

**THE EFFECT OF COGNITIVE STRATEGIES ON THE  
PERFORMANCE OF A CLOSED MOTOR SKILL**

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DECLARATION

I the undersigned hereby declare that the work contained in this thesis is my own original work and has not previously in its entirety or in part been submitted at any university for a degree.

K.G. FAIRWEATHER

To my parents, Pam and George, without whom  
this would never have been possible.

## SUMMARY

The study comprised two separate but closely related parts, an experimental study and a limited field study. The experimental study utilized a closed motor skill accuracy task, putting a golf ball, to determine the effects of two different cognitive strategies on the performance of two experimental groups.

The field study involved distributing questionnaires to professional golfers (N=57) who participated in the South African TweeJongegezellen Masters tournament in Stellenbosch. The questionnaire was designed to determine the extent to which these golfers used structured mental strategies within pre-shot routines. Results reveal that local golfers do not have adequate knowledge of psychological techniques and of how to employ them.

The experimental strategies could be divided into two distinct components: a cognitive component and a behavioural component. The behavioural component of the experimental groups was identical and took the form of a mechanical pre-shot routine. Subjects were required to learn a step-by-step routine which they would repeat before every putt. This behavioural strategy can be seen as a primary strategy (Singer, 1984) in that it enables the performer to absorb all the relevant information from the environment that is necessary to formulate an appropriate motor programme. The cognitive component is aimed at allowing the primary strategy to operate more effectively. This cognitive component could therefore, according to Singer (1984), be seen as a secondary strategy. Both experimental groups received training in the Centering technique devised by Nideffer (1986). Only one experimental group received instruction in relaxation and imagery skills.

Male, amateur, single figure handicap golfers participated in the study (N=24). Subjects were randomly assigned to one of three groups: (a) an attentional pre-shot routine group (n=8); (b) an attentional pre-shot routine with imagery and relaxation group (n=8); and (c) a control group (n=8). All subjects completed a putting test before and after the five-week experimental programme. The putting test was conducted in a laboratory where a putting green was constructed. This allowed for maximum control of external variables while still simulating identical competition conditions. Subjects had sixteen putts from eight different distances during the test. Standardized instructions were read out to each subject to ensure maximum control.

The treatment of the experimental groups involved a series of lectures over a five week period. Experimental group A had five lectures and Experimental group B had a total of seven lectures during which typed handouts, which explained the theory behind the techniques learnt, were distributed to subjects. The final lecture was devoted purely to the practical application of these techniques.

Although both experimental groups improved, the results of the test found only the experimental group trained in imagery and relaxation to have improved significantly. The results suggest that using a structured attentional pre-shot routine that includes imagery and relaxation will produce more consistent putting scores for golfers. The conclusion drawn from the results of the experiment was consistent with the proposed hypothesis.

A number of theories, inter alia the schema theory (Schmidt, 1988), the set hypothesis, and the information processing theory are proposed to support why the use of strategies improve performance.

## OPSOMMING

Die studie het bestaan uit twee afsonderlike maar verwante dele, naamlik 'n eksperimentele studie en 'n beperkte veldstudie. In die eksperimentele studie is gebruik gemaak van 'n akkuraatheidstoets, om 'n gholfbal te set, om die effek van twee verskillende kognitiewe strategieë op die prestasie van twee eksperimentele groepe te bepaal.

In die veldstudie is vraelyste gegee aan professionele gholfspelers (N=57) wat aan die Suid-Afrikaanse TweeJongegezellen Meesterstoernooi op Stellenbosch deelgeneem het. Die vraelys was daarop gemik om die mate waartoe hierdie gholfspelers gestruktureerde sielkundige strategieë aanwend voordat hulle die bal slaan, te bepaal. Resultate toon aan dat plaaslike gholfspelers nie oor voldoende kennis van sielkundige tegnieke en die aanwending daarvan beskik nie.

Die eksperimentele strategieë kon in twee duidelike komponente verdeel word: 'n Kognitiewe komponent en 'n gedragskomponent. Die gedragskomponent van die eksperimentele groepe was dieselfde en het die vorm aangeneem van 'n meganiese roetine wat die hou voorafgaan. Proefpersone moes 'n stapsgewyse roetine aanleer wat hulle voor elke sethou moes herhaal. Hierdie gedragstrategie kan as 'n primêre strategie beskou word, aangesien dit die persoon in staat stel om al die relevante inligting uit die omgewing wat nodig is om 'n geskikte motoriese program te formuleer, in te neem.

