Master Thesis

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IMPROVEMENT OF SOCCER PENALTY KICK PRECISION THROUGH MENTAL TRAINING

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1 Introduction

The penalty shoot-out can decide a soccer tournament. About one of four knockout stage games in major FIFA tournaments is decided with these kicks. At the World Cup quarter-finals 2010, for example, Ghana and Uruguay levelled at 1-1 in the final minute of the extra time, Ghana got a penalty kick and Asamoah Gyan just hit the bar. In the following penalty shout-out Ghana lost that match. Consequently a solid practice of penalties seems to be important. Can sport psychological methods support such practice? Players in penalty kick situations have to deal with a variety of demands. As influencing factors the possibility to miss the goal as well as its consequences, fatigue, goalkeeper stalling behaviour, choice of shoot technique, the fact to be not allowed to repeat the penalty kick and expectations from themselves and others like spectators or coaches can be named (cf. Jordet, Hartman, Visscher & Lemmink, 2007). Pain & Harwood (2004) emphasize the role of psychological influences in soccer penalties and point out that the help of a sport psychologist is often not utilized by several reasons. The goal of this work is to show the relevance of mental training in the field of soccer. More precisely, it explains if and how mental training can possibly improve the precision of penalties in soccer. Also following questions are of importance: which variables influence efficiency of a mental training intervention for the increasement of precision in a soccer penalty situation? Can this investigation be seen as a fundament for further investigations in the field of soccer penalties?

In this work 54 players of over-regional level clubs in the age between 14 and 22 were investigated in a one-within plus one-between design (cf. Haag & Borms, 2004). The durance between pre-test and post-test was three weeks. The aim was to improve the score-rate in a certain part of the goal next to the posts without a goal keeper. Beside three practical sport psychological interventions the participants got a

workbook with daily tasks. The results of the investigation imply indications of a performance increasing effect of mental training combined with a practical training in comparison to just practical training.
Starting with a scientific overview of sport psychology and mental training embeds the study in the scientific coherence before conception and investigation methods, results and their discussion are followed by a prospect.

2 Theoretical foundations of mental training

2.1 Disambiguation

Mental training is besides the regulation of soliloquies and regulation of activation part of sport psychological methods (cf. Weinberg & Gould, 2011). It is used in a wide range of fields of application also beyond sport (cf. Eberspächer & Immenroth, 1999; Mayer & Hermann, 2009) and mental training is the best known and most often empirically verified form of cognitive-accentuated training for improving motor skills (cf. Gabler, Nitsch, Singer & Munzert, 2000). The expressions motor imagery and mental practice (Richardson, 1967) are quite close to the term of mental training and interdependent. In this work the term mental training is preferred. Eberspächer (2001) describes mental training as a planned, repeated and conscious imagination of a movement in the absence of any gross muscular responses. For him only a regularly and intensive training of mental information processing can lead to an improvement of movement execution through optimized cognitive skills. The difference of the term mental training to the terms of mental practice and motor imagery is the degree of scheduling, which is at the highest level for mental training. Experiencing unintentional images, e.g. like in daydreams, cannot be called mental training, because the conditions of training are not

fulfilled (cf. Sheikh & Korn, 1994). Performers create intentionally detailed and realistic images. This symbolic rehearsal of a physical activity which all three expressions have in common (cf. Morris, Spittle & Watt, 2005) is achieved through the use of mental imagery of movements (cf. Carr, 2006). Imagery is described as a creation of an experienced or an idea of sensory perception in the absence of intentional momentary perception (cf. Hall, 2001; Suinn, 1989).The working definition of imagery from Morris, Spittle and Watt (2005, p.19) summarizes these positions:

> Imagery, in the context of sport, may be considered as the creation or re-creation of an experience generated from memorial information. Involving quasi-sensorial, quasi-perceptual, and quasi-affective characteristics, that is under the volitional control of the imager, and which may occur in the absence of the real stimulus antecedents normally associated with the actual experience.

An imagination of a movement can be seen as a control and reference variable of a human action. This means that only an adequate imagination can lead to a good action (cf. Eberspächer, 2001). Understanding the human being as a bio-psycho-social system (Mayer & Hermann, 2009) explains the importance of psychological and social variables for performance. Especially in a competition a shared attention can lead to minimized performance. Therefore the orientation on the present situation decreases thinkable losses through multi-tasking in the outcome. The reasons for such a possible multi-tasking can be manifold. Examples are thoughts of (negative) outcome, spectators or the unrepeatability of a competition (cf. Klein, 2006; Morris, et al., 2005). This orientation on the present and on the actual movement in sport can be reached through mental training (Carr, 2006) but is depending on several factors intra and inter different conditions, athletes, coaches or fields of applications (cf. Mayer & Hermann, 2009; Weineck, 2004). Therefore this method reaches the highest efficacy, if its application is individual and specifically tailored to the performer (cf. Tenenbaum & Eklund, 2007;

Uneståhl & Schmierer, 2007). A closer description of the mechanisms of action and efficacy influencing variables is given in the next chapter.

2.2 How does mental training work?

A central precondition for the existence of imaginations is the ability of our memory to store and represent perceptions with the possibility to go back to them actively. Imagery of things we have done can lead to imaginations of future events (cf. Munzert, 2001). Perception is a constructive and individual process. Every human percepts different and creates his own reality (cf. Foerster & Ollrogge, 1993). For example a study including witnesses of car accidents from Erdfelder (2003) shows that suggestive influences, a lack of contribution of attention in the phase of the impress as well as adulterating information between the first perception of an action and the remembering can distort a perfect rendition of the (objective) scene. A complex interaction of what we experienced in the past and what we percept with our senses (actively or passively) creates our perception (cf. Mayer & Herrmann, 2009). There are many sensory inputs in daily life as well as in a sport situation that our brain has to filter and not all can be actively perceived. Furthermore it is not possible to anticipate or track this process from outside in detail (cf. Mulder, 2007; Spitzer, 2010) Perceptions are fundamental for imaginations and sport psychologists want to work with these perceptions to be effective with mental training. How can they understand the coherence of perception, neuronal representation of a movement and movement by itself? According to Balgo (1998) movement and perception are a system, they are interdependent. Information from outside the brain has intern representatives. Thus imaginations of movements are an active re-enactment of a movement representation. Therefore mental training needs a strong focus on individual supervision (cf. Morris, et al., 2005). Building up an imagination of a movement can

consequently be seen as individual mental effort, which is depending on former experiences and not possible without a mental representation of a movement (cf. Uneståhl & Schmierer, 2007). Thereby Heuer (1985) names three different ways to describe and produce movement patterns for the mental representations: kinaesthetic, spatial-pictoral and symbolic-verbal. For the spatial-pictoral aspect, besides others, the mirror-neuron system is important. With this system internal neuronal copies of external actions are created, which are responsible for the triggering of the same stimuli during observation as they would be created through active execution (cf. Rizzolatti & Craighero, 2004). It is distinguished between internal and external imagery. The expression of internal imagery refers to the kinaesthetic aspect (e.g. watching a video of an own performance), whereas the external representation refers to the spatial-pictoral aspects. Performing the latter an athlete would experience imagery as though he is actually performing the action. Often a combination of internal and external imagery information is used to build symbolic-verbal based interventions of mental training, which use written descriptions of a task (cf. Mayer & Hermann, 2009; Weinberg & Gould, 2011).

Through imagination motoric processes become aware (cf. Spitzer, 2010). These conscious movements are mental processes which influence the motoric system on the one hand and one the other hand activate and build motoric networks (cf. Mayer & Hermann, 2009). Effective mental training is depending on these networks (cf. Smith & Link, 2010). Referring to these statements the next chapter summarized different hypotheses trying to explain the mechanisms of mental training and furthermore chapter 2.3 describes the current status of research in regard to scientific theories.

2.2.1 Hypotheses

Scientific attempted explanations of the mechanisms of action can be matched to three categories of hypotheses: specific, unspecific and

curious (cf. Heuer, 1985). Recent empirical findings cannot support the unspecific and the curious hypotheses, whereby curious hypotheses refer to a special case of learning through imitation and unspecific hypotheses explaining the efficacy of mental training merely attribute to motivation and attention (cf. Feltz & Landers, 1983; Morris, et al., 2005). The latter can by way of example not fully explain how specific improvements of cognitive movement skills occur through mental training (cf. Immenroth, Eberspächer & Hermann, 2008). Specific hypotheses include following hypotheses because of their reference to specific effects of mental training: the cognitive hypothesis, the ideomotor hypothesis and the hypothesis of programming. The cognitive hypothesis restricts the mental exercise on its cognitive elements of motoric skills depending on symbolic and pictoral representations (cf. Heuer, 1985). Referring to non-cognitive elements like kinaesthetic aspects of a movement this hypothesis may possibly be criticized (cf. Mayer & Hermann, 2009). Focussing psychophysiological measures such as from peripheral muscular effects during imaginations of a movement the ideomotor hypothesis is based on the ideomotor principle, which is also known as Carpenter-Effect (cf. Carpenter, 1852). Since a muscle by itself cannot make sensomotoric learning possible and kinaesthetic effects during imagery are not comparable with actual movements, also this hypothesis cannot be sufficient (cf. Mayer & Hermann, 2009). The hypothesis of programming, however, is better proven, since being a modification of the ideomotor hypothesis. Neuro-physiological investigations lead to the assumption of functional equivalence between imagination of movement and execution of movement (cf. Daugs, Blischke, Marschall, Mueller & Olivier, 1996), which are fundamental for the hypothesis of programming. Mental and physical practice are understood as functionally similar (cf. Eberspächer & Immenroth, 1999). In this sense imagination and execution of a movement differ merely in the activation of the periphery of the body,

which also leads to visibly movement. Thereby the central process, which is induced by imaginations of movements, is seen as cause for the efficacy of mental training (cf. Heuer, 1985; Mayer & Hermann, 2009). In consequence of this an existing programme of movement execution may be consolidated or completed through the repetition of movement imagery due to several reasons (cf. Beckmann & Kellmann, 2009; Stoll, Pfeffer & lfermann, 2010). On the one hand often, intensive trained repetitions fortify the connection between stimulus and reaction (Thorndike-Law) and on the other hand the possibility of a correction is given through comparison with internal and external reference in the context of motoric learning (Spitzer, 2010). Results of anticipation and transfer effects support this hypothesis (cf. Mayer & Hermann, 2009; Schlicht, 1992).

One additional aspect is summarized in the hypothesis of restriction. The idea behind is that mental training can be used to raise performance without any restrictions through physical fatigue, environmental restrictions or risk of injuries. Especially in rehabilitation it can be very helpful to train mentally, when it is not possible to train physically. An optimal constructed imagination of a movement can be repeated any number of times, which may partly explain the efficacy of mental training (cf. Immenroth, et al., 2008).

Understanding these hypothetical ideas to explain the efficacy of mental training the next chapter describes the theories about the mechanisms of action of imagery and mental training.

2.3 Theories about the efficacy

Knowing why imagery operates the way it does is the basis for every practitioner for using it effectively. There are theories aiming to explain the mechanisms of action of mental training in following categories: classical theories, cognitive theories, psychological state theories and theories based on functional equivalence as well as neurophysiological research (cf. Mayer & Hermann, 2009).

2.3.1 Classical theories

Early theories and models of imagery and mental training in sport are based on research of Carpenter (1984), Jacobson (1932) and Richardson (1967) (cf. Mayer & Hermann, 2009). This works are referring to the psychoneuromuscular theory, which assumes the efficacy of mental training to be based on the production of minute muscle innervations through imagery, which are weaker in magnitude but structural identical to actual movement execution. Consequential a feedback results through comparison of imaged and actual movement execution with sensory and perceptual information which can be used in the application of mental training (cf. Hale, 1994). Investigations of Jacobson (1932) show that muscles, which are included in an imaged movement task, show electrical activation. To date, however, research is not conclusive whether such electromyographic activation during imagery is specific to the task. For example studies of Wehner, Vogt, and Stadler (1984) as well as of Slade, Landers, and Martin (2002) show different results referring to task specification (cf. Hale, 1994). Furthermore the psychoneuromuscular theory may be criticized, because research indicates that cognitive processing is more likely an explanation for the efficacy of mental training than neuromuscular feedback, since showing a higher efficacy of mental training in cognitive tasks than in strength tasks (cf. Driskell, Copper & Moran, 1994; Feltz & Landers, 1983).

Another classical theory is the symbolic learning theory by Sackett (1934). Tasks and movements always include symbolic components, which are coded in the CNS (central nervous system). Imagery is a possibility to support the development of these symbols and for this reason it promotes an easier movement execution. Though repetition of imagery tasks key elements of a movement task are in focus, which allows the setup of sub-conscious motor plans based on perception. As a result, this theory only focuses on the cognitive aspects of a skill, such as structuring and timing or planning of a movement (cf. Morris,

et al., 2005). It is proposed that cognitive skills are less complex coded than motor tasks or muscle strength, which should result in a higher efficacy of mental training for cognitive tasks (cf. Morris, et al., 2005). Feltz and Landers (1983) as well as Driskell et. al. (1994) support this thesis in meta-analyses of literature about mental training and imagery. Both meta-analyses show stronger effects of mental training on cognitive tasks than on physical or strength tasks. Furthermore both works show no significant difference between novice and experienced participants' performance in imagery studies. Consequently the effects of mental training seem to occur in all stages of learning, although single studies state an opposing view, because in this studies the participants with the least experiences showed the biggest positive influence of mental training on their performance (cf. Morris, et al., 2005). Explaining these differences Eberspächer (2001) pronounces the importance of an accurate imagery, which is based on manifold perceptions and as close to reality as possible. This variable is not utilized in the studies described above, therefore it is not replicable how adequate imaginations the participants had during the studies (cf. Morris, et al., 2005). Experienced participants are supposed to have a more adequate imagination, whereby novice participant have a wider range to improve in a movement task by also using a higher amount of visual (symbolic) perceptions during imagery (cf. Murphy, 1994). Latter supports the theory of symbolic learning, since pronouncing the importance of symbolic imagery. However this theory cannot explain improvements of motor and strength tasks through mental training as, for example, are shown by Driskell (1994).

The two early theories, the classical theories, can both not adequately explain the mechanism of action of mental training. Murphy (1994) assumes the reason for that in the limitation on trying to explain skill learning and effects of mental training with these theories, whereas sport psychological research could be more complex. Consequently a

look towards cognitive psychology seems to be useful, intending to investigate the effects of mental training more closely (cf. Morris, et al., 2005).

