Level 3 Surf Coach
Post Course Research Assignment:
Mental Practice

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INTRODUCTION

The relationship between cognitive factors and athletic performance has received a great deal of attention in recent years. With most elite athletes trained to a very similar physiological state coaches and athletes are trying to get a competitive advantage wherever they can. Most commonly coaches and athletes will look to nutrition, equipment, technique, skills, tactics and recovery methods as areas where advantage may be gained. Perhaps though, the largest advantage may be gained from mental practice. Researchers have thus begun to examine the role that specific cognitive strategies play in improving motor performance. This paper and experiment contemplates the question of whether athletes really can gain a competitive advantage by investing time in a mental practice.

BACKGROUND

Mental practice (imagery) can be defined in a number of ways:

> *Mental practice refers to the cognitive rehearsal of a physical skill in the absence of overt physical movements* (Magill, 1989).
>
> *Mental practice simply involves practicing as a visual image an athletic technique, procedure or event in ones mind* (The Elite Athlete, 1987).
>
> *Imagery is the ability to evoke a vivid image like a real picture in the mind* (The Elite Athlete, 1987).
>
> *Imagery is an experience similar to a sensory experience (seeing, feeling, hearing) but arising in the absence of the usual external stimuli* (Martens, 1987).
>
> *Imagery involves using all the senses to recreate or create an experience in the mind* (Williams, 1986).

Mental imagery essentially provides the performer with a chance to deal with a problem or event in their head before being confronted with it in a real situation. If and when the problem or event arises, having practiced mentally, the performer

will be more readily prepared to cope. Mental practice allows the performer to confront situations feeling confident, like ‘I’ve been here before’ or “I can handle this’. Additionally mental practice has the advantage of being able to be stopped in the midst of an error with corrective measures then adopted prior to suffering any negative ramifications such as poor performance or injury.

An individual is said to be engaged in mental practice when he or she is imaging a skill, or part of a skill that is actually being performed. Observation of the performers musculature whilst mental practice is being conducted will result in no apparent muscle movement. This imaging may occur while the learner is observing another person or a film, or it may occur without any visual observation.

Mahoney and Avener (1977) categorized these two types of imaging as internal and external imagery. Internal imagery involves the individual actually imaging the real life situation to an extent where that person actually images being inside his/her body and experiencing those sensations, which might be expected in the real situation. External imagery by contrast, involves the individual viewing himself/herself from the perspective of an observer, as in watching a video of oneself.

Imagery is more than just visualizing an experience in your minds eye, although visualization is usually the dominant sense. Imagery can and should involve all the senses. In sport the visual, auditory (hearing), olfactory (smell), taste, tactile (touch) and kinesthetic senses are all important. Kinesthetic sense is the sensation of the body as it moves in different positions. A combination of all these senses helps the athlete create more vivid and effective images.

It is now that the importance of experience or elitism manifests itself. When a performer experiences reality they learn to attach various emotional states or moods to these experiences. Martens (1982) proposed that in using imagery to help control anxiety, anger or pain athletes must be able to recreate these emotions in their minds. For this reason mental imagery is generally more effective with the highly skilled athlete.

Imagery is based on memory and is experienced internally by reconstructing external events in the performers mind. Pieces of information stored in the long term memory from all types of experiences are reshaped into meaningful reverie via a thought process. This allows the performer to create new event in their mind. As the programmer of their own imagery program the performer is able to build an image from whatever pieces of memory they choose.

When an action is imaged the central nervous system (CNS) sends impulses in a pattern associated with that action. The stimulation that is generated by imaging is manifested bodily in the neurological patterns generating low levels of muscular response. The more the skill is imagined the more efficient and

effective subsequent imagery or action becomes. This indicates that regular mental practice is effective.

It has already been said that senses and emotions are important in the practice of imagery and how imagery may be used to recreate past experiences as well as future ones. It remains now then, how can a sensory experience in our mind enhance our ability to perform in sport? Sports psychologists have developed two theoretical explanations for this imagery phenomenon.

Psycho-Neuromuscular Theory

When athletes engage in various sports movements the brain is constantly transmitting impulses to the muscles for the execution of the movements. Psycho-neuromuscular theory proposes that similar impulses occur in the brain and muscles when athletes imagine the movements without actually performing them. Therefore, although the magnitude of the efferent activity is reduced during imagery, this activity is a mirror image of overt performance patterns. When the neuromuscular activity mirrors actual physical performance it is said to be localized. This localization of the neuromuscular activity during imagery provides feedback to the movement schema in the brain. The feedback can then be used either to make cognitive comparisons and then corrections in the motor response or to provide a preparatory set for future performance.

