil et al., 1981; Van Raalte, et al., 1991). Thus, I presumed that an activated superstition would also be most effective if participants are highly ego-involved. To generate a high level of ego-involvement in the participants, I used a similar cover story to the one administered by Van Raalte and colleagues (1991). Participants were informed that they were about to take part in a study examining the relationship between the ability to adapt to different cognitive performance tasks and the successful achievement of tasks in everyday life such as at one's job or university. They were told that a fast and successful adaptation to different cognitive tasks would be accompanied by the ability to adapt flexibly in real life

situations. Therefore, people who are able to adapt quickly to cognitive tasks should be more successful in real life than people for whom this adaptation is more difficult. Participants were informed that they would successively engage into two mental tasks which require different cognitive abilities. Whereas the main focus of the first task would lay on verbal abilities, the second task would mainly require spatial skills. To reduce the time gap between the first and the second task, detailed instructions for both tasks were given to the participants at the beginning of the experiment. Each explanation was followed by a short practice trial to ensure participants understood the task. The first task was the conceptual priming task, which was embedded in a lexical decision task (e.g., Dijksterhuis, Aarts, Bargh, & van Knippenberg, 2000; Mussweiler & Förster, 2000). Instructions for this task pointed out that participants should focus their attention on a fixation point in the center of the screen and respond as soon as they detected whether a letter string presented at this position did or did not constitute a German word. Responses were to be given by pressing either a yellow or a blue computer key.

The subliminal priming task was constructed in accordance with the suggestions of Bargh and Chartrand (2000). For each priming sequence, the fixation point (“XWXXWWX”) was first presented in the center of the computer screen for 3000 ms and was overwritten by the priming word (15 ms). This priming word was again overwritten by the fixation point (500 ms) which was then followed by the target letter string. This letter string remained on the screen until participants had responded by pressing the appropriate computer key. The three practice trials participants accomplished did not include the priming word but only the target letter strings of which two were neutral target letter strings (Kaktus [cactus], wenden [shift]) and one was a nonword (Pritzel). Of the 72 target letter strings during the critical priming phase, 54 were neutral words (e.g., towel) and 18 were non-words. For half of the participants, each lexical decision trial used the word “Glück” (“good luck”) as a prime. For the other half of the participants each trial used the word “Pech” (“bad luck”) as a prime. Note that while the English expressions for good and bad luck the German language possesses two different words for the two opposing concepts. After completion of the 72 trials, participants were asked to answer a few questions before playing the Tetris game. These judgments assessed participants’ general mood on one item as well as their specific feelings towards the upcoming performance task on three critical items. On 9-point scales, participants had to indicate how they felt at this very moment (1 = not good at all; 9 = very good), how likely it was that they would do well in accomplishing the following task (1 = very unlikely; 9 = very likely), how insecure they felt at this very moment (1 = not insecure at all; 9 = very insecure), and how confident they felt concerning the upcoming task (1 = not confident at all; 9 = very confident). Subsequently, participants were asked to

proceed to the second task, for which they had received detailed instructions prior to the priming task.

In these instructions, participants were informed that the second task was a game of Tetris, which primarily calls for spatial skills. They also read the rules of the game, which explained that differently-shaped figures would move from the top of the screen to the bottom. The task was to keep these figures from piling up and reaching the top of the screen. Therefore, it was possible (and necessary) to either rotate the figures or to move them left or right using the arrow keys on the keyboard. Once participants were sure that the position of a figure was correct they were able to speed its movement by pressing the down arrow key. It was participants' aim to position the figures such that they would build complete horizontal rows. A completed row then disappeared from the screen, thus leaving more room to position the following figures. As is common for computer games like Tetris, the level of difficulty continuously increased the longer the game went on. Specifically, the speed of the downward moving figures increased by ten percent of the previous speed after three rows were completed and removed. The sequence of the differently-shaped figures was randomized and thus could not be influenced by the participants. The game was over as soon as the piled up figures reached the top of the screen. Participants were informed that they would only have the chance to play the game once, and were asked to try to stay in the game as long as possible and to complete as many rows as possible. After reading these detailed instructions, participants engaged in a practice trial that lasted for 30 seconds. Just before the critical trial started, participants again were reminded of the overall goal of the game, how to use the arrow keys, and the importance of keeping the game going as long as possible and completing as many horizontal rows as possible. The Tetris game started as soon as participants pressed the space bar. The number of rows successfully completed by the participants were recorded in a separate data file.

After the Tetris game, participants were asked to answer a few questions similar to those in the previous studies. Specifically, participants were asked to judge their subjectively perceived performance on a 9-point scale (1 = "not good at all"; 9 = "very good"). As in Study 4, participants were also prompted to indicate on a 9-point scale the importance of performing as well as possible in the Tetris game (1 = "not important at all"; 9 = "very important").

Subsequent to these questions, some self-descriptive information, including participants' sex, age, field of study, and current semester were assessed. Finally, participants answered a funneled debriefing questionnaire which was included to assess

awareness of (a) the subliminal primes and (b) the real purpose of the study. None of the participants indicated awareness.

After completion of all parts of the study, participants were thanked for their participation and given their compensation.

In sum, Study 5 is based on a single factor design consisting of two priming conditions (“good luck” vs. “bad luck”).

## Results

The number of rows participants were able to complete during the Tetris game reflects their performance in that task and thus served as the main dependent measure.

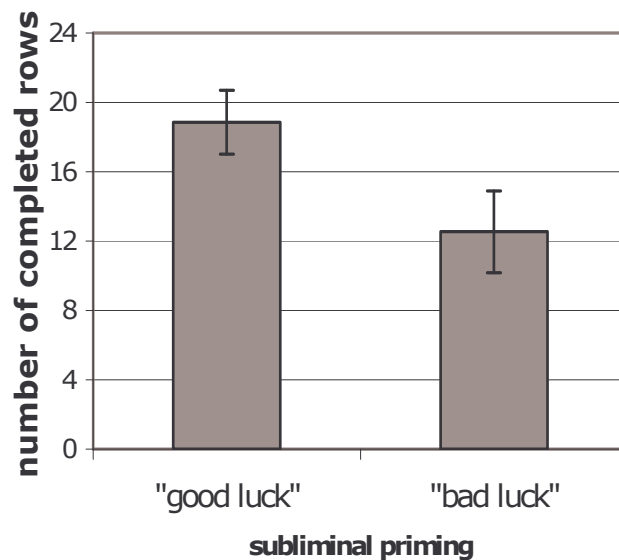
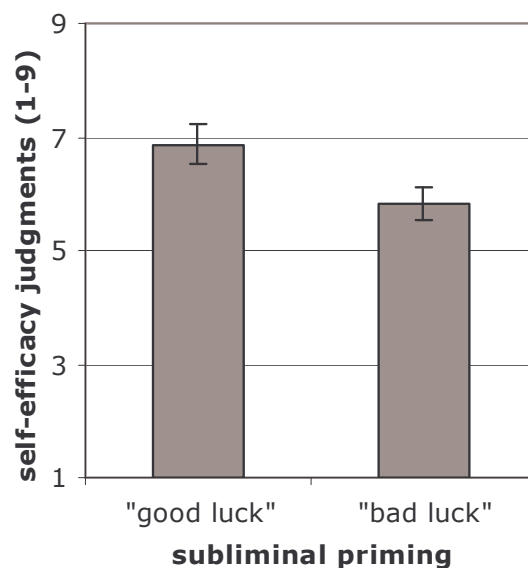


Figure 4a. Number of completed rows in the Tetris game by subliminal priming (“good luck” vs. “bad luck”). Error bars represent one standard error from the mean.

Replicating the findings of the previous studies, inspection of Figure 4a reveals that the performance in the Tetris game depends on the superstition that had been activated prior to the task. Specifically, participants who were subliminally primed with the concept of “good luck” were able to complete more rows during the Tetris game ( $M = 18.85$ ) than participants who were primed with the concept of “bad luck” ( $M = 12.54$ ),  $t(24) = 2.11$ ,  $p < .05$ . Interestingly, but consistent with the findings of the previous studies, participants’ perception of their own performance did not mirror the findings of the actual performance. Inspection of the means reveals that participants’ perception of their performance does not

depend on whether they had been primed with the concept of “good luck” ( $M = 4.15$ ) or the concept of “bad luck” ( $M = 3.92$ ),  $t < 1$ , ns.

For the present study, it was also predicted that the activation of the superstitious concepts of good and bad luck would affect participants’ confidence towards the upcoming performance task. Specifically, I expected that participants who were primed with the positive superstitious concept of “good luck” would report higher self-efficacy beliefs (Bandura, 1977, 1997) prior to the performance task than would participants who were primed with the negative superstitious concept of “bad luck.” This was not expected, however, for participants’ judgments of their general mood. Before analyzing the data, the three critical judgments regarding participants’ specific feelings toward the upcoming performance task were combined into a single score with higher values indicating higher levels of self-efficacy. To do so, the insecure judgment was reversed and the mean of all judgments was calculated (Cronbach’s  $\alpha = .75$ ).



*Figure 4b.* Means for participants’ judgments about their experienced self-efficacy by subliminal priming (“good luck” vs. “bad luck”). Error bars represent one standard error from the mean.

Inspection of the means depicted in Figure 4b reveals that the magnitude of participants’ reported self-efficacy indeed depends on whether the concept of “good luck” or the concept of “bad luck” had been primed. Specifically, participants who were subliminally primed with the concept of “good luck” felt more confident towards the Tetris game ( $M =$



6.87) than did participants who were primed with the concept of “bad luck” ( $M = 5.82$ ),  $t(24) = 2.30, p < .04$ .

Participants’ general mood, however, was not affected by the kind of the superstitious concept that had been primed. Specifically, subliminal priming of the concept of “good luck” ( $M = 6.31$ ) did not lead to different judgments of participants’ general feeling than subliminal priming of the concept of “bad luck” ( $M = 5.54$ ),  $t(24) = 1.09, p > .2, ns$ .

As in Study 4, one item with the purpose to control for a similar level of encouragement between the experimental conditions was included in the present study. As expected, participants who were primed with the concept of “good luck” ( $M = 6.0$ ) did not believe it was more important to perform in the Tetris game as well as possible than participants who were primed with the concept of bad luck” ( $M = 5.54$ ),  $t > 1, ns$ .

*Mediation.* Follow-up analyses examined whether self-efficacy as assessed in the judgment task mediated the effect of superstition activation on performance in the Tetris game. For this analysis, subliminal priming with “bad luck” was coded as -1 and subliminal priming with “good luck” was coded 1. As outlined by Baron and Kenny (1986), three preconditions for documenting mediation are required. First, the dependent variable should be regressed on the independent variable to show that the independent variable predicts the dependent variable. In the present study, this regression refers to the effect of the subliminal superstition priming on the performance in the Tetris game. Second, the mediator variable should be regressed on the independent variable to show that the independent variable predicts the mediator variable. In the present study, this regression refers to the effect of the subliminal superstition priming on the self-efficacy judgments. Third, the dependent variable should be regressed on both the independent variable and the mediator variable to show that the mediator variable predicts the dependent variable, and accounts for at least a portion of the direct effect of the independent variable on the dependent variable. In the present study, this regression refers to the effect of perceived self-efficacy on performance in the Tetris game as well as the effect of the subliminal superstition priming on the performance in the Tetris game, controlling for the influence of self-efficacy.

In the preceding analyses, the first premise was satisfied in that the superstition priming predicted performance in the Tetris game, and the second premise was satisfied in that superstition priming also predicted perceived self-efficacy toward the Tetris-task. To test the final requirement, the regression analysis examining the effect of superstition priming on performance was repeated, with self-efficacy also included in the equation.

The regression yielded a significant effect for self-efficacy,  $\beta = .53$ ,  $t(24) = 3.02$ ,  $p < .01$ , indicating that the more self-efficacy participants experienced the better they performed in the Tetris game. The direct effect of superstition priming on performance was reduced and rendered insignificant, from  $\beta = .40$ ,  $t(24) = 2.11$ ,  $p < .05$  to  $\beta = .21$ ,  $t(24) = 1.09$ ,  $p > .28$ .

To determine whether the judgments of perceived self-efficacy beliefs mediated the effect of the superstition activation on performance, I applied the bootstrap approach recommended by Preacher and Hayes (2004). Bootstrapping is a nonparametric approach to effect-size estimation and hypothesis testing which is especially recommended for small sample sizes (Preacher & Hayes, 2004; Shrout & Bolger, 2002). Furthermore, this approach that makes no assumption about the distributions of the variables or the sampling distribution of the statistic (Efron & Tibshirani, 1993; Mooney & Duval, 1993). Thus, it has been suggested as a way of circumventing the power problem introduced by asymmetries and other forms of nonnormality in the sampling distribution (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Shrout & Bolger, 2002) which is apparent in other techniques for assessing mediation, such as the Sobel test (Baron & Kenny, 1986) (for additional discussion of the bootstrapping approach see Shrout & Bolger, 2002).

The results of the bootstrapping analysis reveal that reported self-efficacy mediated the effect of the superstition manipulation on the performance in the Tetris task. Specifically, a point estimate for this indirect effect of 3.23, with a 95% confidence interval of 0.26 to 7.94 was obtained. Because zero is not in the 95% confidence interval, it can be concluded that the indirect effect of self-efficacy is indeed significantly different from zero at  $p < .05$  (two tailed) and thus is a statistically significant mediator of the effect of the superstition activation on performance (see Figure 4c).

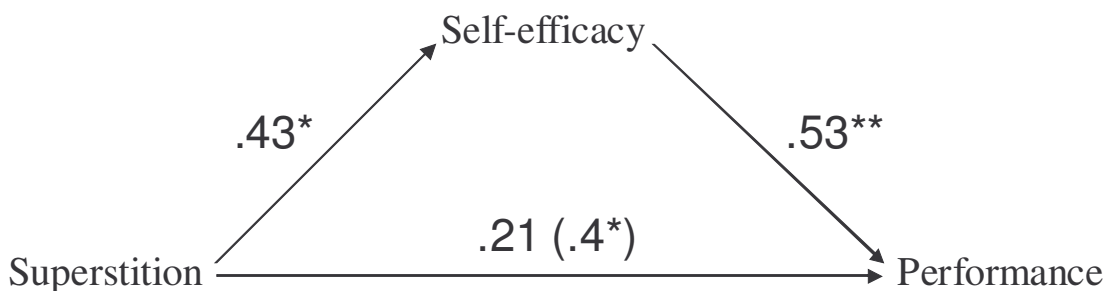


Figure 4c. Path coefficients for mediation in Study 5. The coefficient in parentheses is from the analyses testing the direct effect of superstition priming on performance. \*  $p < .05$ , \*\*  $p < .01$

## *Discussion*

The present findings replicate the previous results and demonstrate that the activation of superstitious constructs such as good or bad luck causally influence subsequent performance. Unlike in the previous studies, performance was not measured using a motor task but rather a task demanding cognitive skills. Consistent with prior predictions, participants primed with the superstitious concept of “good luck” performed better in a subsequent game of Tetris than participants primed with the superstitious concept of “bad luck.” Moreover, the present findings suggest that this effect is mediated by participants’ confidence toward the upcoming task. In other words, participants experienced higher self-efficacy expectancies and therefore were able to complete more rows in a subsequent Tetris task after they had been primed with the superstitious concept of “good luck” rather than the superstitious concept of “bad luck.”