Die kognitiewe komponent is daarop gemik om die primêre strategie meer doeltreffend te laat werk. Volgens Singer (1984) kan hierdie kognitiewe komponent dus as 'n sekondêre strategie beskou word. Albei eksperimentele groepe is geleer hoe om die Sentreringsstegniek van Nideffer (1986) te gebruik. Net een eksperimentele groep het opleiding in ontspannings- en beeldingsvaardighede ontvang.

Manlike amateurgholfspelers met enkelsyfervoorgeë (N=24) het aan die studie deelgeneem. Proefpersone is lukraak toegewys aan een van drie groepe: (a) 'n Groep met die aandagroetiene wat die hou voorafgaan (n=8); (b) 'n groep met 'n aandagroetine wat beelding en ontspanning insluit (n=8); en (c) 'n kontrolegroep (n=8). Al die proefpersone het voor en na die eksperimentele program van vyf weke 'n setspeltoets afgelê.

Die setspeltoets het in 'n laboratorium plaasgevind waar 'n setperk aangelê is. Sodoende kon maksimum kontrole oor eksterne veranderlikes uitgeoefen word terwyl kompetisietoestande geskep is. Gedurende die toets het proefpersone sestien sethoue van agt verskillende afstande af gespeel. Standaard instruksies is aan elke proefpersoon voorgelees.

Die eksperimentele groepe het oor 'n tydperk van vyf weke 'n reeks lesings bygewoon. Eksperimentele groep A het vyf lesings en eksperimentele groep B sewe lesings bygewoon waartydens getikte aantekeninge uitgedeel is waarin die teorie agter die tegnieke wat aangeleer is, verduidelik is. Die laaste lesing is aan die toepassing van hierdie tegnieke gewy.

Alhoewel albei eksperimentele groepe verbeter het, het die toets resultate getoon dat net die eksperimentele groep wat beelding en ontspanning aangeleer het, beduidend verbeter het. Die resultate dui daarop dat die gebruik van 'n gestruktureerde aandagroetine wat die hou voorafgaan en wat beelding en ontspanning insluit, tot meer konsekwente setspeltellings vir gholfspelers sal lei. Die gevolgtrekking wat uit hierdie resultate gemaak kan word was in ooreenstemming met die gestelde hipotese.

'n Aantal teorieë, waaronder die skema-teorie (Schmidt, 1988), die gestelde hipotese, en die teorie van informasieprosessering, word voorgestel om te verklaar waarom die gebruik van strategieë prestasie verbeter.

CONTENT

	p.
CHAPTER ONE	
STATEMENT OF THE PROBLEM	1
INTRODUCTION	1
THE PROBLEM	6
HYPOTHESIS	7
SCOPE OF THE STUDY	7
METHOD	8
LIMITATIONS	9
CHAPTER TWO	
RELATED LITERATURE AND RESEARCH	10
INTRODUCTION	10
PRIMARY STRATEGIES	12
Sensory input	14
Perception	17
Decision-making	18
Motor Control	19
Motor Output	21
Memory and Feedback	22
Arousal	23
Attention	24
SECONDARY STRATEGIES	28
Causes of Competitive Stress	30
Arousal-Performance Relationship	31
Neural Mechanisms of Arousal	32
Arousal-Performance Theories	34
Optimum Levels of Arousal	36
Task Demands	36
Skill Level of Performer	38
Individual Variations in Inverted-U Patterns	39
Physical Fitness	41

Explanations for Arousal-Performance Relationship	41
Identifying Overaroused Performers	42
Arousal Management Techniques	44
Educational Techniques	44
Relaxation Techniques	44
Cognitive Techniques	50
Cognitive-Behavioural Management Programmes	53
 SUMMARY	 59
 CHAPTER THREE	
METHOD AND PROCEDURES	61
INTRODUCTION	61
Subjects	63
Testing Procedures	63
Apparatus and Facilities	64
Pilot Study	64
Experimental Design	65
Experimental Programme	66
FIELD STUDY	69
 CHAPTER FOUR	
RESULTS OF EXPERIMENTAL STUDY	71
ASSESSMENT OF EXPERIMENTAL PROGRAMME	73
RESULTS OF FIELD STUDY	76
DISCUSSION	80
CONCLUSIONS	88
FUTURE RESEARCH	90
 REFERENCES	 92