2.3.2 Cognitive theories

Knowledge of cognitive psychology offers promising explanations for the mechanisms of action of mental training in sport (cf. Mayer & Hermann, 2009). Thereby sport psychologists can refer to several segments, which are involved in a cognitive process beginning with a sensory input entering our information-processing system. This information from outside the brain is meant to be transformed, reduced, elaborated, stored, recovered and used (cf. Neisser, 1976). Consequently the representation of reality is not a passive process or copy of our surrounding, which is shown in several studies (cf. Balgo, 1998). Furthermore our memory is used to produce the present perception and imagery, so the process and storage of sensory input and images is central in the understanding of mental training from the cognitive perspective (cf. Morris, et al., 2005). In the early cognitive psychology serial step-by-step processing of information was in the focus, whereas today it is believed that different information, such as words or pictures, can be processed at the same time. This is the current state of research (cf. Spitzer, 2010; Stoll, et al., 2010). In the dual-code theory (cf. Paivio, 1975) it is suggested that learning is most effective, if words and pictures (two independent memory structures) are used. Forgetting a verbal code for an imagery task, does not mean to also forget the visual code, because of their independence. Therefore a better chance is given to remember an item (cf. Mayer & Hermann, 2009). The used words are always defined or include relational information (e.g. the schema of cause and effect) which may reduce the use of mental training in complex situations. Another criticism refers to variety of different perceptions in sport, which may offer more possibilities of using than just working

with words and pictures (cf. Morris, et al., 2005). For example the additional use of kinaesthetic imagery seems to be helpful (cf. Stoll, et al., 2010).

A more holistic view on the influence of mental training on the improvement of performance is given through the triple-code theory of Ahsen (1984). In this cognitive theory Ahsen pronounces a strong meaning component of images. In a three step approach (ISM) the reasons why mental training may affect performance are described. The first aspect is the image itself with all inner representations that deal with the movement and perceptions which are related to the movement. For Ahsen an image is a “centrally aroused, internal sensation that possesses all the attributes of actual sensation” (Morris, et al., 2005, p. 43). Images cause somatic reactions (cf. Mulder, 2007). These psychophysiological changes (somatic responses) are the second component. As third aspect the meaning of the image is cited. Individual experiences lead to interpersonal different representations; even they receive equal instructions for imagery. Therefore, according to the triple-code theory, the somatic responses should always be cared and the individual meaning of an image should be considered for an adequate sport psychological support of an athlete. Research shows that just positive images can support enhanced performance (cf. Murphy, 1994; Smith & Link, 2010). Consequently the meaning of positive images is underlined through this. Ahsen’s theory was developed outside of sport, and is more and more used by sport psychologists. A point of criticism on the triple-code theory is that it cannot explain why tasks with stronger cognitive aspects seem to benefit more from mental training than tasks with a stronger strength aspect (cf. Morris, et al., 2005; Sheikh & Korn, 1994).

Another clinically based cognitive theory aiming to explain the effects of imagery is the bioinformational theory of Lang (1977). Originally developed for the research on phobias and anxiety disorders this

cognitive hypothesis tries to explain fear and emotional imagery, which is not directly applicable to the context of sport. Comparable with the theory of Ahsen, Lang treats images not only as sensory perception, but also as a link with a certain meaning. Thereby these meanings are structured in a three-step description, which includes stimulus (from the environment) and response in combination with the interpretation of the processes. For Lang, the effects of mental training on the performance in sport are attributed to the increasing of strength of the connection between stimulus and response (cf. Morris, et al., 2005). As a result imagery should include feelings and physical perceptions. Including such kinaesthetic components one refers to internal imagery contrary to external imagery, which described the imagery of an external view on oneself during the performance. Several non-sport studies, as well as parts of sport psychological literature support the bioinformational theory directly or indirectly. For example studies of Hale (1994) found higher neurophysiological response for internal imagery than for external imagery, which may indicate a higher efficacy for the internal perspective. Also Feltz (1983) supports Lang's theory with results of a meta-analysis, because experienced athletes seem to benefit more from imagery than novice athletes in his investigations, which is also attributed to their greater experience of different feelings and situations in their discipline. For a possible future holistic theory about the efficacy of mental training the importance of the meaning propositions, as well as the linkage between stimulus and reaction seem to be necessary (cf. Morris, et. al., 2005).

Going in another direction, but also based on a classical psychology field (Gestalt Psychology), the Gross Framework of Insight Theory focuses on the support of mental training referring to the setup of a holistic picture of a movement. Thereby detailed observations or perceptions are not in the centre of consideration (cf. Hale, 1994). Through trial and error athletes learn in steps by generating new ways

of seeing or solving a movement specific problem. In consequence a positive learning effect through mental training is not guaranteed or predictable. But, maybe especially for novices, this theory could explain the performance enhancement through a holistic view. Nevertheless more scientific research in this field seems to be necessary to give this theory a stronger meaning in the field of cognitive theories about the efficacy of mental training. (cf. Morris, et al., 2005)

Beside the cognitive theories, which are primarily derived from the field of psychology, also a third category of theories exists to explain the effects of imagery and mental training, which illuminates the athlete's psychological state and the consequences out of it.

2.2.3 Psychological State Explanations

Imaging to shoot an important goal in front of many spectators can influence the athlete's motivation or arousal, even self-confidence or anxiety could be affected. This in turn can influence performance (cf. Gabler, et al., 2000). The attention-arousal set theory refers to this phenomenon and explains the effects of mental training through the control of attention and arousal before a competition (cf. Schmidt & Lee, 2005). There is no direct empiric support for this theory (cf. Morris, et al., 2005). But research for example of Jacobson (1932) is indirectly supporting by finding low-level innervations of muscles during mental training. Nevertheless this theory does not consider effects of mental training programs outside the preparation of a competition in daily training (cf. Mayer & Hermann, 2009).

Other explanations that have stronger empiric support are those, which refer to motivation, self-efficacy and self-confidence (cf. Morris, et al., 2005). Driskell et. al. (1994) suggested in a meta-analysis that the effects of mental training were not explicable with the Hawthorne Effect. Therefore changes in the investigated studies were ascribed to the independent variable (mental training) with the help of control

groups. Thus a placebo effect or unintended impact of the researcher or the design of the research on the participant, including behaviour, can be excluded. Consequently the results of Driskell et. al. are seen as a motivational explanation for the evaluation of imagery. Bandura (1977) explains positive effects of imagery on performance with a possible raise of self-confidence and self-efficacy through imagery of a desired outcome as it is used in mental training (cf. Mayer & Hermann, 2009). There is research support for Bandura's thesis on the one hand and on the other hand there are also investigations which hint at the possibility that imagery affects both self-efficacy and performance at the same time (cf. Morris, et al., 2005). These two models are shown in figure 1.

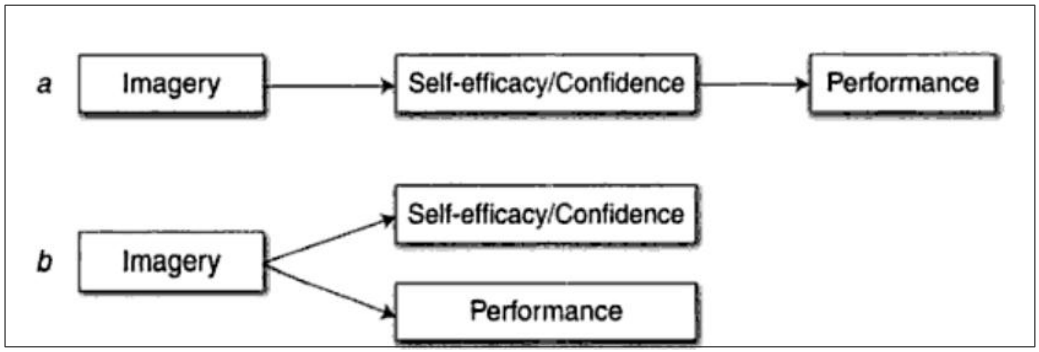

Figure 1: Possible influence of imagery on performance and self-efficacy based on Morris et al. (2005, p. 49)

The model a (in figure 1) is, for example, supported by Feltz (1983), whereby model b (in figure 1) seems to benefit from investigations of Callery & Morris (1997). The results of the latter did show that self-efficacy is a mediator between performance and imagery. Consequently more research is needed to explain the co-existence of both models. Further, motivational or self-efficacy theories cannot explain the positive effects of imagery on cognitive skills or performance increases in strength and motor tasks (cf. Feltz & Landers, 1983). Additionally they cannot explain muscle innervations such as documented by Jacobsen (1932). (cf. Morris, et al., 2005)

Paivio (1985) suggested a different point of view as motivational explanation of imagery which provides a framework for the evaluation of imagery. Verbal mechanisms as well as the function and task of memory are thereby seen as being of importance. In a 2 x 2 factor model Paivio correlates following four factors with each other: motivational or cognitive role and a general or specific level. Thereby the former are seen as the main reason for performance enhancement through imagery. In the Sport Imagery Questionnaire (SIQ) the 2 x 2 factors can be measured (cf. Morris, et al., 2005).

How imagery can enhance motor skills, such as sport performance may be explained by a further way. Explanations of the efficacy of mental training through functional equivalence and neurophysiological measurements are supported by modern technologies in neurophysiology and brain research. For example through regional cerebral blood flow scans and the positron emission tomography researchers can gain complex information from the inside the body to get a deeper understanding of the relationship between sport performance and imagery (cf. Spitzer, 2010). Consequent research assumes that imagery and movement are very similar. In this context some investigations lead to the hypothesis of functional equivalence of motor imagery and motor preparation (cf. Jeannerod, 1999; Mayer & Hermann, 2009). This hypothesis is based on the assumption that imagery, perception and movement recruit the same structures and processes in the neuronal networks, whereby the causal role of a movement generation would be the same for imagery and movement (cf. Mayer & Hermann, 2009) and the positive effects of mental training would be “due to increased traffic in the neural circuits responsible for synaptic efficacy” (Morris, et. al, 2005, p. 52-53). In preparation imagery and performance is seen as the same, but during imagery the execution of the movement through motor commands from the brain is blocked (cf. Ross, Tkach, Ruggieri, Lieber & Lapresto, 2003). Thereby visual imagery and visual perception are

seen as functional equivalent as well as motor imagery and motor preparation. There are many studies supporting the functional equivalence of visual imagery and visual perception through showing that the activation of rear (occipital) and inferior temporal regions of the brain is similar during performance for tasks including visual perception and visual imagery (cf. Morris, et al., 2005). The functional equivalence of motor imagery and motor preparation can also be shown through the involvement of the supplemental motor cortex in motor imagery, whereby the supplemental motor cortex is involved in the assembling of an established motor pattern and activated during the imagination of a movement (cf. Cunnington, Iansek, Bradshaw & Phillips, 1996). Also the primary motor cortex is activated during imagery, which is combined with pre-motor areas to plan and execute movements, which supports both categories of functional equivalence as well (cf. Mayer & Hermann, 2009).

Another neurophysiological aspect by which the mechanisms of action of mental training could be explained is neuronal plasticity. This characteristic of the human brain is a precondition for learning, optimization, stabilisation and automation of movements and therefore important to reach the aims of mental training (cf. Mayer & Hermann, 2009). Connections between neurons can be established and reduced at all times and the architecture and quality of the neuronal networks can be modulated through cortical reorganisation depending on their use and intensity (cf. Mayer & Hermann, 2009). Researches show that increased, intensive and behaviour-relevant imagery can increase the cortical expansion, which is seen as a positive training result, depending on frequency and motivation related to the imagery (cf. Morris, et al., 2005; Spitzer, 2010). Additionally the timing of mentally represented actions can be seen as support for the neurophysiological theories, because the timing of stimulated movements is similar to that of actual movement (cf. Decety, Jeannerod & Prablanc, 1989). This aspect, as part of the functional

equivalence, is called temporal equivalence. The functional equivalence of imagery and performance is a promising idea to explain the mechanisms of action of mental training, but more research seems to be necessary, especially with regard to complex movements or sport performance (cf. Morris, et al., 2005).
But none of the theories discussed in chapter 2.3 has sufficient research support (cf. Morris, et al., 2005). Maybe a future comprehensive theory, combining some theories described in this chapter can solve this problem. Although there is the fact that the effectiveness of mental training is investigated and many research results show positive effects of mental training on sport performance, as described in the next chapter.

2.4 Is mental training effective in sport?

To investigate the efficacy of a mental training programme often a four-step-model is used to compare the pure mental training with mental training combined with a practical training, a pure practical training and no training. But there are also other models of investigations about the mechanisms of action in regard to mental training that leave, by way of example, pure mental training or no training out of account (cf. Morris, et al., 2005). Some meta-analyses provide information about the efficacy of mental training. Often cited are the meta-analyses by Driskell (1994), by Feltz and Landers (1983) and by Hinshaw (1991). Driskell (1994) investigated effect sizes concerning the improvement through mental training of motor skills and cognitive skills. The finding implies that the effect of mental training is more effective, the more cognitive elements are concerned through the task, because the effect sizes differenced in more than r_{diff}=.3 (r=.69 for cognitive skills and r=.34 for motor skills). For beginners this effect could be shown, but not for advanced athletes, who show no difference between motor and cognitive skills. Hereby has to be taken into account that effect sizes are depending on

several factors, such as the movement task, which are often not good enough described for an adequate evaluation in meta-analyses as well as the concrete procedure of the mental trainings that are investigated (cf. Mayer & Hermann, 2009; Morris, et al., 2005). Feltz and Landers (1983) summarized 146 effect sizes from 60 studies, with the result, that mental practice was more effective than no practice with a moderate effect size of the mental training (r=.48). Out of 21 studies 44 effect sizes were presented by Hinshaw (1991) with the same result that mental training is more effective than no practice (r_{MT}=.68). However, Immenroth (2008) adds for consideration that quite less studies are included in such meta-analyses, which show no effect of mental training and attributes this to psychological and methodological principles of the researchers. Consequently the calculated effect sizes are actually rather smaller than higher. Evaluating the efficacy of mental training in sport it is furthermore important to have a closer look at the specific task that is investigated (cf. Gee, 2010), due to a large amount of studies about the efficacy of mental training with different ideas, procedures and participants, which are quite difficult to compare and to evaluate (cf. Sheikh & Korn, 1994). Mayer and Hermann (2009) suggest the use of a model, which is shown in figure 2, to structure different kinds of sport disciplines or movement tasks, depending on the required variation of the movement task, contact or the influence of opponent or teammates. With the help of this structure, studies are detected, which are seen as relevant for this work, because they deal with a similar or equal complexity level. These studies are delineated in this chapter.

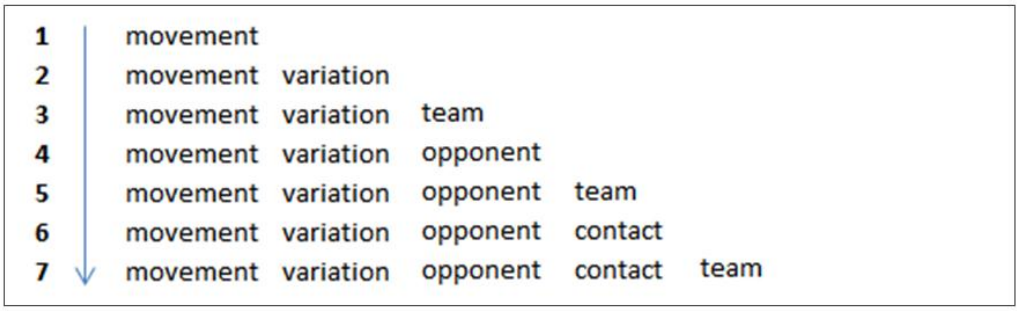

Figure 2: Different levels of complexity (1-7), based on Mayer and Hermann (2009, p. 76)

Soccer penalties without a goal keeper, as are described in this work, require several imaginations of movements that have to be available and are linked with the second level of complexity per definitionem, due to possible external factors like weather conditions and due to two possibilities to hit the target (description of the task in chapter 3). Furthermore there is no team, opponent or (body-) contact involved in the test situation of this work. Soccer penalties belong to open skill tasks performed with discrete skills, similar to golf putting, tennis or volleyball serve or basketball free throw. Therefore also studies dealing with these topics of interest for this work.