In addition to using a new performance domain, the present study also used a new method of manipulating the activation of a superstitious concept. Instead of having the experimenter explicitly manipulate the superstition, as was done in the previous studies, a subliminal priming method was used to activate the opposing superstitious concepts of good vs. bad luck. Thus, the observed results indicate that the causal effect of superstition on performance is even present when the activation of the superstitious concepts occurs outside of people’s conscious awareness. The subliminal priming approach has at least two advantages compared to the rather blatant activation. First, it allows for keeping the experimenters blind regarding the participants’ experimental conditions, thus ruling out the possibility that the observed effect of the activated superstition on performance is based on the experimenters’ knowledge and behavior (Rosenthal, 1966). Second, as confirmed by the funneled debriefing questionnaire, not only the experimenter but also the participants were unaware of the experimental conditions and the true purpose of the study. This way, it is reasonable to assume that the participants neither consciously tried to comply with the experimental hypotheses, nor to hamper them.

However, one might argue that simply priming the pure superstitious concepts of good vs. bad luck is not the same as activating a commonly known and practiced superstition (e.g. keeping one’s fingers crossed). At first sight, it seems that the semantic activation of a superstitious concept lacks the component of believing in that concept. However, upon closer look it becomes apparent that the purpose behind most superstitions and superstitious behaviors is to gain “good luck” or prevent “bad luck” from happening (Albas & Albas, 1989; Vyse, 1997). Thus, a semantic connection between practiced superstitions and the pure concepts of good and back luck underlies nearly every superstitious act. This becomes especially apparent for examples where the superstition is already linked to the concept of

good or bad luck by its name, such as a lucky charm, a lucky/unlucky number, or a lucky/unlucky day. But other superstitions such as knocking on wood, keeping one's fingers crossed, black cats, or rabbits' tails are also semantically associated to the concepts of good or bad luck via their commonly known meaning. According to a spreading activation account of concept activation (e.g., Collins & Loftus, 1975) such associated concepts are linked, so that the activation of one concept activates the associated concept. Ultimately, depending on the underlying purpose of a superstition, activating such a commonly known and practiced superstition should thus also render the broader but certainly superstitious concept of good luck or bad luck accessible, just as it was done in the present study. Moreover, one should keep in mind that in Study 1, the great majority (85 percent) of the present population reported actually believing in the concepts of good and bad luck on at least a moderate level.

Despite this reasoning, a final study was designed to replicate the causal link between the activated superstition and a subsequent performance as well as the role of perceived self-efficacy as the underlying mediator, using a rather individualistic superstition as an independent variable.

## Study 6

Instead of activating the same superstition for all participants, those in Study 6 each brought their own object with a superstitious meaning. Specifically, participants were asked to select and wear their personal lucky charm to the experiment. Recent research has shown that wearing lucky charms is a commonly practiced superstitious ritual in western societies (Bleak & Frederick, 1998; Wiseman & Watt, 2004). In line with these findings, Study 1 in the present research found that 62 percent of all participants reported believing, in at least a moderate extent, that wearing a lucky charm actually helps them in important situations. Interestingly, lucky charms are special among other superstitions in that it is typically believed to be necessary to position the lucky charm close to the person or wear it close to the body in order for the object to function as a good luck-bringing object (Vyse, 1997). This fact was used in Study 6 to manipulate the superstition. Whereas all participants were asked to bring their lucky charm to the experimental session, only half of them were allowed to have the object with them during the performance task. The lucky charm was taken away from the other half of the participants by the experimenter before engaging in the performance task. Similar to Study 5, performance was assessed using a rather cognitive task. Instead of playing Tetris, however, here participants performed a Memory card game on the computer. The task of the game was to uncover as fast as possible and with as few

moves as possible 18 pairs of identically colored and shaped geometric figures. As they were only able to uncover two figures per move, the task demanded an especially good memory for spatial positions. The time and number of moves needed to complete the game was used as an index of performance. Participants who were allowed to keep their lucky charm during the performance task were expected to outperform participants whose lucky charm was taken away prior to the performance task. The goal of Study 6 was not just to replicate the effect of a superstition manipulation on performance but also to strengthen the evidence that this effect is mediated by participants' perceived amount of confidence toward the performance task. Therefore, participants' judgments on five critical measures of self-efficacy (Bandura, 1997; 2006) were assessed subsequent to the manipulation and prior to the performance task. Participants who were allowed to keep their lucky charm while engaging in the performance task were expected to report higher self-efficacy beliefs than participants whose lucky charm was taken away prior to the performance task. According to Study 5, this difference in self-efficacy was expected to mediate the effect of superstition on performance.

## *Methods*

Participants. 41 female and male psychology students of the University of Cologne were recruited as participants and were randomly assigned to one of two experimental conditions. They were contacted over phone and asked to participate in two unrelated studies that would last about 30 minutes. In addition, participants were asked if they were in the possession of a lucky charm. If so, they were asked to bring the lucky charm to the experimental session. Participants indicating that they did not own a lucky charm were not invited to the experiment. Participants were offered course credit as partial fulfillment of their course requirements as compensation.

Materials and Procedure. Participants were run individually by a female experimenter who was the same for all participants. Upon arrival, participants were led to the lab, greeted by the experimenter, and guided to a separate booth where they were seated in front of an 85 Hz computer monitor. The experimenter informed participants that they were about to take part in two unrelated studies that were administered together for efficiency reasons and handed them brief instructions for the first study. Here, participants were informed that they would first work on a questionnaire concerning the prevalence and significance of lucky charms. Before filling in the questionnaire, which was administered to increase the salience and personal relevance of participants' individual lucky charms and thus activate the superstitious concept, participants were asked whether they had indeed brought their personal lucky charm. If they were not wearing the object on their body (e.g. necklace, ring),

participants were prompted to position the object on the table in front of them. The questionnaire asked participants to describe the lucky charm, explain why and when the object had obtained its special meaning, and to suggest how the lucky charm might help in important situations. Additionally, participants were asked whether they had taken their lucky charm to an exam or another important situation before. If so, participants were asked to describe where the lucky charm was kept during this situation. Furthermore, participants indicated on 9-point scales how important the lucky charm was to them (1 = “not at all important”; 9 = “very important”) and how likely it was that they would take the object to their next exam or another important situation (1 = “not likely at all”; 9 = “very likely”). After completion of the questionnaire, the experimenter explained that it was necessary to take a picture of the lucky charm and left the room with the object. Meanwhile, participants were asked to turn to the computer and read the instruction for the second study, which was displayed on the first screen of the monitor. Here, participants were informed that they would now work on a study designed to test material for a new measure of memory skills and concentration. With the purpose of generating high ego-involvement, participants were told that previous research has found a high association between high scores in these domains and the successful achievement of tasks in everyday life such as at one’s job or university (Van Raalte, et al., 1991). Before participants were able to read further instructions on the following screens, the experimenter reentered the experimental laboratory and manipulated the independent variable. For one half of the participants, the experimenter handed the lucky charm back to the participants and asked them to continue with the experiment. For the other half, however, the experimenter did not hand the lucky charm back to participants. Instead, she explained that there was a problem with the camera, which a colleague would now try to repair. Participants were asked to continue with the experiment, nevertheless (i.e., without their lucky charm).

On the next computer screen, participants read detailed instructions for the memory task. Specifically, they were informed that they would be presented with 36 face down game cards, which were arranged in a 6 x 6 square on the screen. When uncovered, these cards depicted geometrical figures, which differed in six shapes (e.g. circle, arrow, square) and in three colors (red, blue, black), respectively. Participants were informed that it was their task to uncover all 18 pairs depicting identical figures (shape and color) as quickly as possible while making as few moves as possible. One move was defined as the uncovering of two cards. After selecting a first card by a mouse click, participants had as much time as they wanted to examine the depicted figure and to choose a second card. After clicking on a second card, it flipped over and both cards remained exposed for three seconds before they were covered again. In the case that both cards depicted the identical figure, they were left

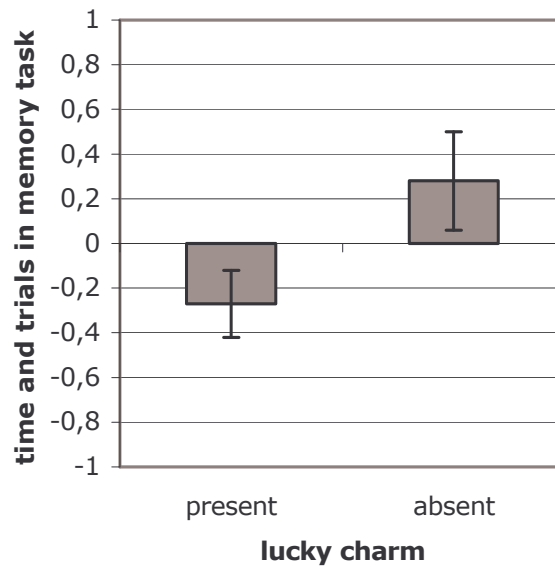
exposed until the end of the task. The task was finished when all 18 identical pairs were uncovered. The total amount of time as well as the number of trials needed to finish the task were recorded in a separate data file.

Before beginning with the memory task, participants were asked to answer some questions about their present feelings. Specifically, participants were prompted to indicate on five critical items their current perceived self-efficacy toward the upcoming memory task (e.g. “I am confident that I will master the upcoming memory task well,” “I have trust in my skills for the upcoming memory task”). These items were constructed in accordance with Bandura’s (2006) guide for constructing self-efficacy scales. Thus, the items were written in terms of present capabilities, not potential or future ones. The capability judgments referred to the specifically upcoming memory task, not to general cognitive functioning. Additionally, judgments were assessed on 9-point scales (e.g., 1 = “agree not at all; 9 = “agree very much”), not on formerly typical but less differential 6-point scales. Upon completion of the self-efficacy judgments, participants began the memory game. Subsequently, participants evaluated their general mood (1 = “not good at all”; 9 = “very good”), their subjectively perceived performance (1 = “not good at all”; 9 = “very good”), and their beliefs about the importance of performing as well as possible in the memory game (1 = “not important at all”; 9 = “very important”). These judgments were followed by some questions assessing self-descriptive information, including participants’ sex, age, and current semester. At the end of the session, participants answered a questionnaire that was designed to assess whether they were aware of the connection between the ostensibly unrelated studies and the real purpose of the study. None of the participants accurately reported the real purpose of the study.

In sum, Study 6 is based on a single-factor design consisting of two experimental conditions (“performing with lucky charm” vs. “performing without lucky charm”).

## *Results*

Prior to the data analysis, I calculated an index of participants’ performance on the memory task based on the total amount of time and the number of trials participants needed to complete the task. To do so, the two scores were *z*-transformed and the mean was calculated (Cronbach’s  $\alpha = .68$ ). The resulting mean score reflects participants’ performance in the memory game in units of the pertinent standard deviation. Note that lower scores indicate a better performance.

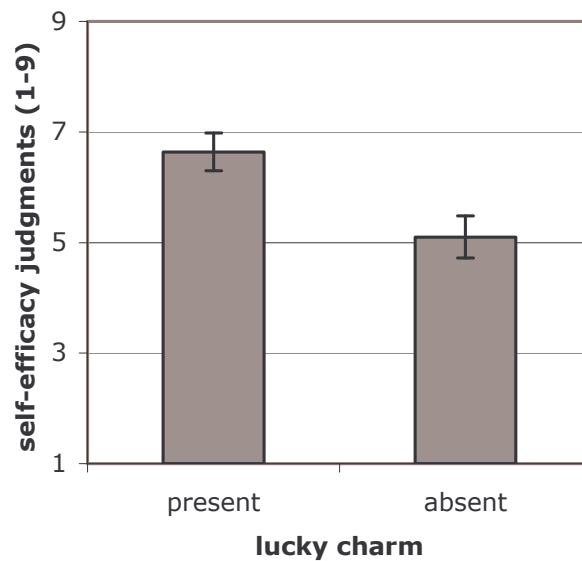


*Figure 5a.* Means (*z*-scores) for participants' performance in the memory task for lucky charm present versus lucky charm absent condition. Error bars represent one standard error from the mean. Note that lower values represent higher levels of performance.

In line with prior expectations, inspection of Figure 5a reveals that participants' performance in the memory task depends on whether they were allowed to keep their lucky charm during the task or if it was taken away from them prior to the task. Specifically, participants performed better in the memory task if they had their lucky charm close to them during the task ( $M = -.27$ ) than if their lucky charm had been taken away from them prior to the task ( $M = .28$ ),  $t(39) = 2.13$ ,  $p < .05$ .

In addition, participants' self-efficacy judgments were combined into a single score with higher values indicating higher levels of experienced self-efficacy. To do so, one of the five critical items on self-efficacy was reverse scored and the mean of all items was calculated (Cronbach's  $\alpha = .93$ ). The resulting mean score reflects participants' ratings of their perceived self-efficacy beliefs prior to the performance task.





*Figure 5b.* Means for participants' judgments about their experienced self-efficacy depending on the presence versus absence of their lucky charms. Error bars represent one standard error from the mean.

As predicted, inspection of the depicted means in Figure 5b reveals, that participants' self-efficacy indeed depends on whether participants had to engage into the performance task with or without their personal lucky charm. Specifically, participants reported feeling more confident toward the upcoming memory task if they were with their lucky charm ( $M = 6.64$ ) rather than without their lucky charm ( $M = 5.10$ ),  $t(39) = 3.07$ ,  $p < .01$ . Similar to the findings of the previous studies, participants' general mood did not differ depending on whether they performed with their lucky charm close by ( $M = 6.19$ ) or not ( $M = 5.50$ ),  $t(39) = 1.02$ ,  $p > .3$ , ns. This was also true for participants' subjective judgments of their performance (with lucky charm:  $M = 4.57$ ; without lucky charm:  $M = 4.40$ ) and the perceived importance of the task (with lucky charm:  $M = 7.38$ ; without lucky charm:  $M = 7.20$ ), all  $t < 1$ , ns.

*Mediaton.* As in Study 5, I conducted an additional analysis to examine whether the reported level of perceived self-efficacy mediated the effect of the lucky charm on performance in the memory task. For this analysis, the absence of the lucky charm was coded as -1 and the presence of the lucky charm was coded as 1. As a first step, I examined whether the three preconditions outlined by Baron and Kenny (1986) for documenting mediation were fulfilled. As preceding results revealed, the first premise was satisfied in that the presence of a superstitious object - the lucky charm - predicted performance in the memory task, and the second premise was satisfied in that lucky charm presence also

predicted perceived self-efficacy toward the memory task. To test the final requirement, the regression analysis examining the effect of lucky charm on performance was repeated, with self-efficacy also included in the equation.