APPENDICES	107
APPENDIX A	107
MENTAL SKILLS PROGRAMME	107
INTRODUCTION	107
RELAXATION TECHNIQUES	110
RELAXATION EXERCISES	111
MENTAL IMAGERY AND REHEARSAL	113
USING MENTAL IMAGERY	116
IMAGERY AND MENTAL REHEARSAL EXERCISES	117
ATTENTION CONTROL TRAINING	119
ATTENTIONAL FOCUS	120
ATTENTIONAL CONTROL PROCEDURES	121
ATTENTIONAL PRE-SHOT ROUTINE	123
APPENDIX B	124
OUTLINE OF A PRE-SHOT ROUTINE	124
OUTLINE OF A PRE-SHOT ROUTINE WITH RELAXATION AND VISUALIZATION	125
APPENDIX C	127
PROGRAMME FOR EXPERIMENTAL GROUP A	127
PROGRAMME FOR EXPERIMENTAL GROUP B	128
APPENDIX D	129
PUTTING TEST INSTRUCTIONS	129
APPENDIX E	130
MANIPULATION CHECK	130
APPENDIX F	134
FIELD STUDY QUESTIONNAIRE	134
APPENDIX G	136
LETTER TO SUBJECTS	136

LIST OF TABLES

<u>TABLE</u>		p.
2.1	Changes associated with increased arousal levels	43
4.1	Pre-test and post-test scores	72
4.2	Manipulative check questions and mean scores	75
4.3	Comparative scores of professional golfers	77

LIST OF FIGURES

<u>FIGURE</u>		<u>p.</u>
1.1	Learnings that contribute to achievement in sport	3
2.1	Basic functional components of motor behaviour	13
2.2	Basic neurological mechanisms for motor behaviour	13
2.3	Information-processing model	14
2.4	Two formulas for stress	31
3.1	The experimental design	66
5.1	Interaction of physiological and attentional processes under stressful conditions.	83

## CHAPTER ONE

### STATEMENT OF THE PROBLEM

#### INTRODUCTION

The demands placed on modern day athletes to achieve excellence are so great that in order to be successful a combination of many factors must be taken into consideration. Nutrition, weight training and task-specific physical conditioning are important factors. In addition knowledge of and the ability to execute task specific skills and tactics in the context of competition are necessary to ensure achievement.

In recent years increasing emphasis has been placed on the need for psychological preparation. Advances in the field of applied sport psychology have in particular benefited the elite athlete with psychological techniques currently used to enhance learning and performance. Mental training programmes, goal-setting exercises and relaxation procedures, are examples of techniques employed by elite athletes.

Substantial research has been done as to the effectiveness of the above-mentioned techniques and the general opinion is that they enhance performance (Cohn, 1990). Of less prominence are studies exploring the possibility of structuring these techniques into task-specific learning and performance strategies that would enhance cognitive processes and in turn facilitate learning and performance.

Singer expresses the view that such strategies can enhance performance:

Cognitive processes of the athlete are continually active in sports situations, associated with training in preparation for competition, orienting for the contest, directing activities during the contest, and interpreting and adjusting to the outcome of competition. Effective learning strategies should improve the way processes work.  
(Singer, 1984:271)

Singer (1988) cites examples of widely acclaimed athletes who have the ability to be in the right place at the right time, to anticipate events and to quickly and creatively adapt to unexpected events. The consistency of concentration and competitive intensity of elite athletes and their ability to perform regularly at their peak are also mentioned. In addition the concentration ability of peak performers to focus attention over a prolonged competition period, such as golf, and assume a finely tuned state is something to appreciate. These sportsmen have apparently refined their readiness strategy over many years and their success is largely due to this aspect of their competition preparation.

Some researchers (Dansereau, 1978; Singer, 1980) maintain that learning and performance strategies should not only facilitate the acquisition and control of specific motor skills but also benefit related skills in related contexts. However, this study is not concerned with the transferability of strategies but rather with the development of a task specific strategy.

Baron (1978) indicates that three kinds of limits exist with regard to task performance:

- (a) failure to use the appropriate strategy
- (b) inadequate proficiency
- (c) limited potential.

Differences in achievement may be due to any one or combination of these factors. It is possible to do something to improve the first two factors but, theoretically, capacity limits cannot be overcome. On the other hand, it is also known that capacities to learn are seldom fully developed (Singer, 1984).

Singer (1984) maintains that sport-specific knowledge, skills and tactics must be acquired but so must supportive learning strategies. The ability to problem-solve, adapt and apply strategies to expected and unexpected situations, provides athletes with comprehensive tools to train and compete favourably. Other supportive learning strategies include the ability of athletes to analyze their readiness state with regard to learning or performing and how to cope with inappropriate states. The relationship of these considerations to achievement is diagrammed in Figure 1.1.