Brouziyne and Molinaro (2005) investigated the improvement of the precision of a golf tee through mental training with 23 beginners in a three-group design. One group combined mental training with practical training in a seven week intervention with one training per week. The result was a distinct improved precision in the group that combined mental and practical training compared with the control groups that solely trained practical or had no training. In another study of Smith and Holmes (2004), 40 male advanced golfers were investigated. In their intervention mental training with two different ways of procedures were evaluated in a 15-ball putting task twice a week for 6 weeks. A group using audio and video techniques of mental training improved significantly better compared with another group using written scripts for mental training. Both groups showed better results than the control group reading golf literature.

Jekauc and Woll (2006) designed a study about tennis serve. They investigated the improvement of the precision of hitting a 80cm x 40cm target in the designated area for a tennis serve through an outcome-focuses mental training intervention with 26 (10 female, 16 male) advanced players. The result was an average improvement of 7.6% referring the target hits for the intervention group, which imaged the serve (ball landing in the target) before the practical serve, as against the group that just served without any instruction.

Through a study in volleyball Shick (1970) could be shown that the discipline-specific skills improved significantly for a mental training group compared with a group without training. Furthermore Morris and Callery (1970) made in a causal modelling analysis out that imagery influences self-efficacy and goal kicking performance (Australian Rules football) positive. Concluding this enumeration of different studies, through a single-case study Silva (1982) shows performance enhancing effects of a sport psychological training including mental training of basketball free throws. In a three-step advance initially specific individual relevant movement tasks were defined and a manifold set of kinesthetic, video-based and written descriptions was established. In the next step inadequate imagery content was identified and replaced by adequate imagery content. Also a regulation of soliloquies was part of the intervention. In the last step the adequate imagery was linked with hubs and performed as mental training in several parts, 30 minutes per day. Compared with the team (2.7%), this player enhanced his free throw performance through the mental training program by 21% in the investigated period.

The study of Crossman (1992) about the effect of three methods on the learning of a soccer penalty kick tested 30 varsity level players with the Crossman Penalty Kick Test. In a three-group design (internal imagery, slow-motion mental practice, and no practice) during eight days the subjects were tested before, during and at the end of the intervention. As a result, internal imagery and slow-motion mental practice showed a

performance increasing effect. Furthermore mental practice was more effective in the first days of the intervention. The variety of applications and methods of mental training in different sport disciplines is large. Consequently research is also manifold and difficult to summarize (cf. Morris, et al., 2005). This chapter gave an overview on several studies. Certainly there is less research about the effects of mental training on soccer penalties without goal keeper. Consequent this work helps to close this gap. As well as the studies investigated in the meta-analyses described in this chapter, also the other studies are difficult to compare, because there is a large range of possibilities to apply mental training (cf. Morris, et al., 2005). Furthermore the efficacy of mental training is depending on several factors, which increases the problem of comparison. An overview of such influencing variables is outlined in the next chapter.

2.4.1 What influences the efficacy of mental training?

There a many different investigations about the factors that influence the effectiveness of mental training. There are direct or indirect influencing factors as well as factors that increase or decrease the effectiveness (cf. Mayer & Hermann, 2009). Basically imagery is depending on imaginations; consequent imagery ability is very important for the efficacy of mental training. Several questionnaires are available, which examine self-reported quality of imagery tasks, e.g. the Movement Imagery Questionnaire (MIQ) from Hall (1985), to investigate this factor (cf. Morris, et al., 2005).

Another often discussed factor influencing the efficacy of mental training is the level of activation. Depending on the content of the mental training the level of activation can have positive or negative influences on the efficacy of the mental training (cf. Immenroth, et al., 2008). Several studies indicate a higher efficacy of imagery through a short phase of relaxation directly before the actual mental training (cf.

Eberspächer, 2001). As possible reason for this effect is a focusing of the attention through the relaxation (cf. Mayer & Hermann, 2009).

For the incurrence of vivid and intensive imaginations the self-efficacy seems to be necessary (cf. Bandura, 1977). Thereby the persuasion of having the ability to build up performance enhancing imaginations is central. Research indicates that the expectation of self-efficacy seems to be even more important than imagery ability for a successful long-term application of mental training (cf. Mayer & Hermann, 2009).

As further factors the skill level and the age is important to name. Certainly it is not concluding reviewed at which skill level and age mental training has its highest efficacy, the meta-analysis of Feltz and Landers found no significant difference for novices and experts referring to the efficacy of mental training (cf. Morris, et al., 2005). Whereas a higher age seems to correlate with a higher efficacy of mental training (cf. Driskell, et al., 1994).

To continue this summary of influencing factors on the efficacy of mental training the content of the imagination and temporal equivalence are described. The closer to reality an imagination is and the more positive the imagination is, the higher is the efficacy that can be expected by a mental training including this imaginations (cf. Morris, et al., 2005). Negative images, however, are seen as detrimental to performance (cf. Immenroth, et al., 2008). Mechanisms, which help to establish such positive and realistic imaginations, are described in chapter 2.2. Thereby it is to add that imagery based on a variety of different information by e.g. internal and external visualization or kinesthetic, auditory, tactile and olfactory sensual input is meant to be more effective than imagery based on less information resources (cf. Morris, et al., 2005). Furthermore the efficacy of mental training can be different for different skill levels, referring to the use of internal and external imagery use (cf. Zachry, Wulf, Mercer & Bezodis, 2005). Mayer and Hermann (2009) tend to a rather internal oriented imagery, focussing the movement itself, for

beginners and rather an external, target oriented imagery for advanced sportsman.

Additionally a high temporal equivalence of imagination and real movement is also seen as important for a high effectiveness of mental training. An incorrect speed of the imagination of a movement may thereby detrimental for the efficacy of mental training (cf. Morris, et al., 2005).

Mayer and Hermann (2009) give the hint, that mental training before sleep, to use effects of long-term potentiation, could be helpful to reach a high efficacy of the mental training program.

To get a better understanding of the mechanisms of action of mental training more studies with a high external validity are necessary. Furthermore more sport discipline specific studies are recommended by Mayer and Hermann (2009), to get a systematic and holistic overview about the mechanisms of action of mental training under sport discipline specific conditions.

2.5 Research question

Concerning soccer penalty kick precision without goal keeper, deduced from various chosen theses of the literature review, the underlying study is described hereafter in chapter three. The study of this work is part of a larger study of the interdisciplinary study group “Sportpsychologie” at the University of Constance under the direction of Dr. Jekauc at the chair of Prof. Dr. Woll. This study group, existing since the beginning of 2010, is collecting and analysing data from following sport disciplines: soccer, volleyball and tennis. The studies in volleyball and tennis contemplate with the precision of the serve, which is seen as comparable with the soccer penalties without goal keeper, referring to the complexity level of the motor and mental task. In this work the part of the study dealing with soccer penalties without goal keeper is depict. The main aim of this subjacent study is the measurement of the possible improvement of precision in soccer penalty kicks through a mental

training intervention. Further research questions refer to efficacy influencing variables of the mental training intervention of this work. Thereby age, imagery ability, ability to concentrate, commitment, application of a workbook and the level of stress are investigated in regard to a possible effect on the efficacy of a three-week mental training intervention with control group.

3 Study and Methods

This chapter explains the hypotheses of the study and describes the pilot study as well as the research design. In further steps the selected variables of the study and their measurement are stated and the statistical procedures are described, which were used to analyse the data in regard to the hypotheses. In chapter four the results of the study are demonstrated, discussed and integrated in context of the relevant scientific literature.

3.1 Hypotheses

This study of this work is based on following hypotheses:

1) There is an interaction of time and groups, referring to soccer penalty kick precision in the test setting that is used.
2) Imagery ability influences the ability of precision at the base level.
3) The application of a workbook influences the effectiveness of the mental training intervention.
4) Imagery ability influences the effectiveness of the mental training intervention.
5) Commitment influences the effectiveness of the mental training intervention.
6) Ability to concentrate influences the effectiveness of the mental training intervention.
7) Age influences the effectiveness of the mental training intervention.

8) The level of somatic and anxiety, unease and confidence influences the effectiveness of the mental training intervention.

3.2 Pilot Study

The pilot study was conducted in July 2010 with student athletes at the soccer fields of the University of Constance. This pilot study aimed to test the appropriateness of the thesis on the feasibility of application and testing in a manageable framework (cf. Haag & Borms, 2004). Furthermore a small, selected representative sample is selected as the experimental group. In the case at hand, these were four student athletes in the age between 20 and 22. They have completed a three-week training program with four sessions including previous pre- and followed post-test. They also carried out the mental training and relaxation in the first three sessions. Furthermore they had the daily task to read the workbook during these three weeks. Besides the quantitative methods, which are equal to the study of this work, also qualitative methods were used to find mistakes or possibilities to optimize in the procedure of the study. Interviews of the athletes investigated their experiences during the intervention and their impression of the relaxation and the workbook.

To separate the target area in the goal, which should be hit, a cord was tested for suitability. It was tested whether this line is seen from the penalty spot and whether they are robust enough to resist wind and rain. We also tested how they could be fixed on the ground (with tent peg or brick). Due to statistical reasons the size of the target area was chosen well, because almost half (46%) of the shoots of the athletes hit the target area in the pre-test, which implies that also possible high deviations in the precision could be measured in the post-test. Furthermore the workbook has been seen as helpful and understandable. However, it was noted that the relaxation should be longer than it was in the pilot study to access the necessary calm and

concentration. The position of the camera, which records the players during the first training seemed to be best placed in the pitch circle marginal to the eighteen-yard area, depending on the run-up of the player. The use of video-analyses was also mentioned as positive, especially when the camera focused player and goal.

3.3 Study design

For an appropriate investigation of the hypothesis of the study a one-within plus one-between study design with pre- and post-test (cf. Haag & Borms, 2004, p.153-155) was fundamental (figure 3).

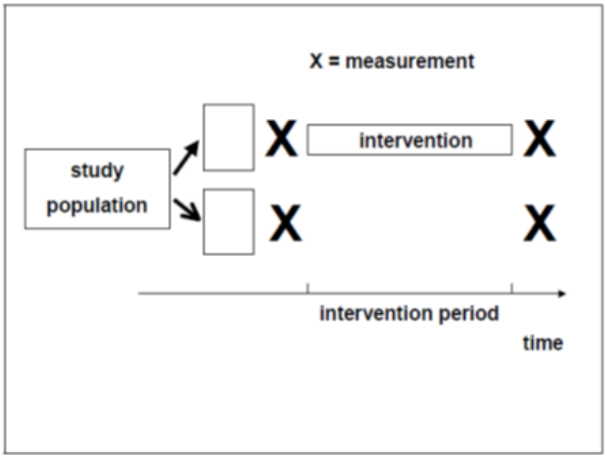

Figure 3: One-within plus one-between study design with pre and post-test (cf. Haag & Borms, 2004, p. 154)

This experimental design was chosen to show that the possible effects of the intervention on the intervention group cannot be explained by natural development or practice of shouting and consequent resulting effects of motor learning. The short and long term follow-up measurements with pre- and post-test capture differences between the groups and in dependence to time. At the beginning of the study the subject of the study were split in intervention and control group. The study population were welcomed and informed about the study procedure with a standardized acquisition text. The male study population consisted of 51 players of two soccer clubs in Constance in the age of 14-18, playing in the third U-19 or U-17 division and four

students of sport sciences in the age of 20-22, playing in the seventh division. The group affiliation was randomly chosen, whereby players of the same club, were in the same group due to technical reasons, which are described in chapter 5. The sport students were allocated randomly. The intervention group (30 players of FC Konstanz and two sport students) received mental and practical penalty kick training and a revised and adjusted workbook with mental training exercises on the basis of Kluge (2008). These exercises can be seen in the appendix (p. 70-81). The control group (21 players of FC Wollmatingen and two sport students) practiced the same amount of penalty kicks and received a workbook including articles about soccer specific training partially referring to sport psychology out of the "fussballtraining" magazines 5/2009- 4/2010 published by Philippka-Sportverlag.

Both groups performed a pre-test including the penalty precision test with 20 shoots on a special prepared standard soccer goal after FIFA rules[1] without a goal keeper and a specially created questionnaire (chapter 3.5) on the basis of number-based data (Haag & Borms, 2004) due to the requirements of the hypotheses. The questionnaire was anonym and included tests of concentration, imagery ability, commitment and information about previous experience with mental training as well as about age, skill level, training frequency and further personal data. The intervention period of both groups was three weeks and the phase of data collection was completed with the post-test, measuring the penalty precision in both groups with the penalty precision test.

3.4 Procedure of the study

The study was conducted between October and December 2010. After the acquisition of the study subjects, the information of the pilot study, described in chapter 3.2, was used to optimize the procedure of the

[1] FIFA - Laws of the game. Retrieved from: http://de.fifa.com/worldfootball/lawsofthegame.html at 06/04/11

study. The intervention group A started at October 11th and finished at November 1st. The intervention group B started at October 18th and finished the intervention period at November, 8th.

Both intervention groups performed at the soccer field Waldheim in Constance. The period of the control groups, which had the sessions at the same time, started at November 15th and finished at December 8th at the soccer field in Wollmatingen. Both groups completed an individual three-week training program with four sessions including previous pre- and followed post-test. During the pre- and post-test part groups were built to reduce the latency. The players, who were not in the test situation had normal club training, as it would have happened without the study. The duration of the pre-test was approximately 30 minutes, for one part group of players. The questionnaires were filled out at the same time and the precision test was performed at two goals. After this every player of the control group had 20 shoots at the goal, which was prepared like in the penalty precision test situation aiming to hit the marked area. The intervention group prepared itself for 20 shoots on the goal with a ten minutes relaxation program and visualization of the shoot with special focus on the ball hitting the target area. With the help of video analysis with SimiVidBack 1.5 (by simi reality motion systems, Unterschleissheim) on a 15” notebook placed on a table in the pitch circle marginal to the eighteen-yard area, depending on the run-up of the player, the subjects had the possibility to include external focus in their visualization through seeing themselves performing on the notebook display with a delay of 20 seconds after their shoot. The control group did not use video analysis. In the intervention group 5-10 shoots from the penalty precision test (PPT) were recorded and shown to the subjects to use them in the first relaxation and imagery session. These sessions took place in a sitting position in the cabin or at a silent place outside depending on the weather and took 13-17 minutes. The shortest distance, with the least disturbances for the player was chosen for the place of these relaxation and imagery sessions. The standardized

relaxation is based on breathing relaxation with external instructions from a member of the workgroup. Also the imagery tasks were standardized and included the external and internal visualization of the preparation of the penalty, the shoot itself and the imagery of the ball hitting the target combined with manifold individual sensory information (s. appendix, p. 82). Thereby they are asked to image themselves in a situation where they stand on the football field near the penalty spot to shoot a goal, visualizing the trajectory of the ball to clear and hearing the noise as the ball strikes the net. As well, it is proposed to recall the joy that comes up when they hit the target. This exercise should first demand the self-efficacy and aims mainly to increase the precision of the shoot. Furthermore, it is often pointed of the individual details of the imagery, such as the self-imagery of the feeling when they hit the ball or the sound when the ball strikes the net.