The regression yielded a significant effect for self-efficacy,  $\beta = -.49$ ,  $t(39) = 3.54$ ,  $p < .01$ , indicating that the more self-efficacy participants experienced the faster, and thus the better, they performed in the memory task. The direct effect of the lucky charm presence on performance was reduced and rendered insignificant, from  $\beta = -.32$ ,  $t(39) = 2.13$ ,  $p < .05$  to  $\beta = -.13$ ,  $t(39) = .84$ ,  $p > .4$ .

To determine whether perceived self-efficacy beliefs mediated the effect of the lucky charm presence on performance the bootstrap approach (Preacher & Hayes, 2004) described in Study 5 was again applied. In line with the hypothesis, the results of these bootstrapping analyses reveal that reported self-efficacy mediated the effect of the lucky charm manipulation on the performance in the memory task. Specifically, a point estimate for this indirect effect of  $-0.18$ , with a 95% confidence interval of  $-0.41$  to  $-0.01$  was obtained. Because zero is not in the 95% confidence interval, it can be concluded that the indirect effect of self-efficacy is indeed significantly different from zero at  $p < .05$  (two tailed) and thus is a statistically significant mediator of the effect of the superstition activation on performance (see Figure 5c).

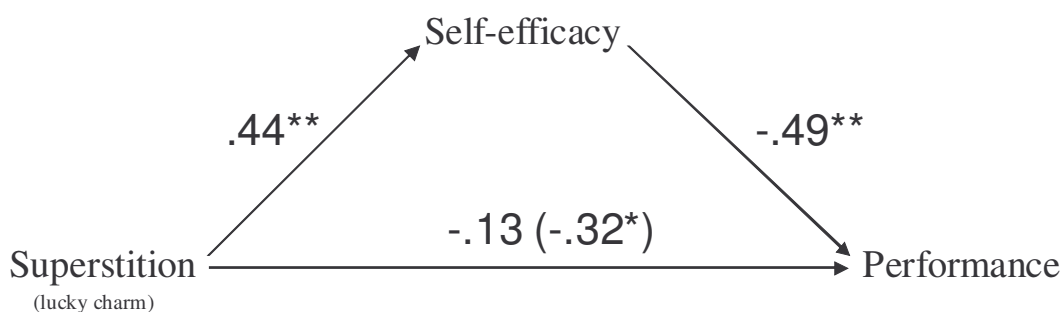


Figure 5c. Path coefficients for mediation in Study 6. The coefficient in parentheses is from the analyses testing the direct effect of lucky charms on performance. \*  $p < .05$ , \*\*  $p < .01$

## Discussion

These findings replicate the previous results by demonstrating a causal link between the activation of a superstition associated with the concept of “good luck” and a superior outcome in a subsequent performance task. Specifically, participants in the presence of their own individual superstitious object were able to perform a memory task better than participants in the absence of their lucky charm. The results further suggest that the

demonstrated effect of the superstitious concept on performance was mediated by participants' perceived self-efficacy, thus replicating the finding of Study 5. As anticipated, participants experienced higher self-efficacy and therefore were able to complete the memory task more efficiently when their luck-bringing object was with them rather than when it was kept away from them.

Admittedly, in Study 6 the manipulation of the superstition was different from the previous studies in at least two ways. First, whereas the concept activated in the previous studies was a commonly known and widespread superstition in society, the superstitious objects used in Study 6 were very private and individual for each participant. Indeed, the objects that were brought along to the lab varied widely, including various stuffed animals, necklaces, wedding rings, stones, and key rings (for some examples see Figures 6a – f).

Even though it is likely that participants knew the superstitions used in Studies 2 to 5, it is unlikely that every single participant actually believed in these concepts. In Study 6, however, only participants in the possession of a lucky charm were invited to the lab. The fact that for a person an original neutral object turns into a lucky charm, thus, ascribing some kind of supernatural luck-bringing power to it, can be seen as a first hint that participants of Study 6 actually developed a special relationship to the superstitious object. This notion is supported by participants' own specifications concerning their lucky charm (see Appendix F26 f., Table 6a-d for detailed descriptive results of the lucky charm questionnaire). On average, participants indicated owning their lucky charm for 59.7 months (approximately 5 years). The average judgment of the personal importance of the superstitious object (1 = “not important at all”; 9 = “very important”) was  $M = 6.78$ , which is significantly higher than the midpoint of the scale,  $t(40) = 7.25$ ,  $p < .001$ .



a)



b)



c)



d)



e)



f)

Figure 6 a–f. Examples of lucky charms which were brought along to the experimental session of Study 5 [a) stuffed animal; b) necklace; c) wedding ring; d) stone; e) Chinese key ring; f) angel figure]

Second, instead of activating two opposing superstitious concepts or a superstitious concept associated with “good luck” versus a control condition, this time a positive superstitious object was initially made salient for all participants. However, as described above, the distinct characteristic of lucky charms is that they only bear their superstitious nature if they are close by in the critical situation (Vyse, 1997). This fact was affirmed by participants in Study 6, of whom 38 out of 41 (93 percent) reported that they had taken their lucky charm to an important situation in the past. The average judgment of the likelihood of taking the object to an important situation in the future (1 = “not likely at all”; 9 = “very likely”) was  $M = 7.37$ , which is significantly higher than the midpoint of the scale,  $t(40) = 7.63$ ,  $p < .001$ . Not surprising for the present population, 27 out of those 38 participants (71 percent) who indicated to occasionally wear their lucky charms with them specifically

reported bringing their lucky charm to exams. Most importantly, all participants who indicated that they had brought their lucky charm to an important situation also reported that they had kept the object very close by during the critical situation. Participants' answers include wearing the object at their body, keeping it in their pocket, putting it on a table, or carrying it in their pencil case. This logic, that lucky charms bring good luck if they are kept close to its owner during a critical situation but lose their superstitious power if this is not the case, was used in designing Study 6. Ultimately, the difference between activating a positive versus a negative or a control superstition and activating a positive superstition that is either believed to function as such or for which its superstitious functioning had been revoked is not that great. Thus, the findings of Study 6 indeed complement the results of the previous studies in a meaningful way. The present findings, their relation to previous research, as well as their implications and future perspectives will be discussed more detailed in the following General Discussion.

# GENERAL DISCUSSION

## Significance of the present findings

There are numerous occasions in everyone's life when we face the request to achieve the best performance possible. Previous research has demonstrated that precisely these situations often elicit the seemingly irrational thoughts and behaviors associated with superstitions (Keinan, 2002; Vyse, 1999). In the present thesis, I suggest that the fulfillment of these superstitions in the face of an upcoming performance task serves a specific beneficial function. In fact, from an evolutionary view, any behavior that maintains over a long period of time should be adaptive (Buss, 2000), and thus the notion of a superstitious benefit is well in line with my suggestion. According to this perspective, I derived two specific research questions, which I experimentally examined in the present line of research.

First, I predicted that the activation of a superstition prior to a performance task exerts a causal influence on the outcome of this task. Given that superstitions are most likely held by athletes and students (Albas & Albas, 1989; Becker, 1975), who face performance related situations most frequently, a direct beneficial influence of superstition on performance rather than other aspects of the situation seems to be likely. Moreover, as it usually is the desire of an athlete or student to perform as well as possible, the most beneficial effect of a superstition on task performance should appear in terms of a performance enhancement. The results of the present research are consistent with this assumption. While Study 1 confirms earlier findings concerning the high prevalence of superstitions within the population of students and identifies several specific common superstitions, Studies 2 through 6 repeatedly demonstrate the causal influence of superstitions on performance. In particular, the findings of these studies suggest that better performance is achieved after the implementation of a superstition associated with the concept of good luck than after the implementation of a superstition associated with bad luck or no superstition at all. This effect was repeatedly demonstrated for both cognitive and motor tasks. Furthermore, the activated superstition as well as the method of implementation varied across the presented studies, and, according to Study 1, always used the most wide spread superstitions within the present population. Studies 2 and 3, for example, utilized the most common superstitious beliefs in good or bad luck by connecting these concepts to a golf ball, which resulted in a similar superstition as had been experimentally established in former research (Van Raalte et al., 1991). Supporting the hypothesis of a superstition-performance link, the results of both studies demonstrate that

participants engaging in a golf putting task using an ostensibly “lucky ball” got the ball into the hole more often than did participants using an ostensibly “unlucky ball”. Moreover, the results of Study 3 specifically demonstrate that participants’ success rate using an ostensible “unlucky ball” is not different from participant’s level of success in the golf-putting task for which the ball was not connected to any superstitious concept. This pattern of results indicates that superstitions associated with the positive concept of good luck are particularly responsible for the effect on subsequent achievement by actually enhancing task performance. Altering both the performance task and the activated superstition, the results of Study 4 show that participants for whom another person kept her fingers crossed were faster in finishing a motor dexterity game than participants in two control conditions. In particular, these results suggest that the observed performance enhancement in the experimental condition is indeed a specific effect of the activated superstition and cannot be attributed to mere encouragement.

The second research question of the present thesis concerns the underlying mechanism of the obtained effect. Specifically, I contend that the influence of superstition on performance enhancement is mediated by participants’ perceived level of self-efficacy beliefs. On the one hand, research on the concept of self-efficacy (Bandura, 1977, 1986, 1997) suggests that people’s efficacy beliefs are susceptible to contextual influences. On the other hand, numerous findings verify that self-efficacy is one of the most influential factors on performance outcomes. Accordingly, I suggest that the implementation of a good luck superstition prior to a performance task leads to an increase in perceived self-efficacy toward the required activity, which in turn improves the final performance. The results of Studies 5 and 6 support this reasoning. Specifically, in Study 5, the concepts of good luck or bad luck were primed subliminally (Bargh & Pietromonaco, 1982; DeMarree et al., 2005) before participants rated their confidence toward a subsequent Tetris game. Despite the fact that the superstitious concepts were merely presented outside of participants’ conscious awareness, the results of this study indicate that participants in the good luck condition completed more rows in the Tetris game and thus performed better than participants in the bad luck condition. Moreover, the result of a mediation analyses supports the assumption that the observed effect is based on participants’ reported level of perceived self-efficacy beliefs. This finding was replicated in Study 6. Instead of priming participants with the superstitious concepts, they performed a Memory task either in the presence or in the absence of their personal lucky charm, which all participants had brought along to the experimental session. Again, the obtained results provide evidence for the assumed superstition-performance link, as participants in the presence of their lucky charm achieved a better performance in the Memory task than did those in the absence of the lucky charm. Importantly, this effect was



mediated by participants' perceived self-efficacy beliefs, which were assessed prior to the actual performance task.

Taken together, the obtained results provide evidence in support of both hypotheses. That is, the activation of a superstition usually performed to gain good luck leads to performance enhancement in a subsequent task. The mechanism underlying this effect can be found in an increase of perceived task-oriented self-efficacy.

## Alternative Explanations

### *Performance enhancement as mood effect*

Instead of stressing the concept of self-efficacy, one might argue that the observed performance enhancement after the activation of a good luck superstition could alternatively be explained in terms of a mood effect. A large body of research suggests that cognitive task performance such as problem-solving tasks, social judgment tasks or creative thinking tasks are influenced by preexisting mood states (Clore, et al., 1994; Forgas, 1991, 1995; Forgas & Bower, 1987; George & Zhou, 2002; Isen, 1999). Some of these findings provide evidence in support of mood-incongruent effects on performance by demonstrating that positive mood produced performance decrements (Isen, Means, Patrick, & Nowicki, 1982) or negative mood produced performance improvement (Sinclair, 1988; Sinclair & Mark, 1995). While other authors reported asymmetrical mood effects on task performance (Davis, Kirby, & Curtis, 2007), the majority of research on mood effects, however, has focused on mood-congruent effects on performance, demonstrating enhanced performance subsequent to the induction of positive affective states (Hirt, Melton, McDonald, & Harackiewicz, 1996; Isen, Daubman, & Novicki, 1987; Isen, Johnson, Mertz, & Robinson, 1985; Murray, Sujana, Hirt, & Sujana, 1990). Several explanations have been suggested to explain the influence of mood on task performance. Thus, for example it has been argued that affective states exert a rather direct effect on task performance by influencing people's processing strategies (Sinclair & Mark, 1992) or their depth of cognitive processing (Schwarz, 1990; Schwarz & Bless, 1991). Alternatively, it seems possible that performance is rather indirectly influenced by mood states. Thus, it has been suggested, for example, that positive mood is linked to higher self-set goals (George & Brief, 1996; Hom & Arbuckle, 1988; Saavedra & Earley, 1991) or higher self-efficacy judgments (Baron, 1990; Forgas, Bower, & Moylan, 1990). In turn, both factors are known to foster superior performance (Bandura, 2001; Locke & Latham, 1990). From this perspective, the obtained effects of the present line of research seem to be explainable by the influence of differently induced mood states on performance outcome.



Given that the concept of good luck is strongly linked to positive instances or events with a successful outcome (Teigen, 1995) it seems possible that the activation of these superstitions induced a more positive mood state than the activation of superstitions associated with the concept of bad luck or no superstitions at all. It is important to note, however, that the findings of the present studies yield no evidence in support of this notion. In all but one of the five experimental studies (Study 3), participants' general mood was assessed. None of these reports contained any indication of mood differences between experimental conditions. In fact, analyses revealed that reports of general mood or well-being for participants for whom a good luck superstition was activated did not differ significantly from judgments of participants for whom no superstition or a bad luck superstition was activated. In conclusion, the present results indicate that the obtained influence of superstition on superior performance is not based on the alternative explanation of a mood effect.

### *Performance enhancement as a request*

A second objection concerning the explanation for the obtained superstition-performance link and its underlying mechanism might have to do with a communicational problem. One might argue that the activation of a superstition associated with the concept of good luck somehow functions as a request to participants to consider the task at hand as more important compared to the activation of a bad luck superstition or no superstition at all. In other words, handing someone a ball and call it a "lucky ball" might implicitly transmit the message that everyone else has done a very good job using this ball so far and that the same is expected of the present participant. Similarly, saying that I keep my fingers crossed for a certain participant might implicitly transmit the message that I want this person to perform as best as possible and to consider the task as very serious. However, handing someone over an "unlucky ball," for example, or simply saying "go" as a starting signal, might be understood as an intention of saying "Oh, don't worry. Don't take the task too seriously. No one had done a good job with it, yet." If this was the case, the intended manipulation of different superstitions might be confounded with a manipulation of the perceived importance of the task. While this notion hardly seems to apply to the subliminal priming of good versus bad luck in Study 5 or the manipulation of a lucky charm in Study 6, it seems plausible for Studies 2 through 4 in which the experimenter directly expressed the good or bad luck associated superstitions. Even though no conclusions can be drawn for the golfing studies, this alternative was controlled for in the following studies by assessing participants' subjectively perceived importance to perform the requested task as well as possible. On the one hand, parts of the results of Study 4 support the assumption that the implementation of a good luck superstition provides more encouragement than a control

condition. Thus, participants for whom the experimenter kept her fingers crossed considered the task more important than participants for whom the experimenter gave an ordinary starting signal. However, this was not true for the additional control condition of this study, in which the superstitious phrase was changed into a phrase without a superstitious meaning. Nevertheless, performance enhancement was found exclusively in the experimental condition in which the specific good luck-associated superstition of keeping one's fingers crossed was activated before the task. Furthermore, in Studies 5 and 6, the results reveal no indication of a difference in the perceived importance of a good performance between the experimental conditions. In this regard, the notion of a performance enhancement as a result of an implicitly transmitted request to consider the task as important can clearly be rejected.