*Sport specific learnings*  
(Taught by coaches)

Skills  
Knowledge  
Tactics

*Sport supportive learnings*  
(Self-taught)

Self-analysis  
Self-management skills  
Primary strategies  
Secondary strategies

**Figure 1.1** Learnings that contribute to achievement in sport  
(Singer, 1984:272)

It would seem that sport-specific learnings of athletes are given considerable attention while supportive learnings are neglected. Strategies that can support learning and performance may be classified as either primary or secondary (Singer, 1984). Primary strategies are related to the improvement of skills and techniques. Also called associative, (Gagne & Briggs, 1974) these represent the processes that an athlete uses to select and control attention, organize and retrieve information and formulation of an appropriate motor programme.

Secondary strategies, also termed support, (Dansereau, 1978) allow the primary strategies to operate more effectively. They pertain to establishing appropriate attitudes or disposition toward learning and performance, coping with concentration lapses, focussing attention, dealing with potential anxiety and evaluation of personal states.

Together these strategies can promote cognitive control over performance. The ultimate aim is to provide athletes with effective strategies that satisfy task demands and personal needs and consequently lead to greater achievements.

Basically athletic acts occur under two types of conditions, self-paced or externally-paced. Self-paced skills are initiated by the athlete and there is time to prepare, view the situation and control the movement. In open skill or externally-paced sports the ability to focus attention on a target or a moving object is a vital determinant of performance (Whiting, 1985).

In closed skill, self-paced sports the role of attention is less spontaneous but equally important. In these types of sports the nature of skill creates ample opportunity for attention to be distracted by other factors such as negative thoughts and irrelevant stimuli (Nideffer, 1976). Thus the task facing closed skill sportsmen is to effectively focus attention on task-relevant cues while simultaneously ignoring irrelevant information and distractions.

The focus of this study is on a self-paced (closed) skill, namely golf putting, and the formulation of an effective cognitive strategy to improve learning, control and performance of such a skill.

Many articles have been published which emphasize the need for the formulation of pre-performance routines in sports such as tennis, basketball and golf (Boutcher & Crews, 1987; Crampton, 1989; Yancey, 1977). Keele (1973) suggests that pre-shot routines have been developed to divert attention from the actual skill. Schmidt (1988) expresses the view that the pre-performance routine may provide a way of reactivating the appropriate physiological and mental state before executing the skill.

Earlier studies (Yancey, 1977) emphasized the development of a mechanical routine but later studies (Crampton, 1989) have combined a mechanical routine with various cognitive strategies. These strategies help to control and direct thought processes during execution of the task. Crampton describes a pre-shot routine as:

...an ordered collection of thoughts and behaviours that is aimed at achieving the necessary mind set, concentrational focus and physical readiness for each shot.

(Crampton, 1989:10)

Often the term learning strategies has been used synonymously with performance strategies. Although overlapping in functions occurs, strategies can have different functions. When skills are being learnt as opposed to being performed the mental approach is quite different (Singer, 1988). During practice sessions, the athlete attempts to perfect skills and techniques. Just as skills and techniques are mechanically and adaptably refined in practice, thoughts and cognitive processes need to be trained as well. As a result more deliberate cognitive intervention occurs in practice than in actual competition.

In competitive performance cognitive control is tuned down and activity flows automatically because competition strategies have been planned and techniques have been well learnt so that deliberate attention to them may be unnecessary. However, when situations change, requiring alternative plans of action, cognitive involvement makes it possible to evaluate situational demands and make adjustments. For the purpose of this study a strategy will be devised that combines a pre-shot routine with cognitive strategies.

#### THE PROBLEM

The problem of the study is to determine the effect of a combination of an overt pre-shot routine and cognitive strategies on golf putting performance. A secondary purpose is determine the extent to which these techniques are being used by local professional golfers in a recognised tournament.

## HYPOTHESES

It is hypothesized that:

1. The formulation and practice of learning and performance strategies will assist golfers to attain a higher level of technical and mental skill with resultant improvement in performance. This is based on the following assumptions:

1.1 Learning and performance are dependent on the ability to process information effectively, from the perception stage until the movement is executed in response to the demands of the task.

1.2 Learning and performance are dependent on the ability of the individual athlete to control and direct cognitive thought and emotional processes prior to and during competition.