Thereafter the subjects perform a series of four times five shoots. Each shoot series is individually discussed with the players in regard to an adequate imagery. During these shoots an individual ritual (defined, recurring behavior in the last moments before a shoot, e.g. putting the ball in a special position or a special breath) was introduced by the coach from the workgroup. The subjects were told to use this ritual for every shoot and every visualization or imagery task during the intervention period.

In all sessions in the two groups the goal was prepared like in the PPT pre- and post-test situation and at no time a goal keeper was appointed. In the second and third session the intervention group exercised the visualization in combination with a relaxation program and performed the penalty shoots on the goal, including their individual ritual. The players of the intervention group were advised and supported by members of the workgroup during in the whole process to build up adequate imaginations, which are as close to reality as possible, including manifold sensory input and temporal equivalence.

The workbook and the articles for the control group, which was also called workbook for the subjects (in this work it is called control group workbook), was hand over at the end of the first session. The workbook for the intervention group integrated several imagery tasks, energy level and imagery ability exercises as well as sensory tasks, to perform at home in undisturbed moments 10-20 minutes per day until the end of the intervention period. At the beginning of the study a standardized explanation of the study was given orally to both groups. The workbook for the intervention group included a system of encryption to arouse anonymity. The readiness of the subjects to answer the questionnaire and to take part in the interventions was tried to reach by acceptance and social distance of the researcher. The possibility to improve the precision skills in penalties can be seen awarding system.

The durance of each of the four sessions of the intervention group was 90 minutes. The control group spent 90 minutes for the first session; the other sessions lasted 60 minutes. The durance for the preparation of the sessions was one hour and for the depletion half an hour. Due to the fact, that the teams were in their current season, the intervention couldn't be held at the same weekdays. But the teams had a session every week. In the last session both groups just performed the post-test consisting of the penalty precision test.

3.5 Instruments of measurement

The penalty precision test (PPT) includes 20 shoots from the penalty spot, with no time restriction, on a special prepared standard soccer goal after FIFA guidelines. On this goal target areas are marked with a cord (Wurstgarn, 3-3.5, Ø 2mm, grey) which is hanging in a distance of 70cm exactly parallel to the goal posts in the direction of the centre of the goal. The following figure shows a sketch of the experimental setup.

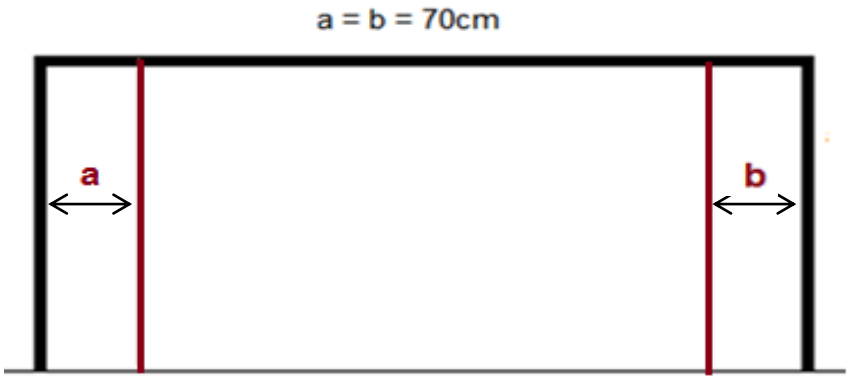

Figure 4: Penalty precision test (PPT) setup. The letters a and b are marking the target areas. (Sketch of the author)

A series of four times five shoots from the penalty spot, on a soccer field after FIFA guidelines, was measured as hit or no hit. The hits of every single player were summed up for the data analysis. If the shoot touched the cord and moved it out of its position, it had to be brought back into position before the next shoot and the shoot was counted as a hit. The used soccer fields are artificial grass pitches, which reduces the influence of weather and ground conditions on the measurements and on the training.

The first test in the questionnaire is the FAIR-Test (Frankfurter Aufmerksamkeits-Inventar) measuring interindividual differences in concentration and attention. In the test, which is delivered by the Testothek of the University of Constance[2], four different signs (circle, square each with two or three points in their centre), organized line by line, include two target signs, which are to be market with the pen, line by line, like it is shown in figure 5.

Figure 5: Example of one line of the FAIR (cf. Moosbrugger & Goldhammer, 2010)

A fast and precise discrimination of the similar items is necessary to have a good result in this test. On two pages 640 items can be

[2] Information about the Testothek on www.uni-konstanz.de/testothek/

processed at maximum in the test time of three minutes for each page. The FAIR was used for an individual test of the subjects, not as a group test. One performance oriented value (L) was calculated referring to the speed and one quality oriented value (Q) was calculated referring to the absence of mistakes. The multiplication of L and Q led to a value K (extent of continuously sustaining concentration). These values are used for the further data analysis. The FAIR is a well-known and standardised test in the area of psychology. The Implementation, evaluation and interpretation is objective and norm based. In a norming sample L and K showed internal consistencies of about c_i=.9. The validity is seen as relatively high. Whereby the content and construct validities are seen as assured. The reliability of the test is for the L and K value calculated with r=.90 and for the Q value with r=.77-.80 with the Split-Half method. The parallel test method delivered following results for the reliability: r_{Qvalue}=.80, r_{Kvalue}=.82. The durance of this test is 5 – 10 minutes (cf. Moosbrugger & Goldhammer, 2010).

The following test in the questionnaire is an imagery ability test. In this study a part of the MIQ by Hall et. al. (1983). The reliability of this subjacent test, referring to internal-consistency coefficients, is ranging from r_{visual}=.87-.89 to $r_{kineaestethic}$=.86-.91. The test is recommended for the use with young and fit people, if there is no time restriction during the test. The validity of the MIQ is discussed and a comparison with other imagery ability tests shows a moderate-high validity of the MIQ depending on the target group (cf. Morris, et al., 2005, p. 72-73). This test is recommended by Mayer & Hermann (2009) for the measuring of imagery ability, and can be found in Mayer & Hermann (2009, p. 219-228) in the German version, which was utilized in this study. Therefore the first four questions, which include movement tasks of leg, arm or full-body, were extracted. The other 14 questions included in the MIQ (Deutsch) were not noted, due to temporal-organisational reasons. In all tasks and questions movement tasks have to be performed and afterwards this movement is to be imaged and the imagery is to be

rated. If the imagery was easy to build, a low rating is to choose, otherwise a high. Out of the four questions, selected for the questionnaire of the study, two refer to pictoral (the first and third) and two refer to kinaesthetic imagery (the second on fourth). The ratings of each of the two categories were summed up, whereby a small sum (close to two) indicates high imagery ability and a high sum (close to 16) indicates small imagery ability. Due to the limitations of this test, the durance for the test is between 5 and 10 minutes.

Furthermore questions about the commitment referring to the mental training intervention of the subjects are raised in the next part of the questionnaire. These questions can be seen in figure 6.

Bitte geben Sie an, wie weit Sie den folgenden Aussagen zustimmen.

Ich möchte das Mentale Training so gut wie möglich durchführen.	☐1 Stimmt	☐2	☐3	☐4	☐5	☐6	☐7	☐8 Stimmt nicht
Ich fände es schade, wenn ich das Mentale Training nicht so gut wie möglich durchführen könnte.	☐1 Stimmt	☐2	☐3	☐4	☐5	☐6	☐7	☐8 Stimmt nicht
Ich fühle mich mit dem Mentalen Training verbunden.	☐1 Stimmt	☐2	☐3	☐4	☐5	☐6	☐7	☐8 Stimmt nicht
Ich glaube daran, dass das Mentale Training meine Leistung verbessern wird	☐1 Stimmt	☐2	☐3	☐4	☐5	☐6	☐7	☐8 Stimmt nicht

Figure 6: Questions about the commitment of the subjects referring to mental training

The origin of this part of the questionnaire is based on an article of Hollenbeck, Klein, O'Leary & Wright (1989) under the guidance of Prof. Dr. Gollwitzer (Professor of Social Psychology & Motivation at the University of Constance). The subject has to rate the extension of consent with the statements ordinal scaled from 1 (high consent) to 8 (no consent). Summing up the ratings in the four parts, a low sum (close to 4) indicates a high commitment and belief in the effectiveness of mental training. A high sum (close to 32) indicates a low commitment and low belief in the effectiveness of the mental training intervention. The reliability for the underlying source of these questions is given with an

estimated internal consistency of c=.71 and the construct validity was empirically tested with

> […] (a) dimensionality and internal consistency, (b) convergence with alternative measures of the same construct, (c) relatedness to measures of separate constructs within the nomological net of the focal construct, and (d) discriminability from constructs not within the nomological net. (Hollenbeck, Klein, O'Leary & Wright, 1989)

Furthermore in a following test unease, somatic anxiety and confidence are measured with the WAI-S, which online available[3]. It is offered by the Bundesinstitut für Sportwissenschaft in Bonn (BiSp, National Institute for Sport Science). On the theoretical basis of Spielberger (1972) the state anxiety (A-State), referring to a concrete situation and the trait anxiety (A-Trait), referring to a stabile disposition in behaviour over a longer durance, are distinguished. Furthermore the WAI-S is fundamentally based on works from Liebert and Morris (1967). The sport psychological framework is built through the multidimensional theory about different forms of competitive anxiety levels of Martens, Vealey und Burton (1990). Whereby latter is the basis the CSAI (Competitive State Anxiety Inventory by Martens, Burton, Vealey, Bump & Smith, 1990), which is one of the most often used Anglophone sport psychological diagnostic tools (cf. Morris, et al., 2005). Structural equivalent, the WAI-S is a psychometric validated short questionnaire with 12 items (cf. BiSp, 2011b). The reliability (after Cronbach's-Alpha) can be seen as high. For the somatic anxiety value the reliability is given with $\alpha_{som.\ anx.} = .81$, for the unease value with $\alpha_{unease} = .79$ and for the confidence value with $\alpha_{confidence} = .82$ (cf. BISp, 2011a).

In figure 7 the 12 items of the WAI-S used in the study are shown, including the way of rating in the ordinal scale from 1 (very less) until 4 (very much). Also the description of the task can be seen on the top of the figure. All included statements refer to the feelings at the moment.

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[3] http://www.bisp.de/nn_15924/SharedDocs/Publikationen/SpoPsy/DE/Fragebogen/WAI__S,templateId=raw,property=publicationFile.pdf/WAI_S.pdf, 14/03/11

Bitte lesen Sie jede Aussage durch und markieren Sie jeweils die Antwort, die am besten Ihre Gefühlslage bezogen auf Ihren Aufschlag beschreibt.

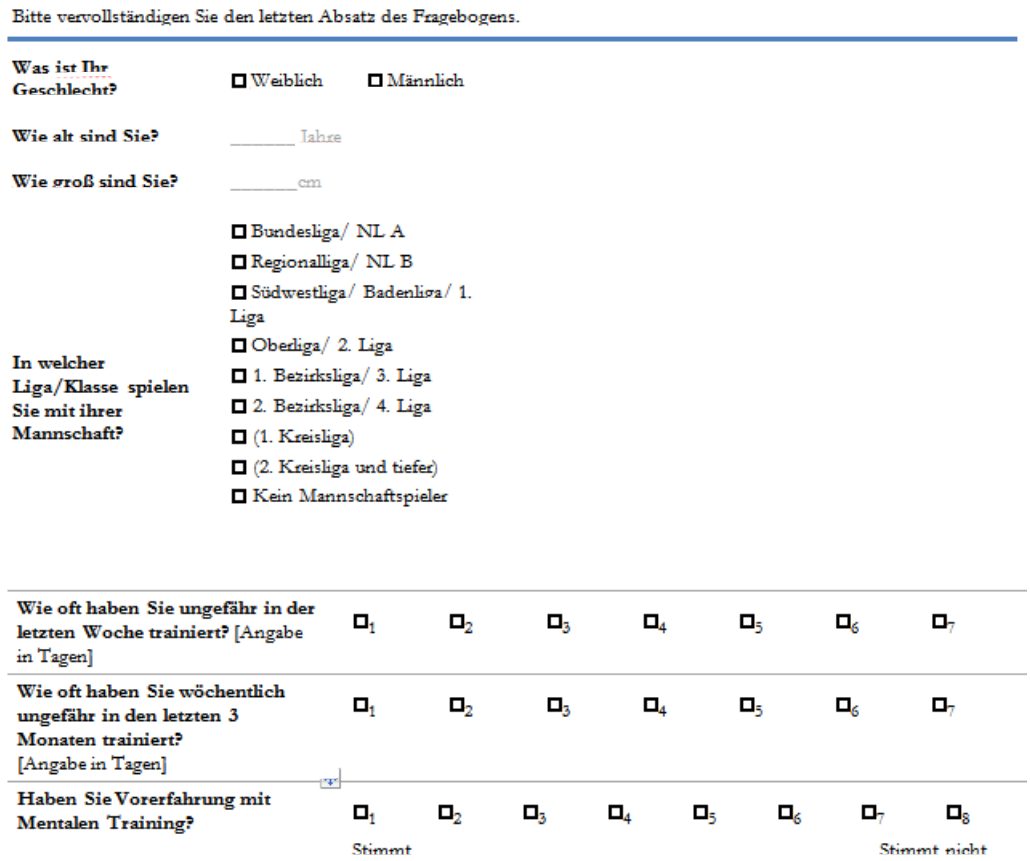
Jetzt, in diesem Moment…	1. gar nicht	2. ein wenig	3. ziemlich	4. sehr
…befürchte ich, weniger gut abzuschneiden als ich eigentlich könnte.	☐1	☐2	☐3	☐4
…pocht mein Herz	☐1	☐2	☐3	☐4
…bin ich überzeugt, dass ich meine volle Leistung abrufen kann.	☐1	☐2	☐3	☐4
…habe ich ein flaues Gefühl im Magen.	☐1	☐2	☐3	☐4
…fühle ich mich sicher, weil ich den Erfolg vor Augen sehe.	☐1	☐2	☐3	☐4
…habe ich Bedenken, dass andere von meiner Leistung enttäuscht werden.	☐1	☐2	☐3	☐4
…fühle ich mich zittrig.	☐1	☐2	☐3	☐4
…bin ich mir sicher, dass ich im Präzisionstest bestehen werde.	☐1	☐2	☐3	☐4
…bin ich besorgt, dass ich dem Druck nicht standhalte.	☐1	☐2	☐3	☐4
…spüre ich, wie mein Körper verspannt.	☐1	☐2	☐3	☐4
…bin ich besorgt, dass ich eine schwache Leistung erbringen werde.	☐1	☐2	☐3	☐4
…bin ich zuversichtlich, dass ich die Herausforderung meistern werde.	☐1	☐2	☐3	☐4

Figure 7: WAI-S, used in the questionnaire to measure somatic anxiety, unease and confidence

For the scaling the rating of each time four items is summed up. The sum of the items 2,4,7 and 10 refer to the somatic fear. The items 1,6, 9 and 11 refer to the unease, whereby the items 3,5,8,12 refer to confidence.