### *Distinction between superstitions and pre-performance routines*

In the world of sports, it is common for athletes to follow a regular routine or a certain ritual prior to a competition or prior to a specific performance. A diver, for example, might approach the springboard exactly the same way each time. A football player might always want to enter the field with the left foot first. Similarly, a basketball or tennis player might bounce the ball three times before each free throw shooting or before each serve, respectively. Indeed, several findings across different sports such as golf, bowling, and basketball suggest that these pre-performance routines enhance subsequent performance (Boutcher, 1990; Cohn, Rotella, & Lloyd, 1990; Foster, Weigand, & Baines, 2006; Kirschbaum, Ordman, Tomarken, & Holtzbauer, 1982; Lobmeyer & Wasserman, 1986; Mccann, Lavalley, & Lavalley, 2001; Predebon & Docker, 1992; Wrisberg & Pein, 1992). Thus, Boutcher and Crews (1987), for example, demonstrated that the introduction of a pre-shot routine led to improved performance in a golf-putting task. Similarly, Lobmeyer and Wasserman (1986) as well as Gayton and colleagues (Gayton, Cielinski, Francis-Keniston, & Hearn, 1989) found that pre-performance routines in basketball free throw shooting significantly contribute to the accuracy of the shot. Specifically, they demonstrated that the execution of the pre-shot ritual enhanced free throw performance, while this performance declined when pre-performance rituals were disrupted. At first glance, this functioning seems to be very similar to the results obtained in the present line of research. In particular, one might ask whether there is any difference between superstitions and pre-performance routines. While in some cases it might be difficult to draw the line between the two concepts (Vyse, 1997), superstitious thoughts and behaviors can often be clearly distinguished from pre-performance routines (Bleak & Frederick, 1998; Czech, Ploszay, & Burke, 2004; Lobmeyer & Wasserman, 1986). First, the pre-performance routines of an athlete or a team often are developed and taught by an expert such as a sport psychologist, for example (Bleak

& Frederick, 1998). In contrast, superstitions are usually learned idiosyncratically by classical and operant conditioning, or are socially-shared beliefs and behaviors that are imitated from or taught by other team members. A second difference between superstitions and pre-performance routines refers to their context. A behavior becomes superstitious when it is given a special, magical meaning, which usually refers to external powers and the perception of luck (Vyse, 1997). Pre-performance routines, however, clearly focus on cognitive self-control as a means of directly influencing an athlete's performance outcome (Bleak & Frederick, 1998). This brings us to the final difference between these concepts, the mechanisms underlying enhanced performance. The findings of the present research indicate that performance enhancement subsequent to the activation of a good luck superstition is mediated by the strength of participants' self-efficacy beliefs. That is, the activated superstition affects people's judgments concerning their own capabilities to perform a task. Pre-performance routines, however, have been found to affect performance outcome via different mechanisms. Specifically, it has been suggested that pre-performance routines improve concentration, help focus attention, and eliminate distraction by associating concentration to specific routines (Schmid & Pepper, 1998; Weinberg & Gould, 2003). Moreover, it has been proposed that pre-performance routines serve the purpose of "motor priming," which allows the athlete to perform the task at hand via an automatized motor sequence (Czech et al., 2004; Van Raalte et al., 1991). In this respect, pre-performance routines prevent the athlete from detrimental thoughts about the outcome, negative thoughts, or the actual physical process of the action (Boutcher & Crews, 1987). Focusing on the actual physical process has been demonstrated to inhibit overlearned or automated behavior (Baumeister, 1984; Beilock & Carr, 2001; Kimble & Perlmutter, 1970; Zimring, 1983).

Taken together, it is evident that the superstitions manipulated in the present line of research can clearly be distinguished from pre-performance routines. In fact, all of the activated superstitions are strongly associated with the concept of luck and none of the manipulations includes a behavioral ritual performed by the participant. In this regard, the present empirical findings are novel in their specific contribution to the understanding of superstitious functioning.

## Maintenance of superstitions

Despite the assumption that superstitious thoughts and behaviors would slowly fade as our contemporary world grows richer in education and technical understanding (Campbell, 1996; Vyse, 1997) it instead seems that the opposite is true. As described earlier, the prevalence of superstitions may have even increased throughout the last decades (Sasol

Olefins & Surfactants, 2005; Wiseman, 2003). What is it that makes superstitions so persistent? Similar to the claims of other theorists, in the present research I argue that the high prevalence and maintenance of superstitions could be explained by a beneficial function of these thoughts and behaviors. Specifically, I proposed a causal influence of superstitions on superior performance outcomes. As outlined before, the present results indeed indicate that the activation of a superstition that usually is performed to gain good luck leads to better achievements in a subsequent performance task. However, the question remains whether this performance enhancement is responsible for the retention of superstitions. Importantly, according to the present results, participants do not seem to consciously notice the performance enhancement as a result of the activated good luck superstition. Despite an objectively measured increase in performance, participants' subjective judgments concerning their achieved performance do not mirror this difference in performance outcome. Specifically, in all of the experimental studies in which subjective performance judgments were assessed (all except Study 3), the results indicated that participants did not believe that they had actually done better in the good luck condition rather than in the bad luck or in the neutral condition.

If people are not consciously aware of the performance enhancement, why are they nevertheless committed to upholding the superstitious thoughts and actions? One reason suggested by the present data could be that people perceive the increased feeling of self-efficacy as the crucial psychological benefit of superstitious actions. As the present findings reveal, people seem to be well aware of this heightened level of self-efficacy in the context of a good luck superstition and are able to report on this improved feeling. Therefore, the increase in self-efficacy might be experienced as an important outcome of superstitions in and of itself, and might thus even be the stronger cause for the high persistence of superstitions than the link between a superstition and superior performance. In fact, this perspective is well in line with a theoretical reasoning by Schippers and Van Lange (2006) who also suggested that the psychological benefits of superstitious rituals might outweigh the more distal relationship between the enactment of rituals and the outcome of an event. Together, the present findings support the notion of a beneficial functioning of superstitions in terms of performance enhancement, but suggest that the most important factor for the existence and maintenance of superstitions might be an increase in people's self-efficacy.

## Relation to previous research

### *Influences on task performance*

Performance depends on several factors, including those within the person engaging in the task as well as situational characteristics. Probably, the most important factors affecting performance outcomes are the level of ability required for the task and the degree of motivation for that task (Schmidt & Hunter, 1998). However, prior research also has identified several seemingly irrelevant factors that contribute to achievement outcomes. For example, Friedman and Elliot (2008) examined the effect of a proprioceptive cue such as arm crossing on performance in anagram-tasks. Similarly, previous research demonstrated a relationship between specific colors and intellectual (Elliot & Maier, 2008; Elliot, Maier, Moller, Friedman, & Meinhardt, 2007) and physical performance (Frank & Gilovich, 1988; Hill & Barton, 2005).

The present line of research extends these findings by suggesting another causal influence on performance by a factor that, at least at first glance, seems to be irrational. Thus, the findings demonstrate that activating a positive superstition prior to a performance task increases people's perceived efficacy expectancies toward this task, which in turn leads to better performance. Thus, the present findings represent the first empirical demonstration of a replicable effect of superstition on performance using controlled experimental research designs. Interestingly, despite the fact that research investigating influences on achievement behavior abounds, most studies focus on instances in which performance is undermined. As such, the present research uniquely contributes to the quest of identifying factors that improve task performance.

### *Self-efficacy – performance link*

Despite the novelty of the present results, they are clearly in line with numerous findings described earlier demonstrating a causal influence of perceived self-efficacy on subsequent achievement behavior. Congruent with the conclusions of previous studies in the athletic or academic context (Bandura & Schunk, 1981; Feltz et al., 2008; Moritz et al., 2000; Schunk & Pajares, 2004), the present findings indicate that people who are more confident regarding their capabilities to master a task indeed achieve a better outcome in this task than people with lower feelings of confidence. However, while those former studies put their focus on either athletic or cognitive achievements, the present line of studies is unique in that it combines both contexts within one line of research.

## *Effect of superstition on self-efficacy*

The present findings also shed further light on the relationship between superstitions and self-efficacy beliefs. The findings clearly indicate a direct effect of an activated good luck superstition on enhanced feelings of task-specific self-efficacy. Thus, the present findings represent the first empirical evidence for this causal effect, despite the many speculations and assumptions concerning a relationship between these two constructs. In fact, the very first research on superstitions and its related personality variables even suggested a negative correlation between superstition and self-efficacy (Tobacyk & Schrader, 1991). However, this research seemed to have many weaknesses that left some doubts about the results. First, to assess superstition, the authors used the superstition subscale of the Paranormal Belief Scale (Tobacyk, 2004; Tobacyk & Milford, 1983), which consists exclusively of negative, bad luck related superstitions. However, many surveys and studies on the subject of superstition have revealed that the majority of people engage in positive, good luck-related superstitions more often than in negative superstitions (Albas & Albas, 1989; Wiseman, 2003; Wiseman & Watt, 2004). Second, to measure participants' self-efficacy, the authors used a very general self-efficacy scale. According to Bandura (2006), however, self-efficacy beliefs are best measured by scales that are specific to particular domains of functioning rather than ones that assess global efficacy expectations that are devoid of context. It is possible that such a global, unspecific measure of self-efficacy as used by Tobacyk and Schrader reflects a general feeling of uncertainty, uncontrollability, and low confidence rather than a task-specific measure of perceived efficacy. From this perspective, the reported negative correlation between superstitions and their measure of self-efficacy can easily be viewed as in line with other findings demonstrating an increased appearance of superstitious thoughts and behaviors in situations characterized by perceived feelings of uncontrollability and uncertainty (Keinan, 1994, 2002; Malinowski, 1954; Rudski, 2004; Vyse, 1997). In this sense, it seems likely that the findings of Tobacyk and Schrader do not necessarily contradict the findings in the present line of research. In fact, knowing that superstitions most often occur under those specific situational conditions, many researchers have suggested that superstitions are related to adaptive, beneficial personality functioning (Keinan, 2002; Neil, 1980; Rothbaum et al., 1982; Womack, 1979) rather than to less effective functioning as indicated by the results of Tobacyk and Schrader (1991). Specifically, as described earlier, some of these previous assumptions and findings point to beneficial psychological functions of superstitions that seem to be very similar to the presently examined concept of self-efficacy. Rudski (2001), for example, found a positive relation between superstition and perceived confidence in future performance. Dudley (1999)

and Matute (1994) demonstrated an effect of superstition on perceived feelings of controllability. Moreover, Day and Maltby (2003, 2005) suggested a positive correlation between the belief in good luck and hope, optimism, and psychological well-being. Looking back at these previous results it seems that all of them assessed individual aspects of the self-efficacy construct, that might be particularly central in performance-related situations. In this regard, the findings of the present research are the first to demonstrate the causal influence of an activated superstition on enhanced feelings of perceived task-specific self-efficacy using rigorous experimental methods.

## Implications for future directions

### *Mechanism of the self-efficacy – performance link*

Undoubtedly, the present findings are unique in their contribution to a deeper understanding of the influence of superstitions on subsequent task performance. The present research presents at least three novel findings that have not been empirically demonstrated before. First, the reported results indicate that activated superstitions associated with the concept of good luck lead to higher self-efficacy perceptions concerning a subsequent achievement task, compared to superstitions associated with the concept of bad luck. Second, the present findings repeatedly demonstrate that implemented superstitions affect subsequent task performance, indicating that good luck superstitions lead to better outcomes than do bad luck superstitions or no superstitions at all. Finally, the present data suggest that the effect of superstition on performance enhancement is mediated by participants' perceived level of self-efficacy beliefs.

As it is true for most work exploring novel fields of research, however, the present thesis also raises further questions that might be examined in future research. One of these questions concerns the core mechanism through which raised efficacy beliefs enhance performance in the current context of superstitions. In fact, existing literature on the effects of self-efficacy on cognitive, motivational, and affective processes identifies several factors that may account for the influence on performance outcome.

Reflecting on cognitive factors first, a great deal of research has demonstrated that beliefs of self-efficacy affect the type of goals that people select (Zimmerman, 2005). More specifically, previous findings indicate that individuals who feel capable of performing a particular task are likely to set more challenging and more specific goals rather than individuals with lower levels of perceived confidence (Bandura, 1986; Cleary &



Zimmerman, 2001; Zimmerman & Bandura, 1994; Zimmerman, Bandura, & Martinez-Pons, 1992). These findings are important, as goal-setting theory predicts that particularly challenging and specific goals lead to the most positive outcomes (Locke & Latham, 1990). From this perspective, it appears possible that individuals who experienced higher self-efficacy due to the implementation of a good luck superstition set higher and more specific goals for the required performance task, and thus achieved better outcomes than participants in the other experimental conditions.

Another cognitive factor that has been identified to account for the effect of self-efficacy on performance are causal attributions (Weiner, 1986). Thus, it has been shown that individuals with a strong sense of efficacy believe performance outcomes to be personally controllable (Bandura, 1997), so they tend to attribute failure to insufficient effort or deficient knowledge, which are factors that they can change (Bandura, 1994; Zimmerman & Cleary, 2006). Conversely, individuals with a low sense of self-efficacy attribute failure to factors they cannot change, thereby increasing feelings of despair and helplessness (Silver, Mitchell, & Gist, 1995). These types of attributions are particularly important as they encourage people to make adaptive changes in their achievement strategies and thus affect performance. A similar process may have come to play in the present studies. Applying this notion to the golf-putting task, for example, it seems to be likely that highly efficacious participants in the lucky ball condition attributed failures in the initial trials of the putting task to personal controllable factors and thus made adaptive changes in the following trials. In contrast, low efficacious participants in the unlucky ball condition might have attributed initial failures to uncontrollable factors and thus were not able to improve their performance throughout the following trials.