Jacobson (1931) first supported this theory by demonstrating that the imagined movement of bending the arm created contractions in the flexor muscles of the arm. Hale (1982) later supported Jacobson by presenting evidence to shoe that the slight firing of neural pathways lays down a mental blue print that helps the individual execute the movement at a later date.

Through imagery then athletes may actually strengthen the neural pathways for certain movements in their sport by continuously practicing a skill over and over. This is a form of response preparation that aids in the tuning process hence overall performance.

Symbolic Learning Theory

This alternative theory advocates that imagery can facilitate sports performance by functioning as a coding system to help athletes acquire or understand movement patterns. All movements must be encoded by the human central nervous system i.e. we must have a blueprint or plan for the movement. This helps the athlete by making the movements more familiar and perhaps more automatic and flawless, the object in performing any sport.

Sackett (1934) first proposed this theory by stating that imagery enables performers to rehearse the sequence of movements as symbolic components of a task. Their theory has also been supported by research showing improved free throw shooting (Hall & Erffmeyer, 1983) and motor performance (Housner, 1984) by using imagery to mentally encode modeled movement behaviours.

Mental practice (covert rehearsal) has been studied extensively throughout this century. Rawlings, Rawlings, Chen and Yilk (1972) studied the rotary pursuit test, making some striking discoveries. All groups in the study were introduced to the task on Day 1 and received 25 trials. On days 2-9 subjects differed in their practice methods. A Physical Practice group practiced 25 trials per day, a No Practice group received no practice, and a Mental Practice group practiced the task only by imaging and visualizing it. On Day 10 the transfer test was conducted. The Mental Practice group improved (learned) considerably over the course of the experiment, almost to the extent that the Physical Practice group did. The No Practice group did not improve significantly during the same period.

Richardson (1967a, 1967b) and Corbin (1972) conducted extensive reviews of studies to evaluate the effects of imagery training on motor performance. The researchers concluded that imagery is valuable in learning and performing sports skills. Martens (1982) followed up this research related to sport and motor behaviour from 1970 to 1982. He too concluded that imagery training is an effective technique in improving sport performance.

HYPOTHESES

Taking all the previously mentioned studies into account and not forgetting opposing studies and theories such as Rotella, Gransneder, Ojala and Billing (1982) who oppose Mahoney and Aveners internal and external imagery theory I propose the following, in accordance with Magill (1989):

1. Physical practice is better than mental practice or no practice;
2. Mental practice is better than no practice;
3. A combination of mental and physical practice used in alternating fashion is better than physical practice alone

Note: It is not proposed that mental practice is a substitute for physical practice, however mental practice can enhance the quality of physical practice and peformance.

METHOD

Subjects

Subjects were randomly selected for one set of trials each. Subjects were arranged into groups of two. The gender of each subject was not important. Important was the fact however, that they use their dominant hand.

Apparatus

A talking pen, maze tracings and clock counter were used to conduct the experiment. The talking pen, as it was called, was used to trace around the maze whilst the clock counter kept a record of the number of errors and the ten second time limit.

Procedure
Four groups of two were formed and randomly allocated to the following types of practice conditions. Each group was given a brief explanation of the procedure and an explanation as to their role in the experiment i.e. to trace the maze with no mistakes in the time limit of ten seconds.

Group 1 – No Practice
This group received one physical trial (maze trace). The physical trial was then followed by five minutes of reading a textbook. After this five minute rest period a second physical trial was conducted.

Group 2 – Mental Practice
This group received one physical trial (maze trace) followed by ten mental practice trials. After the ten mental practice trials a second physical trial was conducted. The mental practice involved imagining going through the maze as accurately and as fast as possible and when the subject believed the time was up he/she called “stop”. Feedback was then given to the subject to try and go faster or slower through the maze. Subjects were given a rest of 5 seconds between the mental trials.

Group 3 – Physical Practice
This group received one physical trial (maze trace) followed by twenty physical practice trials. Subjects were given a rest of 5 seconds between the physical trials. After the twenty physical practice trials a second physical trial was conducted.