The questionnaire concludes with socio-demographic questions about size, age, sex, level of the league the subjects play (if they are in a team), training frequency and previous experience in mental training.

Figure 8 shows the composition.



Bitte vervollständigen Sie den letzten Absatz des Fragebogens.

Was ist Ihr Geschlecht?	☐ Weiblich ☐ Männlich
Wie alt sind Sie?	_____ Jahre
Wie groß sind Sie?	_____cm
In welcher Liga/Klasse spielen Sie mit ihrer Mannschaft?	☐ Bundesliga/ NL A ☐ Regionalliga/ NL B ☐ Südwestliga/ Badenliga/ 1. Liga ☐ Oberliga/ 2. Liga ☐ 1. Bezirksliga/ 3. Liga ☐ 2. Bezirksliga/ 4. Liga ☐ (1. Kreisliga) ☐ (2. Kreisliga und tiefer) ☐ Kein Mannschaftspieler

Wie oft haben Sie ungefähr in der letzten Woche trainiert? [Angabe in Tagen]	☐1	☐2	☐3	☐4	☐5	☐6	☐7
Wie oft haben Sie wöchentlich ungefähr in den letzten 3 Monaten trainiert? [Angabe in Tagen]	☐1	☐2	☐3	☐4	☐5	☐6	☐7
Haben Sie Vorerfahrung mit Mentalen Training?	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8
	Stimmt						Stimmt nicht

Figure 8: Composition of the data of the subjects

The last question about the previous experience with mental training can be answered through an ordinal scale system from 1 (true) until 8 (false). The question about the sex, the league the subjects play (if they play in a team), the number of soccer trainings in the last week and the average number of training during the last three months are linked with a nominal scale. The questions about size and age are ratio scaled.

At the end of the study intervention the intervention group answered two questions in a second questionnaire about the durance and the frequency of the application of the workbook. The first question was about the amount of minutes the subject read the workbook per week. The answer was a number of minutes. The second question referred on how much of the workbook the subjects read. The answer was a percentage between 0% and 100%. Figure 9 shows the questions.

Wie viele Minuten pro Woche hast du dich mit dem Workbook beschäftigt? _____ min

Wieviel % des Workbook hast du bearbeitet? ____ %

Figure 9: Questions about the use of the workbook

3.6 Data analysis

The data was analysed with SPSS Windows, version 11.5 (16/11/2002) by Lead Technologies on a Windows 7 notebook system.

According to the hypotheses following different statistical procedures were selected:

Hypothesis one: For the investigation of the interaction of time and groups referring to soccer penalty precision an ANOVA with repeated measurement was used. The results of the pre- and post-tests represent thereby the depending variables and the groups represent the independent variables.

Hypothesis 2: For the investigation of the influence of the imagery ability on the result in the PPT of both groups' subjects an analysis of the correlation between imagery ability and PPT result was used.

Hypotheses 3-8: For the investigation of the influence of the application of the workbook, the imagery ability, the commitment, the ability to concentrate, the age and the level of somatic anxiety and unease on the effectiveness of the mental training intervention the analysis of the correlation between the named factors on the difference between the pre- and post-test results of the intervention group subjects was used.

4 Results

In this chapter the results of the data collection are shown. The descriptive results are thereby followed by the results referring to the hypotheses.

4.1 Descriptive results

To describe the results each part of the data collection is represented, beginning with the penalty precision test.

4.1.2 Penalty precision test (PPT)

The results of the PPT of the intervention and control group in pre- and post-test can be seen in table 1. The 32 subjects of the intervention group reached a mean of 8.78 in the pre- and 9.53 in the post-test.

Table 1: Results of the control and intervention group in the PPT in pre- and post-test

Measurement	Group	Mean	SD	N
Hits pre-test	Intervention	8.78	2.30	32
	Control	8.95	2.19	22
Hits post-test	Intervention	9.53	2.48	32
	Control	8.36	3.08	22

SD= standard deviation; N= number of subjects

In figure 10 a graphical depiction shows the results of both groups in the pre-test penalty precision test, including outlier.

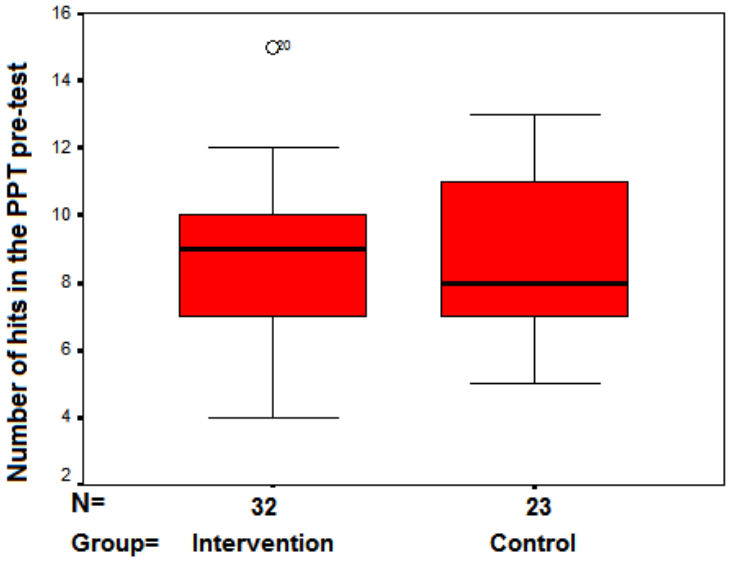


Figure 10: Results of both groups in the pre-test PPT

Figure 11 shows the results of both groups in the post-test, including the outlier (#39). The intervention group shows a higher distribution than the control group.

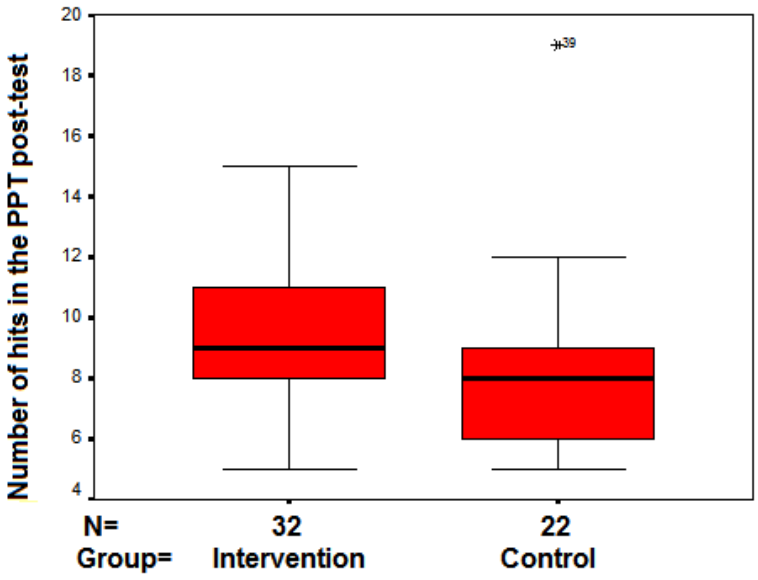


Figure 11: Results of both groups in the post-test of the PPT

An improvement or deterioration of the number of hits of both groups between pre- and post-test can be seen in figure 12. Here it is visible that the intervention group had an improvement of the number of hits (referring to the mean), the control group, however, shows a negative difference (referring to the mean). There are outliers in both groups. In the intervention group the outliers show worse results than the mean of the group, in the control group three outliers have higher results than the mean of the intervention group, two have lower.

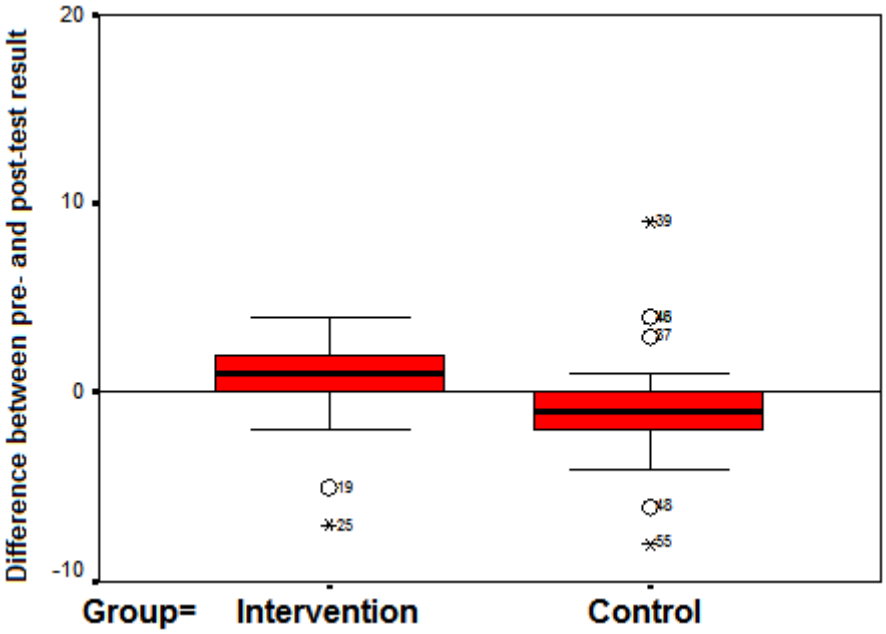


Figure 12: Improvement or deterioration of the number of hits of both groups between pre- and post-test

4.1.3 FAIR-Test

The FAIR-Test resulted in following results for the mean of the intervention group (N=29): M_L=333.9 (SD_L=83.6); M_Q=.92 (SD_Q=.16); M_K=317.77 (SD_K=87.68)

The FAIR-Test resulted in following results for the mean of the control group (N=22): M_L=350.31 (SD_L=75.72); M_Q=.94 (SD_Q=.05); M_K=332.11 (SD_K=79.72.). An alignment with standard values was not made.

4.1.4 Imagery ability test

The measurement of the pictoral and kinaesthetic imagery ability resulted in following findings:

Table 2: Pictoral and kinaesthetic imagery ability in intervention and control group

Imagery Ability	Group	N	Mean	SD
Pictoral	Intervention	33	4.06	1.75
	Control	22	5.27	2.81
Kinaesthetic	Intervention	33	5.00	2.47
	Control	22	4.68	2.34

SD= standard deviation; N= number of subjects

The control group shows a higher mean in the pictoral imagery ability, the intervention group, however, shows a higher mean in the kinaesthetic imagery ability. But the comparison of the groups with a T-Test (with independent samples), referring to imagery ability shows no significant difference.

4.1.5 Commitment

The commitment of the subjects was high on the average. The mean result of all subjects referring to the commitment was 10.29. The commitment of the intervention group was higher than the commitment of the control group, referring to the mean (Table 3). Table 4 shows the descriptive results of the intervention group.

Table 3: Comparison of both groups referring to the commitment

Group	N	Mean	SD
Intervention	33	9.30	5.77
Control	22	11.77	4.90

SD= standard deviation; N= number of subjects

Table 4: Commitment of the intervention group

	N	Minimum	Maximum	Mean	SD
Rating of Commitment	32	4	29	9.31	5.87

SD= standard deviation; N= number of subjects

4.1.6 WAI-S

The measurement of somatic anxiety, unease and confidence in the intervention group shows no significant correlation with the increase of precision between pre- to post-test (referring to the results in the PPT pre- and post-test). Out of the WAI-S values the confidence correlates significant with the results in the PPT (pre-test) for the intervention group (table 5). For the control group no significant correlation with one of the WAI-S values could be verified. Furthermore no significant correlation between one of the WAI-S values with the PPT post-test could be shown.

Table 5: Correlation of WAI-S values with the difference of the results between pre-and post-test and with the PPT pre-test results in the intervention group (N=32)

		Difference	Som. Anx.	Unease	Confidence	PPT pre
Difference	Correlation	1.00	-.04	-.10	-.01	.46**
	Sign.		.83	.60	.94	.01
Som. Anx.	Correlation	-.04	1.00	.06	-.30	.06
	Sign.	.83		.76	.09	.74
Unease	Correlation	-.10	.06	1.00	.04	.13
	Sign.	.60	.76		.83	.48
Confidence	Correlation	-.01	-.30	.04	1.00	.38*
	Sign.	.94	.09	.83		.03
PPT pre	Correlation	-.46**	-.06	.13	.38*	1.00
	Sign.	.01	.74	0.48	.03	

** The Correlation is significant on the level of .01 (2-way)
* The Correlation is significant on the level of .05 (2-way)
Difference= difference between the PPT pre- and post-test results
Sign.= Significance (2-way)
PPT pre=Result PPT pre-test
Som. Anx..= Somatic Anxiety

4.1.7 Socio demographic and further data

All subjects are male and have experience in playing in the over-regional level (Junioren-Verbandsliga or higher). The tables 6, 7 and 8 show the results of the concluding parts of the first and second questionnaires. The values for the workbook refer to the intervention group.

Table 6: Data of the study population

	N	Minimum	Maximum	Mean	SD
Age in years	52	14	22	16.83	1.84
Size in cm	52	164	193	178.77	6.98
Training frequency (in days)	55	1	7	2.87	1.20
Weekly training frequency in the last 3 weeks	55	0.5	9	3.14	1.65
Experiences with mental training	55	1	8	6.53	2.08

SD= standard deviation; N= number of subjects

Table 7: Data of the intervention group (N=32)

	Minimum	Maximum	Mean	SD
age in years	14	20	16.34	1.31
size in cm	164	192	178.69	7.17
Training frequency (in days)	1	7	3.06	1.41
Weekly training frequency in the last 3 weeks	2	9	4.00	1.44
Workbook (in min per week)	15	75	41.06	16.3
Workbook (in %)	25	100	65.16	22.1
Experiences with mental training	1	8	6.25	2.36

SD= standard deviation

Table 8: Data of the control group

	N	Minimum	Maximum	Mean	SD
age in years	20	14	22	17.60	2.30
size in cm	20	170	193	178.90	6.84
Training frequency (in days)	23	1	4	2.61	0.78
Weekly training frequency in the last 3 months (in days)	23	0.5	4	1.93	1.08
Experiences with mental training	23	3	8	6.91	1.59

SD= standard deviation; N= number of subjects

The control group shows a higher mean in age and previous experiences in mental training than the intervention group, whereby the intervention group shows a higher mean in training frequency (in both categories). The average size is similar in both groups. An explorative data analysis with SPSS 11.5 revealed no significant correlation of the PPT pre-test and post-test results with socio-demographic variables, training frequency or experiences with mental training. Table 9 shows a significant correlation between age and PPT post-test result for the study population. Whereby there is no significant correlation between age and PPT pre-test result for the study population. Furthermore there is a significant correlation between the PPT pre-test and PPT post-test results for the study population. For the intervention group the correlation between PPT pre-test and PPT post-test is highly significant ($p_{\text{pre, post}}$ = .46).