Apart from these cognitive factors, motivational processes might just as well drive the effect of self-efficacy beliefs on performance outcomes. Abundant findings demonstrate that self-efficacy beliefs contribute to motivation in several ways: They determine how much effort people expend in a task, how long they persevere in this task despite difficulties, and how they approach a difficult task (Bandura, 1986, 1994, 1997; Pajares, 1996; Schunk, 1981; Schunk & Hanson, 1985). Specifically, it has been shown that people who have a strong belief in their capabilities exert more vigorous effort in their actions than people who have doubts about their capabilities (Schunk, 1981; Schunk & Hanson, 1985; Salomon, 1984). Similarly, individuals who regard themselves as highly efficacious are more persistent and less likely to quit in the face of obstacles and failures than individuals with low efficacy beliefs (Bandura & Schunk, 1981; Bouffard-Bouchard, Parent, & Larivée, 1991; Brown & Inouye, 1978; Lyman, Prentice-Dunn, Wilson, & Bonfilio, 1984; Multon, Brown, & Lent,



1991; Zimmerman & Ringle, 1981). Furthermore, people with high assurance in their capabilities approach difficult tasks as challenges to be mastered rather than as threats to be avoided. In contrast, people who doubt their capabilities shy away from difficult tasks, which they view as personal threats (Bandura, 1986, 1994; Zimmerman & Kitsantas, 1999). All of these findings are of particular importance because the motivational factors of effort, persistence or task choice are known to contribute to effects of efficacy beliefs on accomplishments (Bandura, 1997). Hence, these motivational aspects should also be considered as potential mediating factors for the observed effect in the present line of research. It seems reasonable to assume that people who are primed with good luck, for example, have higher levels of self-efficacy and, therefore, exert greater as well as more persistent effort toward the required performance task than do people who are primed with bad luck. A similar perspective seems to be applicable with regard to affective processes that are known to be influenced by self-efficacy beliefs and likely to contribute to its effects on performance. Thus, it has been shown that people's level of functioning can be impaired when a low sense of efficacy leads to higher stress, anxiety and irrational or disturbing thoughts, rather than a stronger belief in one's own capabilities (Bandura, 1994).

Together, the existing literature on cognitive, motivational, and affective consequences of self-efficacy beliefs suggests a host of factors through which efficacy contributes to performance. In fact, many of these factors even appear to influence each other. For the present findings, several of the identified and outlined processes seem to be likely contributors that might account for the repeatedly demonstrated effect of superstition on performance mediated by self-efficacy beliefs. This is not to say that I assume only one of these factors to play the central role. Rather, I would expect that different processes might come into play for different requirements of the performance task and that most often several of these factors intertwine in their contribution to performance enhancement as a result of raised self-efficacy beliefs. Future research might examine some of these factors and shed further light on the underlying mechanisms.

### *Distinction between different categories of superstitious beliefs*

A second possible issue for future research might concern the question of whether the observed effect in the present studies accounts for all kinds of superstitions or whether one has to differentiate between various forms of superstitions. Admittedly, the field of superstitions includes a wide range of multifarious thoughts and behaviors. One way to categorize these various forms of superstitions, for example, might be to distinguish them in regard to their origins. Thus, some superstitions are socially transmitted whereas others

develop as idiosyncratic beliefs (Rudski, 2003). Although the present research did not intend to focus on this distinction, but rather used those superstitions for which many individuals of the present population indicated knowledge or belief, the current results offer some suggestions concerning the effectiveness of both kinds of superstitions. Specifically, the reported findings indicate that there is no essential difference between socially transmitted and idiosyncratic developed superstitions regarding their influence on task performance. In other words, regardless of whether the experimental manipulation included a typically socially transmitted superstition such as “keeping one’s fingers crossed” or an idiosyncratic superstition such as a “lucky charm,” the results were the same. For both types, the findings demonstrate performance enhancement if the activated superstition prior to the performance task was associated with the concept of good luck than if the activated superstition related to the concept of bad luck.

Another way of categorizing the various forms of superstitions, which has been suggested by several authors, refers to the purpose for which they are executed. More specifically, these authors claim that there is a clear distinction between those superstitions that are performed to bring good luck and those superstitions that serve the purpose of warding off bad luck (Albas & Albas, 1989; Wiseman & Watt, 2004). However, the simple attempt to think of clear examples for each kind of superstitions raises doubts as to whether this distinction is always as clear as suggested. Surely, for some examples, like the well-known behavior of knocking on wood, it seems rather easy to categorize the behavior as belonging to the group of bad luck-avoiding superstitions. However, given a lucky charm, for example, one might wonder whether this very common superstition should be allotted to the good luck-bringing or the bad luck-avoiding kind of superstitions. In fact, it seems possible that its purpose differs between individuals. Similarly, it might even be possible that the meaning of such a particular superstition changes over time. A lucky charm that was believed to bring an extra bit of good luck in the beginning of an athletic career, for example, might later be worn to competitions in order to prevent failures or injuries. Essentially, the borders between these two forms seem to be blurred, as on a more general level, both kinds of superstitions are directed toward a successful outcome – a “happy ending.” Nevertheless, or rather because of these intertwined meanings, it might be interesting for future research to more explicitly examine the consequences of bad luck-avoiding superstitions on subsequent performance. In the light of the results reported here, one might predict that these kinds of superstitions should not affect performance, as they are semantically associated with the concept of bad luck. In this regard, their functioning might be similar to those superstitious thoughts and behaviors that literally call for bad luck such as an unlucky golf-ball, a black cat, a broken mirror, or Friday the 13<sup>th</sup>. On the other hand, it might be just as plausible to

assume that bad luck avoiding superstitions enhance performance outcomes in a similar way as good luck associated superstitions because of their tendency to focus on successful outcomes. Further research may be conducted to address this question.

### *Necessity of believing*

To examine the consequences of superstitions on the perception of self-efficacy and task performance, the present line of research used a novel methodological approach. Instead of having participants experience a lucky or unlucky event prior to a task (Darke & Freedman, 1997b), creating an illusion of control (Matute, 1994; Rudski, 2001), or measuring participants' existing beliefs in superstitions (Dudley, 1999), the present research implemented a superstition by semantically activating the concept. On the one hand, this approach yields several advantages over the previously used methods. Rather than measuring the extent of superstitious beliefs and dividing participants in low- and high-believers, for example, the present method allows for randomized experimental conditions. A second advantage compared to the manipulation of Darke and Freedman (1997b) who had participants experience a lucky or unlucky event is that in the studies reported here, participants of different conditions did not actually have different experiences prior to the performance task. Hence, it seems more likely that the reported effects on self-efficacy and task performance can actually be traced back to the manipulation of the superstition itself rather than due to the emotions evoked by the experience, like happiness or disappointment. Finally, one of the most important advantages of the present method is its multisided applicability. Instead of creating only one specific and very restricted belief, as occurred in various reinforcement studies (Catania & Cutts, 1963; Matute, 1994; Ono, 1987; Rudski, 2001), the present approach enables the examination of numerous superstitions and their potential influences. Moreover, for the studies reported here it is particularly true that the different activated superstitions (keeping fingers crossed, lucky charm, concept of good luck) are identical to those superstitions that are exhibited most often in the examined population. Thus, the research moves much closer to the phenomenon of superstitious thoughts and behaviors that are common in real life compared to research examining rather artificial induced illusory beliefs (Matute, 1994; Rudski, 2001).

On the other hand, the method of activating superstitions might bear some risks or leave some questions open, as well. For example, it seems difficult to draw a final conclusion from the present results concerning the question whether it is necessary for a superstition to affect task performance to actually believe in this superstition or whether it is sufficient to know this particular superstition and its supposed meaning. As has been described before, it is true

for the present studies that only the most prevalent superstitions were used for experimental manipulation. Given the results of Study 1, I might assume that the majority of participants in the following experiments actually believed in these variants of superstition at least on a moderate level. Nevertheless, the present results do not allow me to discriminate between those participants who believe in the activated superstitions and those who merely know these concepts or are aware of their semantic association to good luck and thus, to successful outcomes. Hence, two alternatives seem possible: Either only those participants who believe drive the reported effect of superstition on task performance, or, all participants produce the reported findings because mere knowledge and its semantic associations are sufficient for the influence. In light of the findings in Study 5 indicating that the superstitious concept of good luck exerts an influence on self-efficacy and thus leads to performance enhancement even if the concept was presented outside of participants' conscious awareness, the latter alternative appears particularly plausible. Specifically, due to the method of subliminal priming, it seems questionable as to whether in this study participants actually experience a sense of believing, or whether the effect was due to the pure semantic activation of the superstitious concepts of good versus bad luck.

From this perspective, the present findings appear to fit with several theoretical approaches to explaining priming effects on behavior (see Dijksterhuis & Bargh, 2001; Wheeler & Petty, 2001, for reviews). According to Bargh's (1990) auto-motive model of motivation, for example, the reported effect of superstition on performance enhancement might entail the nonconscious activation of a performance goal, which in turn might account for the reported influence on perceived self-efficacy beliefs (Schunk & Miller, 2002; Schunk & Rice, 1991; Zimmerman & Kitsantas, 1996). Another framework that explains priming effects on stereotypes (Bargh, Chen, & Burrows, 1996, Dijksterhuis & van Knippenberg, 1998), traits (Bargh et al., 1996; Kawakami, Young, & Dovidio, 2002), or habits (Aarts & Dijksterhuis, 2000) on behavior is the Active-Self account (Wheeler, DeMarree, & Petty, 2007). The most central proposition of this account concerns the involvement of the self in prime-to-behavior effects. More specifically, the Active-Self account holds that "primed constructs can affect behavior by temporarily altering the active (current accessible) self-concept" (Wheeler, et al., 2007, p. 236). Applying this view to the present research, the activated superstitions, which might represent a priming of the concept of good luck and its contents, may create changes in the active self-concept and might thus influence the level of perceived self-efficacy beliefs.

In the present set of studies, I did not seek to test which of the theoretical frameworks would fit best to explain the observed effect of activated good luck superstitions on

subsequent performance enhancement. Future research, however, should focus on this issue and examine more closely whether unconscious goal activation or temporary changes in the self-concept account best for the demonstrated influences. However, it might first be necessary to answer the question of whether the observed effect is based on the actual experience of believing in an activated superstition or whether the findings represent a mere semantic priming effect.

## Applied implications

Due to its nature, research on superstition necessarily seems to call for applied implications. Although, one should always keep in mind that superstitions are no panacea, the applications of superstitions nevertheless seem plausible for several areas. In the athletic as well as the educational field, for example, it seems crucial to promote achievement outcomes as much as possible. Many studies suggest new ways to adjust or improve training methods (Raab, Masters, & Maxwell, 2005), learning materials (Otto & McDonald, 1951; Schank & Cleary, 1995), teaching styles (Bowers, 1961; Schwartz, Merton, & Bursik, 1987), and alike in order to approach this goal. The present thesis provides an interesting perspective by introducing an additional factor that may facilitate performance. Specifically, the current data suggests that both motor and cognitive performance can be enhanced by implementing a good luck superstition prior to the task. Why should this knowledge not be used? As a matter of fact, looking at the ubiquity of superstitious beliefs and behaviors it seems that the beneficial functioning of superstitions has already been discovered. However, until today, those who hold superstitious beliefs or perform superstitious actions are often patronized. A professional athlete who admits to wear a certain piece of lucky clothing, for example, can count on humorous media reports mocking this behavior. The present findings might thus help to increase people's understanding of these behaviors and their effective beneficial functions. Moreover, in addition to simply increasing the acceptance of superstitions, we might also wish to systematically embed superstitions in everyone's life. This notion seems to be especially likely in the educational context of children. No matter whether they engage in achievement tasks in school, in sport, or other areas such as art, music, or dance, for example, the present results suggest that children might profit of an implemented superstition. From this perspective, it might be plausible to literally teach children the use of good luck-related thoughts or behaviors. That is, instead of waiting until a superstition arises accidentally it might be helpful to actively develop a particular good luck-related thought. Similar to the golf-putting studies, for example, the concept of good luck could repeatedly be combined with a specific toy or another object until a personal lucky

charm is created. This learned superstitious thought or action could be routinely implemented prior to a demanding or important performance task.

This is not to say that children should create an understanding of the world that is built on superstitions, or that the activated superstition will always lead to best performance outcomes. The present results do not indicate, for example, that the influence of superstition on performance could somehow exceed the influence of knowledge, skill, and ability. Nevertheless, an activated good luck superstition might facilitate performance within the given limits of existing abilities. More specifically, an activated superstition might first increase self-efficacy, through which the individual might feel a stronger sense of confidence and security in the face of an achievement task. In this regard, a lucky pen at a written test, a lucky charm at a swimming meet, or a good luck saying before a play might represent helpful techniques to overcome feelings of anxiety and insecurity, and to boost assurance in one's own capabilities. As the results suggest, this strengthened feelings of perceived efficacy will in turn enable the individuals to perform at a higher level than would have been possible if anxiety or low confidence had haunted their performance.

As outlined above, many people already seem to have embraced the strategy of activating their own personal superstition prior to an achievement task in order to bring about the best possible results. Especially students and athletes seem to adopt this promising approach. However, even within these populations one can find differences in the popularity of superstitions. Thus, previous research has demonstrated a positive correlation between the number of exhibited superstitions and the level of athletic ability (Buhrmann & Zaugg, 1981). Despite the knowledge that correlations are difficult to interpret, many have taken this to mean that better athletes within a team or superior teams subsequently exhibit more superstitious behavior than poorly performing athletes within a team or inferior teams. However, in light of the present results, the opposite interpretation seems just as likely. Thus, this positive correlation might actually indicate that those who engage in superstitions perform better within their team rather than those who do not engage in superstitious thoughts or behaviors. Indeed, next to the present findings, the best proof for this notion might very well be Michael Jordan's blue North Carolina shorts.

# CONCLUSION

The present thesis attempted to examine the effect of activated, commonly-known superstitions on subsequent performance in both motor and cognitive tasks. Specifically, I predicted that an implemented superstition related to the concept of good luck would exert a causal influence on subsequent performance enhancement. This proposal was drawn from previous findings indicating a consistently high prevalence and maintenance of superstitions, particularly among students and athletes, who engage in performance tasks more often than any other population. A specific beneficial effect of superstitions could thus explain its high persistence.

In addition to the behavioral consequences of superstitions, the present thesis also attempted to examine the underlying process of the assumed superstition-performance link. Building on findings concerning performance influences in general as well as previous research on psychological benefits of superstitions, I focused on the concept of perceived self-efficacy as mediating factor. Specifically, I predicted that an implemented good luck related superstition prior to a performance task would increase people's perceived level of self-efficacy toward this task, which in turn should lead to higher task performance compared to an implemented bad luck superstition or no superstition at all.

In light of the present data, superstitions that are held or performed in order to gain good luck appear to be as prevalent in the present population as reported elsewhere. Moreover, these good luck-related superstitions indeed seem to exert an influence by fostering superior performance outcomes. This is not to say that superstitions are the only or the most powerful predictor of performance, but they clearly contribute to achievement outcomes and should thus be accounted for in general models of performance influences.

The data reported here do not only confirm the assumption of the superstition-performance link, but also yield evidence for the notion of self-efficacy as the mediating construct. In this regard, the present findings are clearly in line with previous literature on theoretical models, such as Bandura's (1986) Social-Cognitive Theory, or diverse research areas such as performance influences or correlates of superstition.