Group 4 – Mental and Physical Practice
This group received one physical trial (maze trace) followed by twenty practice trials which, alternated between two mental practice trials followed by two physical practice trials until ten practice trials were completed for each. Subjects were given a rest of 5 seconds between the trials. After the twenty practice trials a second physical trial was conducted.

NOTE: The task of tracing the maze was restricted to either 10 or 20 seconds on the clock counter. As a result, the ten second time limit was chosen and the proposed rest period of 15 seconds reduced to 5 seconds.

RESULTS
Results were based on the difference between the first physical trial (pre practice) and the second physical trial (post practice). The results of practice trials between these two trials were not recorded. Results are the actual errors that the subject made whilst completing the maze tracing in the allotted time.

Group	Subjects	Errors Pre	Errors Post
No Practice	Subject 1	3	0
	Subject 2	1	1
Mental Practice	Subject 1	6	0
	Subject 2	3	2
Physical Practice	Subject 1	0	1
	Subject 2	2	0
Mental & Physical	Subject 1	0	0
	Subject 2	6	2

- The No Practice group made four (4) errors on their initial physical trial and improved by making one (1) error after five minutes of reading. Difference = 3 or 75% reduction in errors.
- The Mental Practice group made nine (9) errors on their initial physical trial and improved by making two (2) errors after ten mental practice trials. Difference = 7 or 77% reduction in errors.
- The Physical Practice group made two (2) errors on their initial practice trial and improved marginally by making one (1) error after 20 physical practice trials. Difference = 1 or 50% reduction in errors.
- The Mental and Physical Practice group made six (6) errors on their initial practice trial and improved by making two (2) errors after an alternating combination of 20 mental and physical practice trials. Difference = 4 or 66% reduction in errors.

For the No Practice group to achieve almost as high a reduction in the number of recorded errors as the Mental Practice group was surprising. For the Mental Practice group to record the most significant improvement in performance was positive. Where the Physical Practice group recorder very few errors in the initial physical practice trial improvement from physical practice was almost impossible to determine. The improvement in performance of the Mental and Physical Practice group was positive however the level of improvement being less than the No Practice and Mental Practice groups was disappointing in terms of supporting the hypotheses. The level of effect that each type of practice condition had was difficult to determine.

DISCUSSION

The results did not prove or disprove the proposed theory that:

1. Physical practice is better than mental practice or no practice;
2. Mental practice is better than no practice;
3. A combination of mental and physical practice used in alternating fashion is better than physical practice alone.

The results did show that a combination of mental and physical practice used in alternating fashion is better than physical practice alone. However no practice

and mental practice alone confounded the theory by showing a greater improvement between pre and post test results.

The fact that the results did not totally support the hypotheses was disappointing. Several limitations to the experiment may help to explain the results.

If conducting the experiment again the suggested 15 second time limit with a 15 second rest between trials would be implemented. The 10 second time limit and 5 second break employed in the experiment may well have had an adverse (fatigue) effect on those subjects practicing up to 20 trials repeatedly.

A larger sample of subjects per group is also suggested to generate greater reliability. 2 members per group would appear not to allow for personal variables such as experience, hand-eye coordination, manual dexterity etc.

Subjects may have had past experience with the maze or any mazes. Practice at such a specialized skill would be advantageous.

The degree of skill that subjects possess in the art of mental practice (imagery) is a limitation. Highly developed mental practice skills would be advantageous.

The study by Rawlings, Rawlings, Chen and Yilk (1972) was very successful in proving the hypotheses proposed in this experiment. However the tests in that study were completed over a period of ten days, which may support the previous suggestion that an adverse (fatigue) effect may have resulted from the short inter-trial rest time allowed. Adequate time for practice and learning may well be a factor to consider.

In light of these limitations to the experiment it is suggested that under improved experimental conditions the results may well be different and in fact, support the proposed hypotheses that a combination of mental and physical practice used in alternating fashion is better than physical practice alone.

RECOMMENDATIONS

In light of the results it is difficult to convincingly argue whether athletes really can gain a competitive advantage by investing time in mental practice. Despite the amateur experimental design and insignificant findings it is still recommended that:

- Physical practice is better than mental practice or no practice;
- Mental practice is better than no practice;
- A combination of mental and physical practice is better than physical practice alone.
- Mental practice is a not a substitute for physical practice, however mental practice can enhance the quality of physical practice and performance.

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