Table 9: Correlation between age, PPT pre-test and PPT post-test results in the study population

		PPT pre	PPT post	Age
PPT pre	Correlation	1.00	.29*	-.14
	Significance (2-way)		.03	.31
	N	55	54	52
PPT post	Correlation	.29*	1.00	.32*
	Significance (2-way)	.03		.02
	N	54	54	51
Age	Correlation	-.14	.32*	1.00
	Significance (2-way)	.31	.02	
	N	52	51	52

* The correlation is significant on the level of .05 (2-way)
Age= Age in years
PPT post= Result PPT post-test;
PPT pre= Result PPT pre-test

Table 10 shows a highly significant correlation between the PPT pre-test and PPT post-test results for the intervention group.

Table 10: Correlations between age, PPT pre and PPT post-test results (N=32)

		PPT pre	PPT post	Age
PPT pre	Correlation	1.00	.46**	-.25
	Significance (2-way)		.00	.00
PPT post	Correlation	.46**	1.00	.02
	Significance (2-way)	.00		1
Age	Correlation	-.25	.02	1.00
	Significance (2-way)	.00	1	

** The Correlation is significant on the level of .01 (2-way)
Age= Age in years
PPT post= Result PPT post-test
PPT pre= Result PPT pre-test

In table 11 further correlations are shown, which refer to data of the intervention group.

Table 11: Correlations between several items of the intervention group (N=32)

		Workbook (min. per week)	Workbook (in %)	Commitment	Age in years
Workbook (min. per week)	Corr.	1.00	.68**	.22	-.32
	Sign.		.00	.22	.08
Workbook (in %)	Corr.	.68**	1.00	.08	-.44*
	Sign.	.00		.67	.01
Commitment	Corr.	.22	.08	1.00	-.13
	Sign.	.22	.67		.49
Age in years	Corr.	-.32	-.44*	-.13	1.00
	Sign.	.08	.01	.49	

** The Correlation is significant on the level of .01 (2-way)
* The Correlation is significant on the level of .05 (2-way)
Corr.= Correlation
Sign.= Significance (2-way)

The use of the workbook (WB in %) correlates highly significant with the use of the workbook (WB in min) and significant negative with the age.
In the next chapter the results of the study are referred to the hypotheses.

4.2 Results referring to the hypotheses

There is a subchapter for each hypothesis.

4.2.1 There is an interaction of time and groups, referring to soccer penalty kick precision in the test setting that is used

Table 12 shows the results of the two-tailed ANOVA with repeated measures with the groups and the time as inter- and intrasubjective factors. The PPT results of the pre- and post-test are the depending variables.

Table 12: Interaction of time and groups, referring to the PPT results of the pre- and post-test

Effect	F ratio	Significance *p*	Eta²
Time	.38	.85	.01
Time*Control Group	2.67	.11	.05

Method of the ANOVA: Wilks-Lambda
df= 52

The interaction of time and groups, referring to the results of the PPT in the pre- and post-test could not significantly be proven. An additional one way ANOVA bisected the value of the significance (p=.11), to a value (p=.055) close to the .05 significance level.

Considering the interaction of time and groups, referring to the means of the PPT results of the groups in pre- and post-test, the improvement of the precision of the intervention group compared to the control group between pre- and post-test is given. The difference of the means ($m_{control}$ - $m_{intervention}$) of both groups is -.17 in the pre-test. In the post-test, the difference ($m_{control}$ - $m_{intervention}$) is 1.17. Table 13 and figure 13 show this increasement of the intervention group results (referring to the mean) compared with the control group results in the PPT tests.

Table 13: PPT results in pre-and post-test of both groups

Results	Group	Mean	SD	N
PPT pre-test	Intervention	8.78	2.30	32
	Control	8.95	2.19	22
	Study population	8.85	2.24	54
PPT post-test	Intervention	9.53	2.48	32
	Control	8.36	3.08	22
	Study population	9.06	2.77	54

SD= standard deviation; N= number of subjects

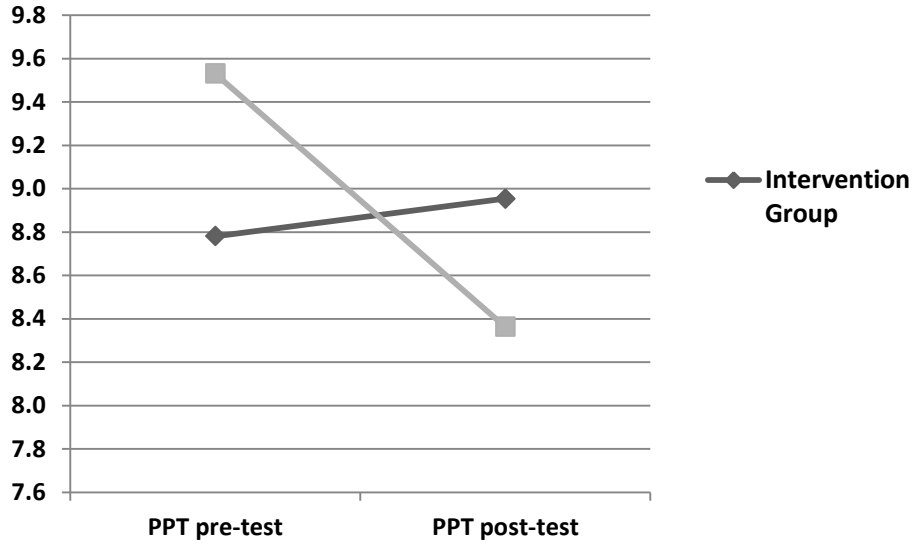


Figure 13: Development of the means of the PPT results of both groups between PPT pre- and PPT post- test

Here it is clearly visible that the intervention group increases their precision test results, while the control group shows lower values in the PPT post-test than in the PPT pre-test. Consequently a penalty precision positive influencing effect size through the mental training intervention is supposed.

4.2.2 Imagery ability influences the ability of precision at the base level

This hypothesis cannot be significantly verified. As shown in the tables 14 and 15 there is no significant correlation of both imagery ability values. The correlation coefficient of the pictoral imagery is .15. The correlation coefficient of the kinaesthetic imagery ability is .73. However, there is a highly significant correlation between the results of both investigated forms of imagery ability – pictoral and kinaesthetic imagery – in the intervention group and the study population.

Table 14: Correlation of the imagery ability with the PPT pre-test results of the intervention group (N=32)

		Pictoral	Kinaesthetic	PPT pre
Pictoral	Correlation	1.00	.65**	.26
	Significance (2-way)		.00	.15
Kinaesthetic	Correlation	.65**	1.00	.06
	Significance (2-way)	.00		.73
PPT pre	Correlation	.26	.06	1.00
	Significance (2-way)	.15	.73	

** The Correlation is significant on the level of .01 (2-way)
Pictoral= Pictoral imagery ability
Kinaesthetic= Kinaesthetic imagery ability
PPT pre= Result PPT pre-test
N= Number of subjects

Table 15: Correlation of the imagery ability with the PPT pre-test results of the study population (N=55)

		Pictoral	Kinaesthetic	PPT pre
Pictoral	Correlation	1.00	.56**	.09
	Significance (2-way)		.00	.51
Kinaesthetic	Correlation	.56**	1.00	-.03
	Significance (2-way)	.00		.85
PPT pre	Correlation	.09	-.03	1.00
	Significance (2-way)	.51	.85	

** The Correlation is significant on the level of .01 (2-way)
Pictoral= Pictoral imagery ability
Kinaesthetic= Kinaesthetic imagery ability
PPT pre= Result PPT pre-test
N= Number of subjects

4.2.3 The application of a workbook influences the effectiveness of the mental training intervention

This hypothesis cannot be significantly verified, because there is no significant correlation between the use of the workbook (in % or min.) with the difference of the PPT pre- and post-test results. Hereby it is referred to the intervention group.

Table 16: Correlation between the use of the workbook and the difference of the PPT pre- and post-test results of the intervention group (N=32)

		WB min.	WB %	Difference
WB min.	Correlation	1.00	.68**	-.10
	Significance (2-way)		.00	.59
WB %	Correlation	.68**	1.00	-.10
	Significance (2-way)	.00		.60
Difference	Correlation	-.10	-.10	1.00
	Significance (2-way)	.59	.60	

** The Correlation is significant on the level of .01 (2-way)
Difference= difference of PPT pre- and post-test results
WB min.= Workbook (in min. per week)
WB%= Workbook (in %)

4.2.4 Imagery ability influences the effectiveness of the mental training intervention

The effectiveness of the mental training intervention was not significantly influenced by imagery ability. No significant correlation of pictoral imagery ability at the one hand or kinaesthetic imagery ability at the other hand with the difference of the PPT pre- and post-test result could be verified. But it could be shown that both forms of imagery, which are investigated, are high significantly interdependent correlating.

Table 17: Correlation between imagery ability and difference of the PPT pre- and post-test result

		Pictoral	Kinaesthetic	Difference
Pictoral	Correlation	1.00	.65**	-.05
	Significance		.00	.78
Kinaesthetic	Correlation	.65**	1.00	.20
	Significance	.00		.28
Difference	Correlation	-.05	.20	1.00
	Significance	.78	.28	

** The Correlation is significant on the level of .01 (2-way)
Pictoral= Pictoral imagery ability
Kinaesthetic= Kinaesthetic imagery ability
Difference= difference of PPT pre- and post-test results
Significance= Significance (2-way)

4.2.5 Commitment influences the effectiveness of the mental training intervention

The effectiveness of the mental training intervention cannot be significantly be influenced by the measured commitment. The correlation coefficient is .00. Hereby it is referred to the intervention group.

Table 18: Correlation between commitment and difference of the PPT pre- and post-test result (N=32)

		Difference	Commitment
Difference	Correlation	1.00	.00
	Significance		.99
Commitment	Correlation	.00	1.00
	Significance	.99	

Difference= difference of PPT pre- and post-test results
Significance= Significance (2-way)

4.2.6 Ability to concentrate influences the effectiveness of the mental training intervention

Table 19 shows that the ability to concentrate, which is intended to be measured by the FAIR with the values L, Q, K, is positive, but not significantly correlating with the penalty precision ability in this study.

Table 19: Correlation of the L, Q and K value with the PPT result and the difference of the PPT pre- and post-test result, showing no significant correlation with the FAIR results and the PPT results (N=29)

		L	Q	K	Difference
L	Correlation	1.00	.70	.99**	.21
	Significance		.00	.00	.29
Q	Correlation	.70	1.00	.75**	-.03
	Significance	.00		.00	.89
K	Correlation	.99**	.75**	1.00	.22
	Significance	.00	.00		.25
Difference	Correlation	.21	-.03	.22	1.00
	Significance	.29	.89	.25	

** The Correlation is significant on the level of .01 (2-way)
Difference= difference of PPT pre- and post-test results
L, Q, K= Values of the FAIR-test
Significance= Significance (2-way)

4.2.7 Age influences the effectiveness of the mental training intervention

The age does not correlate with the effectiveness of the mental training intervention (difference of the PPT pre- and post-test result).

Table 20: Correlation of age and difference of the PPT pre- and post-test results (N=32)

		Difference	Age in years
Difference	Correlation	1.00	.26
	Significance (2-way)		.16
Age in years	Correlation	.26	1.00
	Significance (2-way)	.16	

Difference= difference of PPT pre- and post-test results

4.2.8 The level of somatic anxiety, unease and confidence influences the effectiveness of the mental training intervention

It cannot be significantly shown that somatic anxiety, unease and confidence can influence the effectiveness of the mental training intervention. All three items out of the WAI-S show no significant correlation with the difference of the PPT pre- and post-test results. However, they, including confidence, show a small negative correlation, which is at maximum for unease (-.10). The appropriate data is shown in table 21.

Table 21: Correlation between the WAI-S items and the difference of the PPT pre- and post-test result in the intervention group (N=32)

		Difference	Som. Anx.	Unease	Confidence
Difference	Correlation	1.00	-.04	-.10	-.01
	Sign.		.83	.60	.94
Som. Anx.	Correlation	-.04	1.00	.06	-.30
	Sign.	.83		.76	.09
Unease	Correlation	-.10	.06	1.00	.04
	Sign.	.60	.76		.83
Confidence	Correlation	-.01	-.30	.04	1.00
	Sign.	.94	.09	.83	

Sign.= Significance (2-way)
Difference= difference of PPT pre- and post-test results
Som. Anx.= somatic Anxiety

The following chapter discussed and interprets the results of the study in the context of the underlying literature and expectations of the researchers in regard to the research question.

5 Discussion

This chapter includes the discussion of the study results pre-eminently in regard to the research questions, hypotheses and expectations of the research team. Furthermore the disturbing variables are analysed and the study design is investigated in regard to possible improvements. This chapter closes with a view on the transfer to practice of the study results.

5.1 Discussion of the study results

In respect to the hypotheses of the study it becomes recognizable that none could be significantly verified through the data of the study, but there are indications on positive effects through the mental training intervention. Hypothesis one (there is an interaction of time and groups referring to the PPT results) could closely not significant be verified ($p_{\text{one-wayANOVA}}$= .055). But a strong improvement of the mean of the intervention group concerning the PPT results of the pre- and post-test, with a simultaneous deterioration of the control group results between PPT pre- and post-test indicates a positive effect of the mental training intervention, which was combined with practical training, in contrary to just practical penalty shoot training. This positive effect was expected on the basis of the studies and meta-analyses about the effectiveness of mental training (chapter 2.4); however, the expected effect size could be estimate higher on the same basis of decision. A larger study population had possibly led to a significant interaction between time and groups referring to the PPT pre- and post-test results, due to the small difference of the significance value ($p_{\text{one-wayANOVA}}$= .055) for the interaction of time and groups referring to the PPT pre- and post-test results to the significance criteria p=.05 and due to the described

development of the means of the results in the PPT test of both groups (chapter 4.2.1). Hereby it was not expected that the control deteriorated their PPT results, although they had three weeks of practical training. Perhaps this result is due to disturbing variables.

Concerning the variables that influence the efficacy of mental training (chapter 2.4.1), it was to investigate if they have a verifiable effect on the mental training intervention. But no significant correlation of imagery ability (hypothesis four), ability to concentrate (hypothesis six), somatic anxiety, age (hypothesis seven) or unease and confidence (hypothesis eight) on the mental training intervention could be significantly substantiated. Furthermore no effect of imagery ability on the PPT pre-test results (hypothesis two) could be manifested in the study. The effect of the imagery ability on the PPT pre-test result (hypothesis two) was not appreciable on the basis of the literature review, due to a lack of research. In this field more specific research could show if natural imagery ability (in the absence of mental training) influences the precision ability or other motor or cognitive abilities.

The workbook with different imagery tasks included also tasks referring to the repetition of the soccer penalty imagery, which is, on the basis of research (chapter 2.3), a positive influencing variable for the mental training. A significant influence of the workbook on the mental training intervention in the underlying study could not be shown. Hereby it is to mention that it was expected that the intervention group did spend more time (WB in min. per week, WB in %) with the workbook. A relatively high positive measured commitment result did not influence this (chapter 4.1.5). Furthermore the workbook was strongly adjusted and revised for this study; consequently it was used for the first time in this form.

The commitment itself (hypothesis five) does not influence the efficacy of the mental training intervention. This means that a possible low commitment does not influence the efficacy of mental training on the basis of the study data.