Because of the small number of existing experimental studies on superstition and its effects, it is not surprising that many questions still remain unsolved. The present findings, for example, do not indicate whether the increase in self-efficacy that follows superstition activation leads to performance enhancements via more effort, higher persistence, higher

self-set goals, or other mechanisms. In addition to this question, further research might also explore differences between various forms of superstitions, such as idiosyncratic developed versus socially-shared superstitions. Moreover, it might be interesting to investigate whether the pure activation of a known superstition is sufficient for its effect on performance, or whether one actually has to believe in the superstition. In this regard, the presented thesis appears to be a promising starting point for future research on this interesting phenomenon.



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# APPENDIX

Study 1	
<i>Explorative Questionnaire on Superstition</i> .....	A1
<i>Tables</i> .....	A4
Study 2	
<i>Consent Form</i> .....	B10
<i>Final Questionnaire</i> .....	B11
Study 3	
<i>Consent Form</i> .....	C12
<i>Demographic Questionnaire</i> .....	C13
Study 4	
<i>Dexterity Game</i> .....	D14
<i>Final Questionnaire</i> .....	D15
Study 5	
<i>Consent Form</i> .....	E16
<i>Instructions</i> .....	E17
<i>Material Subliminal Priming</i> .....	E19
<i>Mediator Questionnaire</i> .....	E20
<i>Tetris Game</i> .....	E21
<i>Final Questionnaire</i> .....	E22
Study 6	
<i>Questionnaire on Lucky Charm</i> .....	F24
<i>Tables</i> .....	F26
<i>Consent Form</i> .....	F28
<i>Instructions</i> .....	F29
<i>Self-efficacy Judgments</i> .....	F30
<i>Memory Game</i> .....	F31
<i>Final Questionnaire</i> .....	F32

# Study 1

## *Explorative Questionnaire on Superstition*

### **UNIVERSITÄT ZU KÖLN**

Institut für Psychologie/ Lehrstuhl für Sozialpsychologie

Dipl. Psych. Lysann Damisch

Lieber Versuchsteilnehmer!

Vielen Dank, dass Sie an unserem Versuch teilnehmen!

In unserer Forschung wollen wir uns in Zukunft näher mit dem Thema Aberglaube beschäftigen.

In dieser Befragung wollen wir einen ersten Eindruck darüber gewinnen, inwieweit Aberglaube allgemein verbreitet ist, in welchen Situationen er besonders häufig gezeigt wird und welche Formen des Aberglaubens Ihnen generell bekannt sind.

Die bisherige Forschung macht deutlich, dass Aberglaube vor allem im sportlichen Bereich weit verbreitet und besonders häufig zu beobachten ist.

So zeigte sich zum Beispiel bei der WM 2006, dass Fußballer den Rasen lieber zuerst mit dem rechten als mit dem linken Fuß betreten, ihn vor dem Spiel mit der Hand berühren wollen und ihre Haare nach einem Sieg wochenlang nicht schneiden, da dies einen negativen Einfluss auf die kommenden Spiele mit sich bringen könnte.

Englands früherer Stürmer Gary Lineker: "Beim Warmmachen habe ich niemals aufs Tor geschossen, denn ich wollte keinen Treffer vergeuden. Ich wollte mir die Tore fürs Spiel aufsparen. In der Halbzeitpause habe ich immer mein Trikot gewechselt, wenn ich kein Tor erzielt hatte. War ich dagegen erfolgreich, behielt ich das Trikot an. Wenn ich mal längere Zeit nicht erfolgreich war, bin ich auch immer zum Friseur gegangen." (Spiegel Online, 06.09.2006)

Der Glaube an Glück bringende Kleidungsstücke scheint weit verbreitet. Am ersten Spieltag der Saison 1987/1988 spielte der 1. FC Köln 1:1 in Karlsruhe. Manager Lattek trug trotz der Sommerhitze einen blauen Strickpulli. Nach dem Abpfiff fragte ihn ein Reporter: "Udo, ist das jetzt dein neuer Glücksbringer?" Lattek antwortete: "Na, klar, und den ziehe ich erst wieder aus, wenn der FC mal ein Spiel verliert." (Spiegel Online, 07.09.2006)

Um einen ersten Eindruck zu gewinnen, inwieweit Aberglaube auch außerhalb des Sports verbreitet ist, werden Sie im Folgenden gebeten, einige Fragen zu Ihrer Person zu beantworten.

Alle gesammelten Daten werden anonym behandelt.

Im Voraus vielen Dank für Ihre Mithilfe!



6) Bitte listen Sie die von Ihnen unter Frage 2 genannten abergläubischen Verhaltensweisen noch einmal auf und versuchen Sie nachzuvollziehen, wie diese bei Ihnen entstanden sind (z.B. „habe meinen Glücksbringer vor einer wichtiger Prüfung geschenkt bekommen und diese sehr gut bestanden, seitdem nehme ich ihn zu jeder Prüfungen mit“).

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7) Was glauben Sie, hilft es Ihnen, wenn Ihnen in einem wichtigen Moment die Daumen gedrückt werden?

1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 --- 8 --- 9  
nein, ja,  
gar nicht sehr

8) Was glauben Sie, hilft es Ihnen, wenn Sie in einer wichtigen Situation Ihren Glücksbringer dabei haben?

1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 --- 8 --- 9  
nein, ja,  
gar nicht sehr

9) Was glauben Sie, hilft es Ihnen, wenn Sie vor einer wichtigen Aufgabe ein Glücksschweinchen geschenkt bekommen?

1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 --- 8 --- 9  
nein, ja,  
gar nicht sehr

10) Was glauben Sie, bringt es Ihnen Pech, wenn eine Prüfung auf Freitag den 13. fällt?

1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 --- 8 --- 9  
nein, ja,  
gar nicht sehr

11) Was glauben Sie, würden Sie einem Schornsteinfeger gerne die Hand geben, wenn Sie ihn sehen?

1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 --- 8 --- 9  
nein, ja,  
gar nicht sehr

12) Was glauben Sie, stimmt es, was in Ihrem Horoskop steht?

1 --- 2 --- 3 --- 4 --- 5 --- 6 --- 7 --- 8 --- 9  
nein, ja,  
gar nicht sehr

## Tables

*Table 1:* Means, standard deviations, and frequencies for judgments “To what extent would you describe yourself as superstitious?” and “What do you think, how much influence have these superstitions in specific situations?”

	Descriptives			Frequencies on 9-point scale		
	N	Mean	SD	N (%) „not at all/somewhat“ (1-3)	N (%) „moderate“ (4-6)	N (%) „fairly/ ” very much“ (7-9)
superstitious	173	3.77	1.76	91 (52.6)	70 (40.5)	12 (6.9)
effective	172	4.02	2.11	73 (42.4)	78 (45.3)	21 (12.2)

Note, N depicts the number of valid responses out of a total of 173 participants.

*Table 2:* Frequencies of entries regarding specific superstitions in open response format ordered by number of reports

	N	(%)
None (missings in first response)	16	(9)
Wearing a lucky charm	93	(54)
Knocking on wood	49	(28)
Wearing lucky clothes	15	(9)
Friday, 13 <sup>th</sup> is unlucky day	15	(9)
Performing a ritual/getting dressed in ritual order	13	(8)
Believing in horoscope/zodiac sign	12	(7)
Black cat crossing street brings bad luck	11	(6)
Avoid walking under ladders	10	(6)
Having a lucky number	8	(5)
Keeping fingers crossed	7	(4)
Wish on a shooting star comes true	5	(3)
Using lucky pen	5	(3)
Lighting a candle to prevent bad luck from happening	5	(3)
Touching a chimney sweeper brings good luck	4	(2)
Breaking a mirror brings bad luck	4	(2)
Broken glass brings good luck	4	(2)
Bad things will happen when said out loud	4	(2)
Others	55	(32)

Note, multiple responses of up to six entries were allowed. Values in parentheses represent the number of reports as percentages of all participants (N = 173).



*Table 3:* Frequencies of entries regarding specific situations in which superstitions are exhibited ordered by number of responses

	N (%)
None (missings in first response)	23 (13)
Verbal exams/written tests	101 (58)
Daily life	33 (19)
Severe and important situations	28 (16)
Athletic competitions/public performances	26 (15)
When hoping that things turn out well	14 (8)
Traveling/in the car	12 (7)
Maintain good fortune after saying things out loud	12 (7)
Avoiding misfortunes	10 (6)
Health issues	10 (6)
When experiencing fear or worries	9 (5)
Others	7 (4)

Note, multiple responses of up to four entries were allowed. Values in parentheses represent the number of reports as percentages of all participants (N = 173).

*Table 4a:* Means, standard deviations, and frequencies for judgments on specific superstitious behaviors (see Appendix A1) ordered by the number of people who rated them at least moderately effective

	Descriptives			Frequencies on 9-point scale		
	N	Mean	SD	N (%) „not at all/somewhat“ (1-3)	N (%) „moderate“ (4-6)	N (%) „fairly/ ”very much“ (7-9)
Good/bad luck	168	6.15	2.14	25 (14.9)	61 (36.3)	82 (48.8)
Fingers crossed	171	4.60	2.46	63 (36.8)	62 (36.3)	46 (26.9)
Lucky charm	171	4.68	2.49	65 (38.0)	56 (32.7)	46 (26.9)
“Lucky piglet”	171	4.16	2.35	75 (43.9)	59 (34.5)	37 (29.2)
Four-leaf clover	170	3.49	2.49	95 (55.9)	48 (28.2)	27 (15.9)
Chimney sweeper	170	3.32	2.67	107 (62.9)	33 (19.4)	30 (17.6)
Belief in horoscope	170	3.04	2.23	110 (64.7)	43 (25.3)	17 (10.0)
Knocking on wood	170	2.59	2.36	131 (77.1)	21 (12.4)	18 (10.6)
Breaking mirror	170	2.30	2.08	137 (80.6)	22 (12.9)	11 (6.5)
Black cat on street	169	1.96	1.88	142 (84.0)	20 (11.8)	7 (4.1)
Friday, thirteenth	171	1.87	1.56	148 (86.5)	19 (11.1)	4 (2.3)

Note, N depicts the number of valid responses out of a total of 173 participants.

*Table 4b:* Frequencies for reports regarding the existence of “lucky numbers” and “lucky days”

	N	Existence of lucky number/lucky day	
		N (%) affirmation	N (%) denial
Lucky number	170	71 (41.8)	99 (58.2)
Lucky day	168	21 (12.5)	147 (87.5)

Note, N depicts the number of valid responses out of a total of 173 participants.

*Table 5a:* Frequencies of entries regarding supposed mechanisms of superstitious effectiveness ordered by number of responses

	N (%)
None (missings in first response)	35 (20)
Gives positive feelings of security and foothold	57 (33)
Approaching the situation differently/more positive	32 (18)
Calms down, reassures	28 (16)
Encourages, elicits feelings of assurance	20 (12)
Strengthens belief in oneself, enhances confidence	20 (12)
Others	26 (15)

Note, multiple responses of up to three entries were allowed. Values in parentheses represent the number of reports as percentages of all participants (N = 173).

*Table 5b:* Frequencies of entries regarding supposed consequences for hindered superstitious practice ordered by number of responses

	N (%)
missings in first response	35 (20)
No consequences	61 (35)
Rising feelings of uncertainty, nervousness, uneasiness, fear, and panic	68 (39)
General negative feelings	9 (5)
Others	53 (31)

Note, multiple responses of up to three entries were allowed. Values in parentheses represent the number of reports as percentages of all participants (N = 173).

# Study 2

## Consent Form

**UNIVERSITÄT ZU KÖLN**  
Erziehungswissenschaftliche Fakultät  
Institut für Psychologie



Institut für Psychologie • Gronewaldstr.2 • 50931 Köln

Dipl.-Psych. Lysann Damisch  
Institut für Psychologie  
Gronewaldstraße 2  
50931 Köln

Telefon: 0221 470-7915  
Telefax: 0221 470-5105  
Email: lysann.damisch@uni-koeln.de

### Zustimmung zur Teilnahme

Dipl.-Psych. Lysann Damisch, Institut für Psychologie, bietet Ihnen die freiwillige Teilnahme an einer Untersuchung. Hierbei werden Sie gebeten, ihre bestmögliche Leistung in einer feinmotorischen Koordinationsaufgabe zu erzielen. Im Anschluss bitten wir Sie noch um einige wenige schriftliche Informationen. Insgesamt wird die Studie ca. 5-7 Minuten dauern.

Die Teilnahme an der Studie führt zu keinen bekannten Risiken und alle gesammelten Daten werden anonym und nur für Forschungszwecke behandelt. Wenn Sie trotzdem eine Frage nicht beantworten wollen oder können, lassen Sie diese aus. Wenn Sie im Verlauf der Studie Fragen haben, wenden Sie sich bitte an den/die Versuchsleiter/in.

Sie können zu jeder Zeit, ohne Angabe von Gründen, die Bearbeitung der Aufgaben abbrechen, ohne dass Ihnen daraus Nachteile entstehen. Auf jeden Fall erhalten Sie die Ihre Entlohnung. Sie können nachträglich Ihre Einwilligung zur Datenanalyse widerrufen. Wenden Sie sich dafür bitte an Dipl.-Psych. Lysann Damisch, 0221 - 470 7915.

Nach Ablauf der Studie erhalten Sie die Möglichkeit, detaillierte Informationen über die Studie zu bekommen. Nähere Informationen hierzu finden Sie auf einem Informationsblatt, welches Sie am Ende der Untersuchung erhalten. Bitte geben Sie diesen Bogen ausgefüllt an den/die Versuchsleiter/in ab, damit wir mit der Untersuchung beginnen können.

Ich stimme der Verwertung meiner hier gemachten Aussagen und Angaben als Datengrundlage für eine anonymisierte wissenschaftliche Auswertung und Publikation zu. Die Auswertung der Daten erfolgt auf Gruppenebene, d.h. es sind keine Rückschlüsse auf die Angaben einer konkreten Person möglich.

Ich stimme zu.

Datum \_\_\_\_\_ Unterschrift \_\_\_\_\_

## *Final Questionnaire*

Wir möchten Sie nun bitten, einige Fragen zu der soeben durchgeführten Aufgabe zu beantworten.

---

1) Was würden Sie sagen, wie gut haben Sie bei der soeben durchgeführten Aufgabe abgeschnitten?

1----2----3----4----5----6----7----8----9

gar nicht gut

sehr gut

---

2) Was würden Sie sagen, wie haben Sie sich während der Aufgabe gefühlt?

1----2----3----4----5----6----7----8----9

gar nicht gut

sehr gut

---

3) Was würden Sie sagen, wie nervös waren Sie während der Aufgabe?

1----2----3----4----5----6----7----8----9

gar nicht nervös

sehr nervös

---

4) Was würden Sie sagen, wie ruhig waren Sie während der Aufgabe?