2. Local professional golfers do not consistently make use of structured competition strategies.

## SCOPE OF THE STUDY

The experimental study is limited to closed (self-paced) skills and in particular to golf putting skill. The sample will consist of 24 highly skilled male league golfers who compete on a regular and organized basis. They will be randomly assigned to three groups (n=8).

A limited field study also involves golf putting skill. A sample of 57 local professional golfers competing in a tournament are the subjects of study.

## METHOD

Singer's (1988) Five-Step Strategy will be used as a basis for the pre-shot routine which in turn is the basis of the experimental study. The Visio-Motor Behavior Rehearsal method developed by Suinn (1976) will be used within the pre-shot strategy. This method consists of relaxation (Jacobson, 1930) and mental imagery. Nideffer's Centering technique (Nideffer & Sharpe, 1978) will also be incorporated in the routine.

The dependent variable would therefore be the performance of the golfers in a putting task. The dependent measure is the accuracy of several putts made from different distances. The independent variable is the cognitive strategy that the golfers will be exposed to. The results of the two experimental groups will then be compared to a control group. A pretest - posttest randomized group design will be used. All three groups will be subjected to two tests, a pre-test and a post-test after a period of six weeks.

The field study consists of a questionnaire that will be distributed to male professional golfers participating in a golf tournament. The tournament is called the TweeJonggezellen South African Masters and forms part of the Sunshine Circuit, which is the official golf tour of South Africa.

The questionnaire will be designed to determine what psychological techniques are utilized by local golfers and if they are used within a structured pre-shot routine.

## LIMITATIONS

In the process of maintaining internal validity a certain degree of external validity is sacrificed. Due to difficulties in controlling variables in a proper tournament a simulated competition situation will be created. A putting green will be constructed from artificial material and erected in a laboratory. This will make control of variables easier but will limit the generalization of test findings of the experimental study.

In an attempt to solve the above problem a limited field study will attempt to discover how local professional golfers behave in tournament conditions.

## CHAPTER TWO

### RELATED LITERATURE AND RESEARCH

#### INTRODUCTION

Sportsmen and sportswomen in conventional programmes are trained to acquire sport-specific knowledge, skills and tactics. However, the emphasis in this study is not on sport-specific learnings but on the supportive strategies that assist in problem solving and adapting to expected and unexpected situations. According to Loehr (1984) top-level athletes have the ability to identify an ideal performance state (IPS) and have learned, intentionally or subconsciously, to create and maintain this state voluntarily so that physical skills can flourish. It is hypothesized that effective supportive strategies will enhance the ability to create an ideal performance state and this IPS will ultimately lead to consistently better performances.

Supportive strategies are classified as primary or secondary strategies (see Fig.1.1). It is the intent of this literature review to discuss the nature of such strategies and also to focus on the underlying mechanisms that are responsible for improvement in performance.

Primary strategies are represented by the behavioural processes that sportsmen use to attend selectively, to manage and retrieve information and make decisions in movement situations. In other words these strategies are associated with improving the capacity to learn and perform from an information-processing perspective.

By understanding the processes that are used by performers from the point where information is received until actual movement occurs, one can attempt to determine ways of facilitating their functioning (Crossman, 1964).

Individual variations in the operation of perceptual, attentional, retrieval, decision making and motor mechanisms all contribute to the ultimate skill level that is seen in different performers. The difference in skill level that is demonstrated by beginners and highly proficient performers is accountable in part by their use of appropriate strategies to process information (Singer, 1984).

Secondary strategies allow primary strategies to operate more effectively. As stated previously these strategies assist in establishing the correct mental attitudes, coping with distractions, dealing with potential anxiety and being able to monitor personal readiness states. These strategies include attentional control training, mental imagery, relaxation skills and use of positive self talk.

As is the case with the learning and performance of specific motor skills, learning to be mentally prepared for competition is equally important. The ultimate objective is to teach learners and performers to acquire the ability to channel their motivation toward concentration in a relaxed manner so that the optimal arousal and attentional condition is attained for the performance of the task (Landers, 1980).

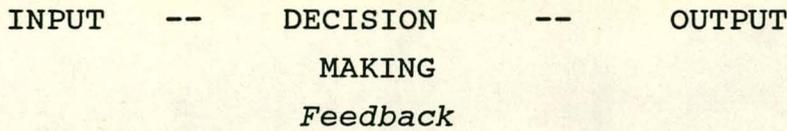
A review of related literature reveals an accelerated interest in cognitive intervention strategies as well as learning and performance strategies. A closer study of this literature reveals that a substantial portion is not applicable to this particular research task.