To transfer these study results to practice and for a better understanding of the study data and results the following chapter about the disturbing variables is necessary.

5.2 Disturbing variables

Conducting a field study means having to deal with external confounders. It is assumed that the weather and climate conditions were one of the most important disturbing factors. The study was during October and December and especially in November and December cold, rain and snow affected the study procedure and possibly the results. Hereby the weather conditions had direct physiological influence on the players (cold muscles etc.), indirect possible influence on the precision through clothing (different choice of shoes) and further direct or indirect influence on the imagery through a different visual and further sensual input in different weather conditions in the sessions. Artificial light reduced the possible influence of the darkness on the imagery and PPT results and artificial grass reduced the possible influence of uneven ground on the results in the tests. However, rainy conditions influenced the state of the surface, which could have influenced imagery and performance in the PPT tests. In the PPT post-test of the control group snow covered the surface of the soccer field, which was removed as good as possible with snow shovels in the area around the penalty spot and between penalty spot and goal to get acceptable conditions. It is not traceable if the weather conditions had positive or negative influence on the PPT results, but including them in the imagery leads to a higher complexity of the imagery, which in turn could influence the intervention group results.

A further disturbing factor was that the players had regular training during the sessions two and three. Consequent some players had a rather higher fatigue at the beginning of the session which could influence concentration and coordinative ability (cf. Weineck, 2004). Furthermore the level of fatigue may have influenced the phase of

relaxation, which had to be rather longer for players out of breath. Especially at the soccer field of FC Konstanz several different teams are training, with the consequence of a permanent possibility of noise or distractions through other players during all four sessions. Due to the new situation for the players (some did relaxation exercises for the first time) and maybe due to their age the players sometimes distracted each other in the phase of relaxation through laughing or joking in the first two sessions. Referring to a possible transfer to practice these distractions could be seen as helpful due to a high rate of distractions and noise in a soccer match. For the investigation latter was rather not supportive. The training fields of FC Wollmatingen and of the sport students showed less distracting factors.

The coaches of FC Konstanz and FC Wollmatingen watched all sessions, which is possible another distracting factor, because they did not watch hidden. But also for this aspect the influence on a single player is not verifiable. The coaches also showed their attitude to the study. Except one coach all coaches had a positive attitude to the study and motivated the players. One coach of FC Wollmatingen showed a strong refusal towards the participation of his players, although he agreed to the study procedure beforehand. This refusal could have affected the motivation and commitment of the players during the study period. Prior to begin of the study the study population was chosen team-wise to avoid intensive communication of members of the control group and intervention group. But some of the players of the teams go to the same school or share similar free-time activities, which lead to a communication of the two groups, which possibly resulted in a change of the commitment in the control group. For this point it is to mention that the intervention group finished three weeks earlier with the PPT post-test than the control group. Summarizing, the influence of confounding variables on a single player cannot be traced exactly.

Due to illness, injuries, private or school-based appointments not all players joined all sessions. In the first and last session all players took

part, but in the session two and three permanently two till four players were absent. Furthermore it was difficult to measure the use of the Workbook (WB in min, WB in %), because some players had possibly problems in estimating these variables and because of this the data analysis of this aspect was negatively influenced.

5.3 Points of criticism of the study

With the information of the last chapter some changes could be made to optimize the study. Due to the aim to conduct a study that is practical oriented and in compliance with scientific principles some restrictions have to be seen on both sides also in this study. The fact, that no goal keeper was included, made the mental training easier for the improving of precision (lower complexity level) and the scientific, statistical procedure, but it was a point of criticism for coaches that want a close-to-practice mental training, which made the acquisition more difficult (especially referring to the DFB coordinators). The same argument was used for the legitimation of regular training during the study sessions (another legitimation was the amount of players and the durance of the sessions, which required a good organisation with many assistant). The mental training intervention showed a positive effect on the increasement of the precision in the PPT tests. With a larger study population this effect could result in a significant interaction between time and groups referring to the PPT results. Furthermore a larger study population possibly had reduced the influence of coincidence in the statistical results due to the confounders. Especially the influence of age, imagery ability and ability to concentrate were possibly more differentiated or significantly verifiable through a lager study population through statistical reasons. An acquisition of study participants of the intervention and control group from different social environments reduced the risk of communication between the groups. The conduction of the study in months without snow risk on soccer fields with less noise

and distraction would have reduced these distracting factors. Also a longer durance of the study (more than three weeks) could arise in more differentiated results or possibly in larger (significant) verifiable effects. Additionally a longer intervention for each player in the intervention, could lead to a more efficient ritual and higher rates of repetitions of the imagery, which could influence the efficacy of the mental training intervention positive. A further revision of the workbook, as well as an older study population (referring to the youngest players) may possibly result in a higher efficacy of the mental training intervention.

To go beyond, a second (or third) measurement with the questionnaire during the intervention or at the end may result in more differentiated or significantly verifiable data, e.g. referring to the development of the commitment, the imagery ability or the use of the workbook in the intervention period. The realization of these changes should be considered on the basis of organizational circumstances, financial effort and statistical requirements of the investigation. According to this aspect a bearable compromise for the study population, the members of the research team and the gained knowledge was found for this study, which is repeated for the investigation of the influence of mental training on volleyball and tennis serves.

5.4 Conclusion

In the introduction the transfer to practice of the mental training study results was mentioned. This work delivers results that can be of relevance in practice, because a positive effect of mental training for the improvement of soccer penalty precision is shown. Factors that have significant negative influence on this effect could not be identified. Neither a low level of imagery ability, commitment or ability to concentrate nor age could influence the effect of the mental training intervention in this study significantly. Therefore this work can furthermore be a basis for additional investigations in regard to mental training for the improvement of soccer penalty precision with a goal

keeper, which may increase the degree of practice orientation. Above that the alignment with other results of the study group “Sportpsychologie” may result in beneficial data through the comparison of the application of mental training for the improvement of the precision in different sport skills (volleyball and tennis serve) with a comparable complexity level, since the same intervention and study procedure is used for investigations in this fields. Further, also other soccer-relevant technique skills could be improved with this mental training intervention. A higher ability for precise soccer penalties (or other technique skills) through mental training may increase the resilience variables of players in situations under pressure, such as at the penalty kick, and could lead to more goals.

6 Table of Literature

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Appendix

In the appendix the task-relevant content of the workbook for the mental training intervention group is presented (p.70-81). It is strongly adjusted and revised for the use in this study on the basis of Kluge (2008). Thereafter the instructions for the relaxation and the imagery tasks of the intervention group sessions are shown (p. 82), which originate from the working group “Sportpsychologie” at the University of Constance.

Universität Konstanz

Workbook Mentales Training im Fussball

Universität Konstanz

Sportwissenschaft

Übungsblock 1

1.Woche

- Sinnesübungen -

Übung 1: Foto-Übung

Schritt 1:

Schließe Deine Augen und atme ruhig und gleichmäßig.

Beobachte, wie sich Deine Bauchdecke beim Einatmen hebt und beim Ausatmen langsam wieder senkt.

Atme dreimal tief ein und aus. Zähle beim Einatmen langsam bis drei und beim Ausatmen langsam bis sechs.

Schritt 2:

Stelle Dir vor, Deine Augen wären die Linsen eines Fotoapparates.

Schritt 3:

Suche Dir einen Ausschnitt Deiner Umwelt aus zum Beispiel Deinen Trainingsort, Deine Wettkampfstätte, Dein Zimmer, eine Landschaft oder einen anderen Ort deiner Wahl.

Schritt 4:

Schau Dir diesen Ort für 1-2 Sekunden an und schließe dann sofort Deine Augen.

Du „schießt“ quasi ein Foto von Deinem ausgewählten Ort mit Deinen Augen.

Schritt 5:

Versuche nun (immer noch mit geschlossenen Augen), das eben geschossene Foto klar und deutlich vor Deinem inneren Auge zu sehen. Nimm das Bild mit allen Einzelheiten so klar wie möglich mit all Deinen Sinnen wahr.

Was siehst Du? Was riechst Du? Was fühlst Du? Was hörst Du? Was schmeckst Du?

Schritt 6:

Bei unklarem inneren Bild die Augen nochmals öffnen und Schritte 3 bis 5 wiederholen

Weitere Tipps zu dieser Übung:

- Diese Übung kannst Du super in Deinen Alltag integrieren. Du kannst Sie überall anwenden.

- Auch in Deinen Wettkampfpausen kannst Du diese Übung immer wieder durchspielen und Dir zum Beispiel deinen Wettkampfort immer wieder vor Deinem inneren Auge hervorrufen.
- Versuche, klare, deutliche, detaillierte Bilder mit geschlossenen Augen entstehen zu lassen.
- Diese Übung trainiert Deine Sinne, Aufmerksamkeit, Konzentration und Deine Vorstellungsfähigkeit.

Übung 2: Fernbedienung-Übung

Schritt 1:

Schließe Deine Augen und atme ruhig und gleichmäßig.

Beobachte, wie sich Deine Bauchdecke beim Einatmen hebt und beim Ausatmen langsam wieder senkt.

Atme dreimal tief ein und aus. Zähle beim Einatmen langsam bis drei und beim Ausatmen langsam bis sechs.

Schritt 2:

Stelle Dir vor, dass Du eine Fernbedienung in Deiner Hand hältst. Auf der Fernbedienung findest Du Tasten, mit denen Du verschiedene Einstellungen vornehmen kannst:

- Laut / Leise,
- Hell / Dunkel,
- Zeitlupe / schneller Vorlauf,
- Zoom von klein bis groß.

Schritt 3:

Stelle Dir nun einen Ort Deiner Wahl vor (z.B. Wettkampfort, Trainingsort, Kaufhaus etc.).

Versuche Dir Geräusche, Umgebung, Gegenstände, Farben usw. sehr genau vorzustellen.

Schritt 4:

Verwende nun Deine Fernbedienung und verändere nach Lust und Laune Deinen Ort.

In Deiner Vorstellung kannst Du Dir auch Tasten für Gerüche, Gefühle und Gedanken auf Deiner Fernbedienung einrichten.

Weitere Tipps zu dieser Übung:

- Diese Übung kannst Du an vielen verschiedenen Orten üben. Sei einfach kreativ und denke Dir die unterschiedlichsten Orte aus, die Du magst.
- Die Fernbedienung-Übung trainiert Deine Sinne, Konzentration, Aufmerksamkeit und Deine Vorstellungsfähigkeit.
- Du kannst sie super in Deine Sportart integriere: pack zum Beispiel bei Geräuschen, die Dich stören, Deine Fernbedienung aus und stelle sie leise, oder pack deine Fernbedienung aus, wenn Menschen Dich im Training oder im Wettkampfablenken und zoome sie einfach klein

WICHTIG!

Du musst diese Übung erst gut trainieren und super beherrschen. Teste sie dann erst im Training und schau, wie Du zurechtkommst, bevor Du sie im Wettkampf anwendest.

Übung 3: Obst-Übung

Schritt 1:

Schließe Deine Augen und atme ruhig und gleichmäßig.

Beobachte, wie sich Deine Bauchdecke beim Einatmen hebt und beim Ausatmen langsam wieder senkt.

Atme dreimal tief ein und aus. Zähle beim Einatmen langsam bis drei und beim Ausatmen langsam bis sechs.

Schritt 2:

Stelle Dir einen Obstkorb mit vielen, verschiedenen Obstsorten vor.

Nimm eine Orange heraus. Schaue Dir die anderen Obstsorten, die noch im Korb liegen, ganz genau an.

Schritt 3:

Gucke Dir Deine Orange an. Eine schöne, orange Frucht.

Stelle Dir diese Organe vor. Ihre Farbe, ihre Form. Wie fühlt sich Ihre Schale an? Wie riecht Sie?

Schritt 4:

Stelle Dir vor, Deine Orange mit den Fingern zu schälen und wie der Saft herausquillt.

Achte darauf, wie sie riecht, während Du sie schälst. Achte auf die Geräusche während des Schälens.

Schritt 5:

Teile die Orange in Viertel. Fühle den Saft und das Stück Orange in Deinen Fingern.

Stelle Dir vor, wie die Orange schmeckt.

Wie fühlt es sich an, wenn Du die Orange isst? Wie schmeckt sie?

Schritt 6:

Lass das Bild der Orange langsam verblassen. Nehme Deinen Körper wieder wahr.

Strecke und räkele Dich und atme dreimal tief durch. Öffne dann die Augen.

Weitere Tipps zu dieser Übung:

- Natürlich kannst Du diese Übung mit allen Nahrungsmitteln üben, die Du magst.
- Diese Übung trainiert Deine Sinne, Aufmerksamkeit, Konzentration und Deine Vorstellungsfähigkeit.
- Auch diese Übung kannst Du immer super in Deinen Alltag integrieren und immer wieder üben.

Du wirst sehen, dass deine Vorstellung von dem Objekt umso genauer und detaillierter wird, je öfter Du diese Übung wiederholst.

Übungsblock 2

2.Woche

- Energielevel-Übungen-

Übung 4: Persönliche Sieg-Formel

Schritt 1: Nimm eine für Dich bequeme Körperhaltung ein.

Schließe Deine Augen und atme ruhig und gleichmäßig.

Beobachte, wie sich Deine Bauchdecke beim Einatmen hebt und beim Ausatmen langsam wieder senkt.

Atme dreimal tief ein und aus. Zähle beim Einatmen langsam bis drei und beim Ausatmen langsam bis sechs.

Schritt 2: Stelle Dir in Deinem entspannten Zustand Bilder vergangener sportlicher Höhepunkte vor.

Schritt 3: Überlege Dir welche Bilder, Symbole oder Sätze Dir zu diesen Momenten einfallen. Stelle Dir begleitende Formulierungen geistig vor.

Wie hast Du Dich gefühlt? Was hast Du zu Dir gesagt? Wie hast Du Dich motiviert?

Zum Beispiel:

- „Heute ist mein Tag!“
- „Von Anfang bis Ende, in jeder Situation, gebe ich mein Bestes!“
- „Heute zeig ich, was ich drauf hab!“
- „Das ist mein ganz großer Tag!“
- „In mir steckt ein Sieger!“

Schritt 4: Dies sind nur Beispiele. Wähle Dein/e ganz persönliche/s Formulierung/Symbole, die/das Dich motiviert,

Es soll Dich auf Dein persönliches Energielevel im Training oder im Wettkampf bringen, das Dich unterstützt.

Weitere Tipps zu dieser Übung:

- Bilde einfache Sätze in Gegenwartsform!
- Wiederhole die Formel mehrfach und regelmäßig!
- Benutze nur positive Formulierungen!
- Die Formulierung soll sich gut anfühlen und Zuversicht auslösen.
- Probiere Deine Formulierung erst im Training aus (z.B. teste sie in den Aufwärmphasen oder sag Dir Deine Formel kurz bevor Du im Training auf Zeit dribbelst).
- Du musst diese erst beherrschen und Dein/e Formel/Symbol muss Dich unterstützen, bevor Du sie/es außer-halb des Trainings anwenden kannst.

Übung 5: Problembox-Übung

Schritt 1:

Leg Dir Schreibzeug und einen Briefumschlag bereit.