1----2----3----4----5----6----7----8----9

gar nicht ruhig

sehr ruhig

---

Vielen Dank!

Wir möchten Sie nun noch bitten, einige Fragen zu Ihrer Person zu beantworten.

---

Bitte geben Sie Ihr Geschlecht an. (1 = männlich; 2 = weiblich)

---

Wie alt sind Sie? (in Jahren)

---

Welches Studienfach studieren Sie?

---

In welchem Semester studieren Sie?

---

Noch einmal Vielen Dank!

# Study 3

## Consent Form

**UNIVERSITÄT ZU KÖLN**  
Erziehungswissenschaftliche Fakultät  
Institut für Psychologie



Institut für Psychologie • Gronewaldstr.2 • 50931 Köln

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Telefon: 0221 470-7915  
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Email: lysann.damisch@uni-koeln.de

### Zustimmung zur Teilnahme

Dipl.-Psych. Lysann Damisch, Institut für Psychologie, bietet Ihnen die freiwillige Teilnahme an einer Untersuchung. Hierbei werden Sie gebeten, ihre bestmögliche Leistung in einer feinmotorischen Koordinationsaufgabe zu erzielen. Im Anschluss bitten wir Sie noch um einige wenige schriftliche Informationen. Insgesamt wird die Studie ca. 5-7 Minuten dauern.

Die Teilnahme an der Studie führt zu keinen bekannten Risiken und alle gesammelten Daten werden anonym und nur für Forschungszwecke behandelt. Wenn Sie trotzdem eine Frage nicht beantworten wollen oder können, lassen Sie diese aus. Wenn Sie im Verlauf der Studie Fragen haben, wenden Sie sich bitte an den/die Versuchsleiter/in.

Sie können zu jeder Zeit, ohne Angabe von Gründen, die Bearbeitung der Aufgaben abbrechen, ohne dass Ihnen daraus Nachteile entstehen. Auf jeden Fall erhalten Sie die Ihre Entlohnung. Sie können nachträglich Ihre Einwilligung zur Datenanalyse widerrufen. Wenden Sie sich dafür bitte an Dipl.-Psych. Lysann Damisch, 0221 - 470 7915.

Nach Ablauf der Studie erhalten Sie die Möglichkeit, detaillierte Informationen über die Studie zu bekommen. Nähere Informationen hierzu finden Sie auf einem Informationsblatt, welches Sie am Ende der Untersuchung erhalten. Bitte geben Sie diesen Bogen ausgefüllt an den/die Versuchsleiter/in ab, damit wir mit der Untersuchung beginnen können.

Ich stimme der Verwertung meiner hier gemachten Aussagen und Angaben als Datengrundlage für eine anonymisierte wissenschaftliche Auswertung und Publikation zu. Die Auswertung der Daten erfolgt auf Gruppenebene, d.h. es sind keine Rückschlüsse auf die Angaben einer konkreten Person möglich.

Ich stimme zu.

Datum \_\_\_\_\_ Unterschrift \_\_\_\_\_

## *Demographic Questionnaire*

Vielen Dank! Sie haben die motorische Aufgabe beendet.

Wir möchten Sie nun noch bitten, einige Fragen zu Ihrer Person zu beantworten.

---

Bitte geben Sie Ihr Geschlecht an. (1 = männlich; 2 = weiblich)

---

Wie alt sind Sie? (in Jahren)

---

Welches Studienfach studieren Sie?

---

In welchem Semester studieren Sie?

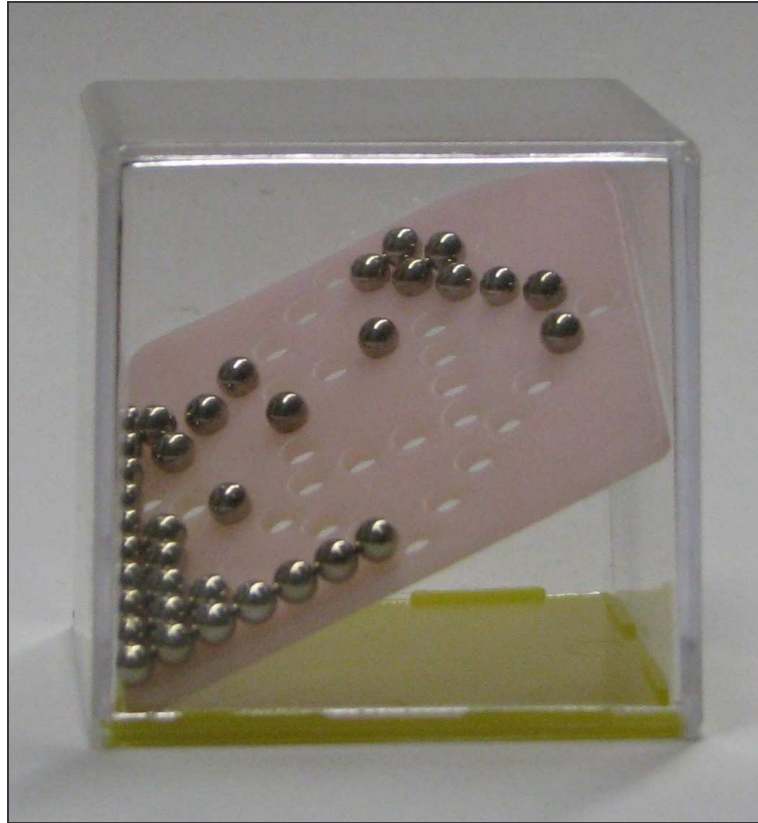
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Noch einmal Vielen Dank!



## Study 4

### *Dexterity Game*



## Final Questionnaire

**UNIVERSITÄT ZU KÖLN**  
Humanwissenschaftliche Fakultät  
Institut für Allgemeine Psychologie und  
Sozialpsychologie  
Dipl. Psych. Lysann Damisch



Vielen Dank, dass Sie uns durch Ihre Mithilfe unterstützen.

Wir möchten Sie bitten, einige Fragen zu der soeben durchgeführten Aufgabe zu beantworten.

1) Was würden Sie sagen, wie gut haben Sie bei der soeben durchgeführten Aufgabe abgeschnitten?

1----2----3----4----5----6----7----8----9

gar nicht gut

sehr gut

2) Was würden Sie sagen, wie haben Sie sich während der Aufgabe gefühlt?

1----2----3----4----5----6----7----8----9

gar nicht gut

sehr gut

3) Was würden Sie sagen, wie wichtig war es Ihnen, alle Kugeln möglichst schnell in die dafür vorhergesehenen Löcher zu bringen?

1----2----3----4----5----6----7----8----9

gar nicht wichtig

sehr wichtig

**Bitte machen Sie im Folgenden noch einige Angaben zu Ihrer Person.**

Alter: \_\_\_\_\_

Beruf bzw. Studienfach: \_\_\_\_\_

Ihre Muttersprache: \_\_\_\_\_

Vielen Dank!

# Study 5

## Consent Form

**UNIVERSITÄT ZU KÖLN**  
Erziehungswissenschaftliche Fakultät  
Institut für Psychologie



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Dipl.-Psych. Lysann Damisch  
Institut für Psychologie  
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50931 Köln

Telefon: 0221 470-7915  
Telefax: 0221 470-5105  
Email: lysann.damisch@uni-koeln.de

### Zustimmung zur Teilnahme

Dipl.-Psych. Lysann Damisch, Institut für Psychologie, bietet Ihnen die freiwillige Teilnahme an einer Untersuchung. Hierbei werden Sie gebeten, ihre bestmögliche Leistung in einer räumlichen Vorstellungsaufgabe (Tetris) zu erzielen, nachdem Sie zuvor eine Konzentrationsaufgabe absolviert haben. Im Anschluss bitten wir Sie noch um einige wenige schriftliche Informationen. Insgesamt wird die Studie ca. 10-15 Minuten dauern.

Die Teilnahme an der Studie führt zu keinen bekannten Risiken und alle gesammelten Daten werden anonym und nur für Forschungszwecke behandelt. Wenn Sie trotzdem eine Frage nicht beantworten wollen oder können, lassen Sie diese aus. Wenn Sie im Verlauf der Studie Fragen haben, wenden Sie sich bitte an die Versuchsleitung.

Sie können zu jeder Zeit, ohne Angabe von Gründen, die Bearbeitung der Aufgaben abbrechen, ohne dass Ihnen daraus Nachteile entstehen. Auf jeden Fall erhalten Sie Ihre Entlohnung. Sie können nachträglich Ihre Einwilligung zur Datenanalyse widerrufen. Um dies zu ermöglichen, bitten wir Sie am Ende der Untersuchung um die Angabe eines Codes, der uns erlaubt, Ihre Daten ohne Preisgabe Ihrer Anonymität nachträglich zu identifizieren und ggf. zu löschen. Wenden Sie sich dafür bitte an Diplom-Psychologin Lysann Damisch, 0221 - 470 7915.

Es besteht die Möglichkeit, detaillierte Informationen über die Studie zu erhalten, sobald die Datenerhebungen vollständig abgeschlossen sind. Dies ist voraussichtlich in 2 bis 3 Wochen der Fall. Nähere Informationen hierzu finden Sie auf einem Informationsblatt, welches Sie am Ende der Untersuchung erhalten.

Ich stimme der Verwertung meiner hier gemachten Aussagen und Angaben als Datengrundlage für eine anonymisierte wissenschaftliche Auswertung und Publikation zu. Die Auswertung der Daten erfolgt auf Gruppenebene, d.h. es sind keine Rückschlüsse auf die Angaben einer konkreten Person möglich.

Ich stimme zu.

Datum \_\_\_\_\_ Unterschrift \_\_\_\_\_

## *Instructions*

Vielen Dank für Ihre Teilnahme!

---

In der heutigen Untersuchung geht es um den Zusammenhang zwischen der Fähigkeit, sich an verschiedene mentale Aufgaben anpassen zu können und das erfolgreiche Abschneiden in allgemeinen Lebensaufgaben wie Studium oder Arbeit.

Unsere Annahme besteht darin, dass erfolgreiches schnelles Anpassen an verschiedene kognitive Anforderungen mit einer flexiblen Anpassungsfähigkeit in echten Lebenssituationen einhergeht. Menschen, die sich schnell an neue kognitive Aufgaben anpassen können, sollten deshalb auch im tatsächlichen Leben erfolgreicher sein als Personen, denen diese Anpassung nicht so gut gelingt.

Im Folgenden werden Sie gebeten, nacheinander zwei mentale Aufgaben mit verschiedenen kognitiven Anforderungen durchzuführen. Bei der ersten Aufgabe liegt der Schwerpunkt auf verbalen Fähigkeiten. Bei der zweiten Aufgabe wird hauptsächlich räumliches Vorstellungsvermögen verlangt.

Auf den nächsten Seiten werden Ihnen die Aufgaben zunächst erklärt.

---

Als erstes werden Sie eine so genannte "Wortentscheidungsaufgabe" durchführen.

Zu diesem Zweck werden wir Ihnen eine Reihe von Buchstabenfolgen darbieten, bei denen Sie entscheiden sollen, ob es sich um ein Wort der deutschen Sprache handelt oder nicht. So sollen Sie zum Beispiel entscheiden, ob "Hut" und "Bopel" tatsächlich existierende Wörter sind.

Ihre Antwort, ob eine präsentierte Buchstabenfolge ein Wort darstellt oder nicht, wird mit Hilfe der blauen und gelben Taste gegeben. Handelt es sich um ein WORT, so drücken Sie bitte die BLAUE Taste, handelt es sich um KEIN WORT, so drücken Sie bitte die GELBE Taste.

Versuchen Sie bei dieser Worterkennungsaufgabe so schnell aber auch so akkurat wie möglich zu antworten. Legen Sie dafür breits vor Beginn der Aufgabe Ihre Zeigefinger auf die blaue und gelbe Taste.

Vor der Präsentation jeder Buchstabenfolg über welche Sie entscheiden sollen, ob diese ein Wort oder kein Wort darstellt, wird in der Mitte des Bildschirms ein Fixationspunkt dargeboten (markiert durch "XXWX"). Die Buchstabenfolgen werden genau an dieser Stelle erscheinen. Achten Sie darauf, dass Sie während des gesamten Versuchs diesen Fixationspunkt fokussieren und Ihr Blick auf den "XXWX" ruht.

---

(3 Beispiel Durchgänge der Lexikalischen Entscheidungsaufgabe ohne Primes)

---

Es folgt nun die Erklärung für die zweite Aufgabe.

Genau genommen handelt es sich dabei um das Spiel Tetris, welches Sie sicher selbst kennen. Tetris ist ein Denk- und Reaktionsspiel, bei dem es hauptsächlich auf räumliches Vorstellungsvermögen ankommt.

Die Spielregeln sind folgende: Blöcke in verschiedenen Formen fallen nacheinander auf ein Spielfeld herunter. Sie müssen versuchen zu verhindern, dass diese Blöcke sich bis zum oberen Spielfeldrand auftürmen. Zu diesem Zweck können Sie die Blöcke während des Falls nach links (linke Pfeiltaste) und rechts (rechte Pfeiltaste) verschieben und auch drehen (Oben Pfeiltaste). Sind Sie sicher, einen Block korrekt positioniert zu haben, können Sie mittels der Unten Pfeiltaste das Fallen beschleunigen. Wenn es Ihnen gelingt, eine Zeile vollständig auszufüllen, verschwindet diese und Sie bekommen Punkte.

---

Zusätzlich wird sich in regelmäßigen Abständen die Schwierigkeit des Spiels erhöhen, indem sich die Geschwindigkeit mit der die Formen nach unten fallen erhöht.

Die Abfolge der herunter fallenden Formen ist zufällig und kann nicht von Ihnen beeinflusst werden.

Sobald die aufeinander getürmten Formen den oberen Spielfeldrand erreicht haben, ist das Spiel beendet.

Insgesamt werden Sie nur einen Versuch zur Verfügung haben. Versuchen Sie dabei, so lange wie möglich zu spielen und so viele Punkte wie möglich zu erzielen.

Auch für diese Aufgabe folgt zunächst ein kurzes Übungsbeispiel, bei dem Sie sich an den Umgang mit den Pfeiltasten gewöhnen können. Das Übungsspiel beginnt durch Drücken der Leertaste und wird nach 30 Sekunden abgebrochen.

---

(30 Sekunden Beispiel Tetris-Spiel)

---

Die Übungsphase ist nun beendet.

Es geht nun weiter mit der ersten Aufgabe zur Worterkennung.

---

Subliminale Priming Phase mit 72 Durchgängen (siehe Subliminales Priming Material)

## *Material Subliminal Priming*

Primes:

Glück versus Pech

Letter strings practice trials:

Kaktus

wenden

Pritzel

Letter strings critical trials:

laufen

Hamster

krump

Jacke

singen

Horn

Mulp

Kugel

Leiter

grompem

Haus

läutern

Tong

Rüssel

fallen

Teppich

Bealk

Postkarte

zeigen

Zebra

fahren

schonzem

Tisch

Kalender

schreiben

Handtuch

julk

Menge

kaufen

Bank

Telmo

Wiese

Nagel

storfen

Kreis

niesen

Felk

Flosse

kriechen

Decke

Munkel

Trompete

suchen

Schwan

klettern

litterm

Tuch

Gardine

tragen

Nashorn

frilk

Weste

mixen

Hand

Bimst

Lager

Zaun

krafftel

Magnet

lehren

Punt

Stachel

lösen

Belag

Wistral

Magazin

nennen

Käfer

bestellen

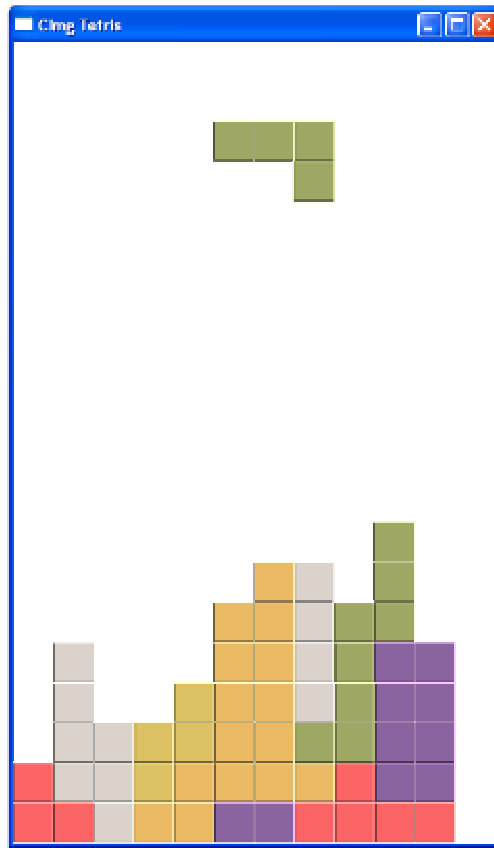
tinselm

Besteck

Umschlag



# Tetris Game







Ist Ihnen aufgefallen, dass die Darbietung der Fixationspunkte kurz unterbrochen wurde?

(1 = ja; 2 = nein)

(Falls ja): Haben Sie irgendeine Idee, warum die Darbietung der Fixationspunkte immer wieder kurz unterbrochen wurde?

---

Tatsächlich ist es so, dass Ihnen in der kurzen Unterbrechung der Fixationspunkte für eine sehr kurze Zeit ein Wort präsentiert wurde.

Waren Sie in der Lage, dieses Wort zu erkennen? (1 = ja; 2 = nein)

(Falls ja): Bitte schreiben Sie das Wort auf, welches Sie erkannt haben.

---

Noch einmal Vielen Dank!

# Study 6

## Questionnaire on Lucky Charm

UNIVERSITÄT ZU KÖLN

INSTITUT FÜR ALLGEMEINE PSYCHOLOGIE UND SOZIALPSYCHOLOGIE

GRONEWALDSTR. 2A

DIPL.-PSYCH. LYSANN DAMISCH

Liebe/r Versuchsteilnehmer/in,

vielen Dank, dass Sie sich bereit erklärt haben an dieser Voruntersuchung teilzunehmen und dazu Ihren Glücksbringer mitgebracht haben.

Wir interessieren uns in unserer Forschung dafür, was es im Allgemeinen für Glücksbringer gibt und welche Glücksbringer besonders hier in Deutschland besonders stark verbreitet sind.

Ziel dieser Voruntersuchung soll sein, einen allgemeinen Überblick darüber zu gewinnen, was für Glücksbringer es gibt, in welchen Situationen diese zum Einsatz kommen und wie Ihr Glücksbringer ein Symbol der Unterstützung geworden ist.

Wir möchten Ihnen nun im Folgenden einige Fragen zu dem von Ihnen mitgebrachten Glücksbringer stellen.

-----

1) Was für einen Glücksbringer haben Sie zu dieser Untersuchung mitgebracht?

---

---

2) Bitte beschreiben Sie das Aussehen Ihres Glücksbringers.

---

---

---

3) Wie lange haben Sie Ihren Glücksbringer bereits?

---

---



## Tables

*Table 6a:* Frequencies of entries regarding the object (categorized) that was brought to the experiment as lucky charm ordered by number of responses (N = 41)

	N	(%)
Jewelry (necklace, ring, bracelet)	19	(46)
Stuffed animal	8	(20)
Animal or figure of different texture than fabric (wood, plastic, pottery)	6	(15)
Stone	3	(7)
others	5	(12)

*Table 6b:* Frequencies of entries regarding the question whether the lucky charm had been taken to an important situation before and if so where it had been taken ordered by number of responses

	N	(%)
Not taken	3	(7)
Exams	27	(66)
Journeys/travels	13	(32)
All important/difficult situations	12	(29)
Job interview	3	(7)
others	3	(7)

Note, multiple responses of up to two entries were allowed. Total amount of entered situations was N = 58. Values in parentheses represent the number of reports as percentages of all participants (N = 41).

*Table 6c:* Frequencies of entries regarding the question where the lucky charm usually is located when brought to an important situation ordered by number of responses

	N	(%)
Around neck	14	(37)
Backback/bag	10	(26)
pocket	6	(16)
Table	5	(13)
Pen and pencil case	2	(5)
“Mainly close by”	1	(3)

Note, the total amount of entries is N = 38 as three out of 41 participants had indicated not to take their lucky charms to those instances. Values in parentheses represent the number of reports as percentages of N = 38 participants.

*Table 6d:* Mean and standard deviations for specific judgments on the personal lucky charm

	Mean	SD
For how long have you been in the possession of your lucky charm? (in month)	59.7	70.2
How important is your lucky charm to you? (1 = “not important at all”; 9 = very important”)	6.78	1.57
How likely is it that you will take your lucky charm to the next exam or another important situation? (1 = “not likely at all”; 9 = “very likely”)	7.37	1.98

## *Consent Form*

UNIVERSITÄT ZU KÖLN  
Erziehungswissenschaftliche Fakultät  
Institut für Psychologie

Dipl.-Psych. Lysann Damisch  
Institut für Psychologie  
Gronewaldstraße 2  
50931 Köln

Telefon: 0221 470-7915  
Telefax: 0221 470-5105  
Email: lysann.damisch@uni-koeln.de

### **Zustimmung zur Teilnahme**

Barbara Stoberock, Mitarbeiterin des Instituts für Psychologie, bietet Ihnen die freiwillige Teilnahme an einer Untersuchung. Hierbei werden Sie gebeten, ihre bestmögliche Leistung in einer Merkfähigkeitsaufgabe (Memory) zu erzielen, nachdem Sie zuvor einige Fragen beantwortet haben. Im Anschluss bitten wir Sie noch um einige wenige schriftliche Informationen. Insgesamt wird die Studie ca. 20 Minuten dauern.

Die Teilnahme an der Studie führt zu keinen bekannten Risiken und alle gesammelten Daten werden anonym und nur für Forschungszwecke behandelt. Wenn Sie trotzdem eine Frage nicht beantworten wollen oder können, lassen Sie diese aus. Wenn Sie im Verlauf der Studie Fragen haben, wenden Sie sich bitte an die Versuchsleitung.

Sie können zu jeder Zeit, ohne Angabe von Gründen, die Bearbeitung der Aufgaben abbrechen, ohne dass Ihnen daraus Nachteile entstehen. Auf jeden Fall erhalten Sie Ihre Entlohnung. Sie können nachträglich Ihre Einwilligung zur Datenanalyse widerrufen. Um dies zu ermöglichen, bitten wir Sie am Ende der Untersuchung um die Angabe eines Codes, der uns erlaubt, Ihre Daten ohne Preisgabe Ihrer Anonymität nachträglich zu identifizieren und ggf. zu löschen. Wenden Sie sich dafür bitte an Barbara Stoberock, 0221 - 470 7915.

Es besteht die Möglichkeit, detaillierte Informationen über die Studie zu erhalten, sobald die Datenerhebungen vollständig abgeschlossen sind. Dies ist voraussichtlich in 2 bis 3 Wochen der Fall. Nähere Informationen hierzu finden Sie auf einem Informationsblatt, welches Sie am Ende der Untersuchung erhalten.

Ich stimme der Verwertung meiner hier gemachten Aussagen und Angaben als Datengrundlage für eine anonymisierte wissenschaftliche Auswertung und Publikation zu. Die Auswertung der Daten erfolgt auf Gruppenebene, d.h. es sind keine Rückschlüsse auf die Angaben einer konkreten Person möglich.

Nein, ich stimme nicht zu.

Ja, ich stimme zu.

## *Instructions*

Willkommen!

Vielen Dank, dass Sie sich bereit erklärt haben an dieser Studie teilzunehmen.

Bitte lesen Sie sich die folgenden Instruktionen sorgfältig durch.

Wir möchten Sie in dieser Untersuchung darum bitten, unsere Forschung bei der Entwicklung eines neuen kultur- und sprachunabhängigen Tests zur Messung des Zusammenhangs zwischen Arbeitsstilen, kognitiver Leistung und Intelligenz zu unterstützen.

Für diesen Test werden verschiedenen Versuchspersonen verschiedene Untertests vorgelegt.

Ein besonderes Augenmerk soll im hier vorgelegten Testabschnitt auf die Erfassung der Merkfähigkeit und Konzentration in alltäglichen Situationen gerichtet werden.

Empirische Studien haben gezeigt, dass hohe Werte im Testbereich Merkfähigkeit und Konzentration eine wichtige Voraussetzung für ein erfolgreiches Studium und beruflichen Erfolg darstellen.

Die für den Testbereich wichtigen Fähigkeiten werden im Folgenden durch eine Aufgabe geprüft, die dem bekannten Spiel Memory sehr ähnlich ist.

Die Instruktion für die Aufgabe befindet sich auf der nächsten Seite.

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Ihre Aufgabe besteht darin, unter umgedrehten Spielkarten alle Paare zu finden.

Ihre Leistung ist umso besser, je schneller Sie sind und je weniger Züge Sie benötigen.

Zu sehen ist ein Spielfeld mit 36 umgedrehten Karten, welche aus 18 Paaren bestehen ( $18 \times 2 = 36$ ).

Durch Mausklick auf eine Karte wird deren Bild sichtbar, zwei identische Bilder bilden jeweils ein Paar.

Pro Zug können Sie zwei Karten gleichzeitig ansehen, nach wenigen Sekunden decken diese sich jedoch von alleine wieder zu.

Bitte versuchen Sie, alle versteckten Paare möglichst schnell und mit möglichst wenigen Zügen zu finden.

Ihre Leistung wird in beiden Bereichen durch den Computer aufgezeichnet.





## Memory Game

Vielen Dank für die Beantwortung der Fragen zu Ihrer Person.

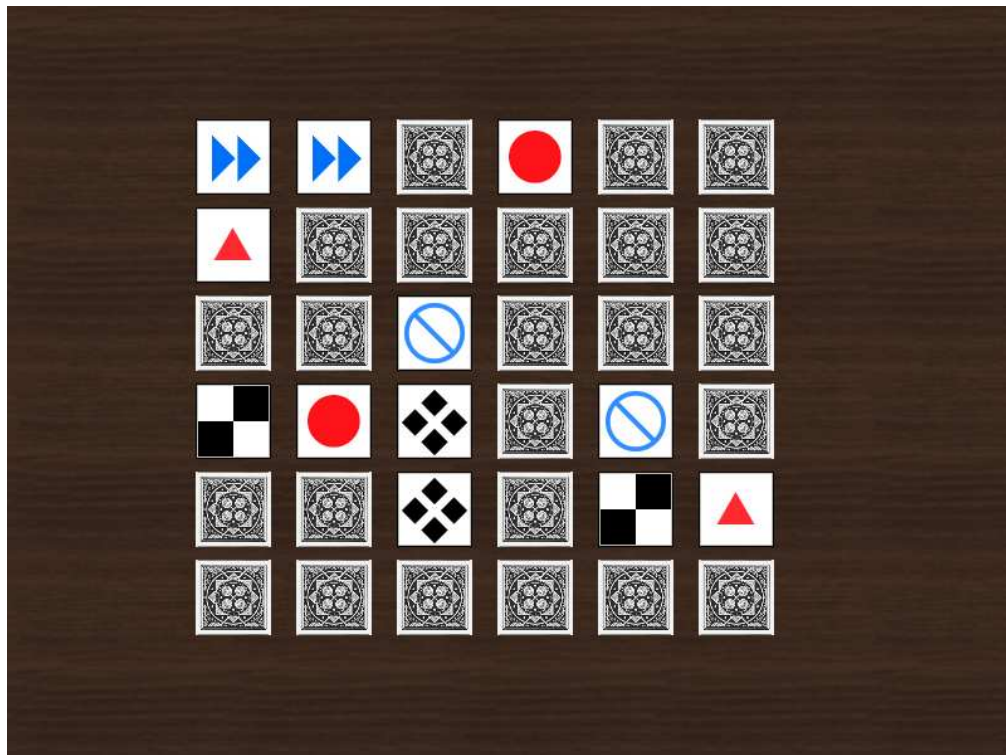
Es beginnt nun der Testabschnitt zur Erfassung der Merkfähigkeit und Konzentration.

Wie Sie bereits wissen, beginnt dieser mit einem dem Spiel Memory ähnlichen Test.

Bitte denken Sie daran:

Für eine gute Leistung ist es wichtig, die Aufgabe gleichzeitig in möglichst kurzer Zeit und mit möglichst wenigen Zügen zu bearbeiten!

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Wie Sie wissen haben wir aus Zeitgründen zwei verschiedene Untersuchungen zusammengelegt. Haben Sie sich hierdurch auf irgendeine Weise gestört oder beeinflusst gefühlt? (1 = ja; 2 = nein)

(Falls ja): Auf welche Art und Weise haben Sie sich durch die Zusammenlegung der Untersuchungen gestört oder beeinflusst gefühlt?

## EIDESSTATTLICHE ERKLÄRUNG

Ich versichere eidesstattlich, dass ich die von mir vorgelegte Dissertation selbständig und ohne unzulässige Hilfe angefertigt, die benutzten Quellen und Hilfsmittel vollständig angegeben und die Stellen der Arbeit einschließlich Tabellen und Abbildungen, die anderen Werken im Wortlaut oder dem Sinn nach entnommen sind, in jedem Einzelfall als Entlehnung kenntlich gemacht habe; dass diese Dissertation noch keinem anderen Fachbereich zur Prüfung vorgelegen hat; dass sie noch nicht veröffentlicht worden ist sowie dass ich eine solche Veröffentlichung vor Abschluss des Promotionsverfahrens nicht vornehmen werde. Die Promotionsordnung ist mir bekannt. Die von mir vorgelegte Dissertation ist von Prof. Dr. Thomas Mussweiler betreut worden.

Lysann Damisch

Köln, .....