Nimm eine bequeme Körperhaltung ein.

Schließe Deine Augen und atme ruhig und gleichmäßig.

Beobachte, wie sich Deine Bauchdecke beim Einatmen hebt und beim Ausatmen langsam wieder senkt.

Atme dreimal tief ein und aus. Zähle beim Einatmen langsam bis drei und beim Ausatmen langsam bis sechs.

Schritt 2:

Lass Deine Gedanken ziehen wie Wolken am Horizont.

Nimm Dir hierfür so viel Zeit, wie Du benötigst.

Schritt 3:

Registriere alle auftretenden unangenehmen Gedanken, die im Hinblick auf den Wettkampf störend wirken und schreibe sie auf.

Schritt 4:

Leg das Geschriebene in einen Umschlag oder in eine Schachtel (Schublade), die „Problembox“, und bewahre es für die Dauer des Wettkampfes dort auf.

Schritt 5:

Hole den Umschlag erst nach dem Wettkampf aus Deiner Problembox und lese Deinen Zettel. Versuche bis zum nächsten Wettkampf Lösungsstrategien für die aufgeschriebenen Störquellen zu suchen.

Weitere Tipps zu dieser Übung:

- Diese Übung dient der Wahrnehmung von Störungsquellen und hilft Dir, Deine Nervosität zu mindern.

- Beziehe bei dem 5.Schritt Deinen Trainier mit ein. Vielleicht kann er Dir helfen, gemeinsam Lösungsstrategien zu finden.

Übung 6: Deine persönliche Wettkampfeinstimmung

Ziel ist die Aufnahme Deiner ganz persönlichen Kassette /CD/ MP3 (oder auch ein beschriebenes Papier).

Schritt 1:

Spreche (bzw. schreibe) eine Ansage des Wettkampfes.

Sie soll die Zeit und das Datum des Wettkampfes beinhalten.

Schritt 2:

Beschreibe die Wettkampfsituation, die Anforderungen und die erforderliche Wettkampftechnik und -taktik.

Schritt 3:

Überlege Dir viele Sätze und Bilder, Symbole, die Dich motivieren und die Dich positiv stellen.

Schreibe sie zuerst auf. Hier ein Beispiel:

„Ich weiß, dass ich gut bin!“ – „Ich freu mich auf den Wettkampf!“ – „Ich bin physisch und psychisch gut vorbereitet!“ – „Sobald es los geht, werde ich voll konzentriert sein!“ – „Ich werde handeln, ohne an Zukunft oder Vergangenheit zu denken!“

Dies ist nur ein Beispieltext. Du kannst ihn gerne ändern oder ergänzen.

Schritt 4:

Spreche Deinen Text nun auf Dein Band.

- Bei der Aufnahme CD sollte Deine Stimme Stärke und Zuversicht ausstrahlen.
- Die Kassette/MP3/CD/Papier kann bei jeweiliger Erneuerung von Schritt 1 und 2 zur Vorbereitung auf jeden Wettkampf (bzw. Training) verwendet werden.
- Du solltest die Aufnahme in ungestörter Umgebung zu einer ruhigen Tageszeit durchführen, bis die Aufnahmen für Dich zufriedenstellend sind.
- Du kannst die Aufnahme mit einem Musikstück kombinieren, dass Dein für Dich passendes Befinden im Wettkampf unterstützt. Wichtig ist hierbei, dass Dein Musikstück Dich beruhigt bzw. anheizt, je nachdem, welches Energielevel für Dich im Training/Wettkampf von Vorteil ist und Deine Leistungsmotivation optimiert.
- Du kannst Deine persönliche Wettkampfeinstimmung immer wieder in ruhigen Zeiten hören bzw. lesen.

WICHTIG!

Wende sie erst in Wettkämpfen an, wenn Du es gut trainiert und wirklich perfekt getestet hast. Übe erst im Training.

Übungsblock 3

3. Woche

- Bewegungsvorstellungsübungen –

Übung 7: Das ideale Vorbild

Schritt 1:

Stelle Dir einen Sportler vor, der das, was Du an Deiner Leistung verbessern willst, perfekt beherrscht.

Achte darauf, dass sein Stil dem Deinigen nicht total entgegensteht.

Schritt 2:

Nimm eine bequeme Körperhaltung ein.

Schließe Deine Augen und atme ruhig und gleichmäßig.

Beobachte, wie sich Deine Bauchdecke beim Einatmen hebt und beim Ausatmen langsam wieder senkt.

Atme dreimal tief ein und aus. Zähle beim Einatmen langsam bis drei und beim Ausatmen langsam bis sechs.

Schritt 3:

Stelle Dir Deinen Trainingsort vor; statt Dich selbst auf dem Platz zu sehen, schaust Du jetzt Deinem Vorbild zu.

Achte besonders darauf, wie er/sie mit seinem/ihrem Körper umgeht, wenn er/sie die Bewegungen ausführt, die Du üben willst. Sehe ihm/ihr ein paar Mal zu.

Entspanne Dich wieder, atme dreimal tief ein und langsam wieder aus, und versetze Dich zurück auf die Wettkampfstätte. Dein Vorbild bewegt sich wieder perfekt.

Schritt 4:

Konzentriere Dich so lange auf seine/ihre Hände, bis Du den Eindruck hast, es sei Deine Hand. Du kannst Dich jetzt in seinen/ihren Körper hineinversetzen und stellst fest, wie es sich anfühlt, wenn man die perfekte Bewegung ausführt.

Achte auf die Leichtigkeit, die Stärke, die Selbstverständlichkeit und die Freude an der richtigen Bewegung, und nachdem Du die richtige Bewegung ein paar Mal gemacht hast, hole diese Gefühle zu Dir in Dein Zimmer.

Weitere Tipps zu dieser Übung:

- Je enger die persönliche Identifikation mit Deinem Vorbild gelingt, je besser Du Dich in die Person hineinzuversetzen vermagst und Dir vorstellen kannst, welche Zuversicht und Sicherheit sie entwickelt, desto wirksamer stellt sich der mobilisierende Effekt für die eigene Bewegung dar.
- Wende diese Übung bei Bewegungsabläufen an, bei denen Du Schwierigkeiten hast in ihrer Ausführung. Ziel ist die Optimierung von Bewegungsabläufen.

Übung 8: Dein perfektes Bild

Schritt 1:

Nimm eine bequeme Körperhaltung ein.

Schließe Deine Augen und atme ruhig und gleichmäßig.

Beobachte, wie sich Deine Bauchdecke beim Einatmen hebt und beim Ausatmen langsam wieder senkt.

Atme dreimal tief ein und aus. Zähle beim Einatmen langsam bis drei und beim Ausatmen langsam bis sechs.

Schritt 2:

Erinnere Dich an eine perfekte sportliche Handlung aus der Vergangenheit, in der „alles stimmte“, wo „alles klappte“, in der Du Dich einfach „super“ fühltest!

Schritt 3:

Führe Dir diese Szene immer wieder vor Augen. Und beobachte Dich von verschiedenen Positionen, um herauszufinden, welcher Aspekt Deiner eigenen Technik für die perfekte Leistung verantwortlich gewesen war.

Schritt 4:

Versetzte Dich in Deine eigene Person, konzentriere Dich besonders auf diesen einen Aspekt und mache Dir bewusst, wie es sich anfühlt, es richtig zu machen.

Schritt 5:

Sehe Dir bei Deiner Bewegung zu, bei der alles stimmt. Beende die Übung indem Du dabei Freunde und Sicherheit empfindest, wie Du eine gute Leistung vollbringst.

Bringe dieses positive Gefühl aus der Vorstellung mit in die Realität des Zimmers zurück, in dem Du Dich gerade aufhältst.

Weitere Tipps zu dieser Übung:

- Anwenden kannst Du diese Übung zum Beispiel, wenn Du zurzeit mit einem Bewegungsablauf Schwierigkeiten hast, die Du früher nicht hattest. Durch die Vorstellung kannst Du erkennen, was Du früher anderes gemacht hast.
- Du kannst Bewegungsfehler erkennen und die Bewegungssicherheit wieder erlangen
- Übe an einem ungestörten Ort und wende diese Übung auch erst wieder nur im Training an, bis Du sie perfekt beherrscht, bevor Du sie im Wettkampf nutzt.

Übung 9: Replay-Übung

Das „Replay“ ist die sofortige mentale Wiederholung der Leistung. Du solltest das „Replay“ üben, wenn Du beim Training gerade eine bestimmte Bewegung oder Fertigkeit beendet hast und Zeit hast, sie im Geist noch einmal ablaufen zu lassen.

Schritt 1:

Schließe nach der praktischen Bewegungsausführung (z.B. dem Elfmeter) deine Augen und atme ruhig und gleichmäßig.

Atme dreimal tief ein und aus. Zähle beim Einatmen langsam bis drei und beim Ausatmen langsam bis sechs.

Schritt 2:

Stelle Dir die vergangene Bewegung vor: Wie hat es sich angefühlt, als Du Dich auf diese Bewegung vorbereitet hast und sie dann ausgeführt hast?

Schritt 3:

Stelle Dir vor, dass Du das Ganze noch einmal durchläufst. Wie verhält sich Dein Körper, wie bewegt er sich, und wie sehr kontrollierst Du diese Bewegung? Welche Eigenschaft kommt dabei zum Ausdruck?

Schritt 4:

Gehe wieder zum Anfang zurück und werde zum Beobachter der eigenen Leistung. Hast Du einen Teil Deines Körpers vernachlässigt?

Führe Dir die Szene noch einmal vor Augen, versetze Dich wieder in Dich hinein, und achte darauf, woran Du gerade vor dem Ansatz zur Ausführung gedacht hast. Was hast Du gefühlt? Haben diese Gedanken und Gefühle unmittelbar vorher geholfen oder abgelenkt?

Schritt 5:

Gibt es eine technische Veränderung, die Du vornehmen solltest? Dann spiele Dir die vergangene Leistung wieder vor, behalte alle positiven Aspekte bei und verändere das, was Deine Leistung verbessern würde.

Jetzt visualisiere die verbesserte Version.

Weitere Tipps zu dieser Übung:

- Verwende die verbesserte Version dann, wenn Du Dich wieder kurz vor der Ausführung der Bewegung befindest.
- Du kannst das „Replay“ auch nach einer perfekten Leistung anwenden, um Dir diese besser einzuprägen.
- Übe das „Replay“ solange im Training, bist Du keine Schwierigkeiten mehr damit hast. Erst dann kannst Du diese Methode im Wettkampf nutzen.

Übung 10: Zielübungen

Schritt 1: Setze Dich aufrecht und bequem auf einen Stuhl. Atme einige Male tief und ruhig ein und aus. Stelle Dir eine rechteckige Zielfläche vor, in der Du den Ball platzieren möchtest. Die

Zielfläche ist ca. 1,0m lang und 0,5m breit und befindet sich in einer der oberen Ecken des Tores.

Schritt 2:

Stelle Dir vor, wie du den Ball durch deinen Schuss in diese Zielfläche platzierst. Du nimmst Anlauf. Du triffst ihn perfekt mit deinem Fuß. Der Ball trifft wuchtig genau die Zielfläche. Der Torwart versucht, ihn zu erreichen, berührt ihn aber nur noch leicht, der Ball zappelt im Netz. Du freust Dich über deinen erfolgreichen Elfmeter und ballst die Faust.

Schritt 3:

Wiederhole nun das oben genannte Bild einige Male.

Schritt 4:

Du kannst die Zielfläche durch weitere Felder ersetzen und die Übung wie oben erklärt durchführen:

- Dein Ziel ist, den Ball in die linke untere Ecke des Tores zu schießen. Diese ist deine neue Zielfläche.

Oder

- Deine Zielfläche ist die rechte untere Ecke des Tores.

  Führe die Übungen mit der neu ausgewählten Zielfläche durch.

Ende des Workbooks

Atementspannung mit Vorstellunsaufgaben während der Interventionen der Studie

Einleitung:

Nimm eine entspannende Sitzposition ein. *Im Sitzen: Setz dich auf die Bank und stell die Füße fest auf den Boden auf. Der Rücken sollte gerade sein und die Schultern sollten lose herunter hängen. Der Kopf sollte mit möglichst geringem Muskelaufwand entspannt auf dem Hals stützen. Die Hände können lose auf den Oberschenkeln oder im Schoß platziert werden. Im Liegen: Kopf und Nacken sollten durch ein Kissen leicht gestützt werden, die Hände sollten entspannt neben dem Körper oder auf dem Bauch liegen.*

- Schließe nun Deine Augen.

<u>Atementspannung:</u>

- Atme 4 mal tief ein und aus
- Richte dich ganz auf und führe deine Schulterblätter zusammen, atme dabei ein
- Lass nun deine Schultern leicht fallen und atme aus
- Sitze nun wieder gerade und atme tief ein. Zähle dabei langsam auf 4
- Bleibe aufrecht und atme langsam aus. Zähle dabei auf 4
- Wiederhole diese Übung. Entspanne dich. Genieße die Ruhe
- Spüre wie dein Bauch sich hebt und senkt während du tief ein und ausatmest
- Konzentriere dich auf den langen Luftstrom deines Atems
- Lass ihn frei fließen. Genieße diesen Zustand. Die Ruhe und Harmonie.
- Atme langsam und gleichmäßig

Vorstellung der Flugbahn

- Stell Dir jetzt vor, wie Du auf dem Fußballplatz einen Elfmeter schießt. Du befindest dich knapp vor dem Elfmeterpunkt und übst deinen Elfmeterschuss, den du mit hoher Geschwindigkeit und Präzision in Richtung der Zielfläche triffst.
- Konzentriere Dich nun auf die Flugbahn des Balles. Den Ball triffst perfekt und mit voller Wucht. Der Ball verlässt deinen Fuß und trifft in die Mitte der Zielfläche. Du siehst die Flugbahn des Balles klar und deutlich.
- Der Torwart versucht den Ball noch zu halten, aber dein Schuß ist zu plaziert. Ein intensives Gefühl der Freude steigt in dir auf und du ballst die Faust.
- Führe Deinen Elfmeterschuß mehrmals im Kopf durch. Konzentriere Dich auf die Flugbahn des Balles.

Ausklingen

- Beuge Deine Arme fest an
- Atme tief durch
- Öffne deine Augen

Kurzvorstellung auf dem Platz

Nimm Deine Position zum Elmeterschießen ein. Überleg dir schon während du den Ball auf den Elfmeterpunkt plazierst in welche Ecke du schießen willst. Schließe die Augen und stellt Dir vor, wie die Flugbahn des Balles in die gewünschte Ecke führt und der Ball in die Mitte der Zielfläche eintrifft.

Jetzt führe den Elfmeter durch!

Wie gut ist dir die Vorstellung gelungen?

Woran lag das?

Könnte man das Ritual ändern?

- Diese Kurzvorstellung mehrmals wiederholen –

Declaration

Hereby I assure that the work

"Improvement of soccer penalty kick precision through mental training"

is made by myself and without any unauthorized aid. It was not presented for any examination on another place and it is not published as full text or excerpt at the present time. The parts of the work, including tables, maps, pictures, etc., which are extracted out of other works referring to wording or sense are marked as reference and the origin is demonstrated.

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