For this reason attention will be focussed only on those studies that are directed at discrete, closed motor skills which involve performing a task that is measured in terms of accuracy.

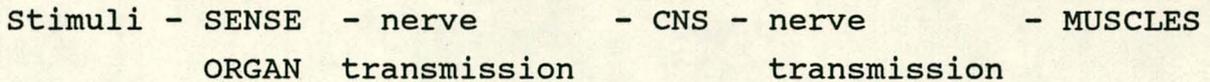
## PRIMARY STRATEGIES

Primary strategies are associated with the capacity to learn and perform from an information-processing perspective. Complex motor behaviour can be viewed as an information-processing system that is guided by feedback control mechanisms that allow adaptive processes to occur. In this view the performer is an active, problem-solving, decision-making, processor of information (Sage, 1984).

Before discussing the information-processing model in detail two simple models will be presented in order to illustrate the basic functional and neurological elements of motor behaviour (Sage, 1984). Figure 2.1 shows the basic functional components. This model begins with the input phase and consists of all the stimuli that a person receives at any one time. Some of the stimuli is relevant at the present time and some of it is irrelevant. The decision-making phase refers to the cognitive process of integrating and analyzing relevant incoming stimuli and deciding on the appropriate response that should be made to comply with the environmental and task demands. Output is the observable part of the response in the form of muscular action. Feedback refers to the information that is received during or after the movement.



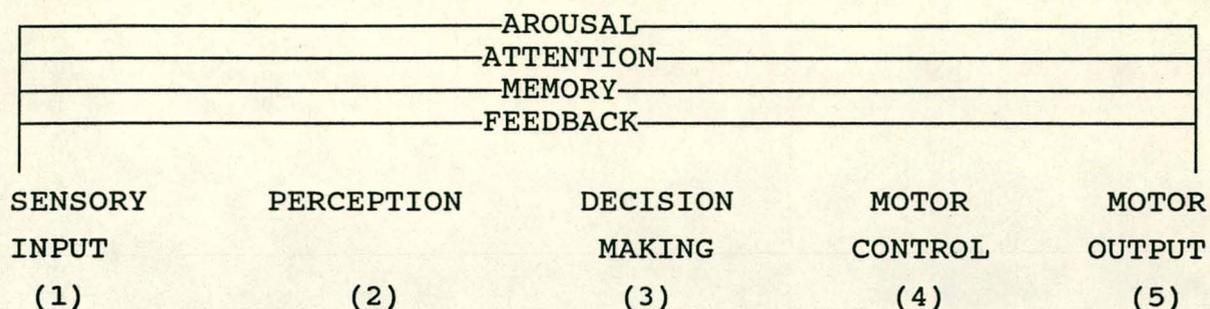
**Figure 2.1** Basic functional components of motor behaviour  
(Sage 1984:43)



**Figure 2.2** Basic neurological mechanisms for motor behaviour  
(Sage 1984:43)

From the functional model it is possible to determine the neurological mechanisms that are responsible for the effective functioning of any movement. Figure 2.2 shows that input is received via the sense organs. The central nervous system by way of the brain and spinal cord serves the decision-making function and output is affected by the muscular and glandular system. Feedback is controlled through the various sensory organs and information moves from one part of the model to the other parts by way of neural transmission.

To get a better understanding of the processes that underlie human movement it is important that the different components of a more complex information processing model be covered in detail. This model is a simplified illustration of Sage's (1984) model. It is based on a review and synthesis of other models for motor behaviour (see Fig.2.3).



**Figure 2.3** Information-processing model (Sage 1984:44)

### 1. SENSORY INPUT

Motor behaviour involves the integration of several kinds of sensory input (Sage, 1984):

- about the present environment;
- about what is to be achieved;
- about previous experiences with a similar task;
- from the movement task itself;
- about the results of the performance.

Successful motor behaviour depends on the performers ability to absorb sensory information from the environment and from within the body. The following receptors are responsible for receiving sensory input: visual, auditory, vestibular, muscle, cutaneous.

#### 1.1 Visual

Schmidt (1988) maintains that the most critical receptor system for supplying information about the movements of objects in the outside world is the eye. In human performance, vision provides information about the movements of objects in the environment.

Recent evidence identifies two visual systems. Trevarthen (1968) refers to them as focal vision and ambient vision. The focal visual system is concerned with events mainly in central or focal vision, and its accuracy decreases with decreasing levels of illumination. This type of vision is closely linked to conscious thought processes.

Ambient vision is concerned with the entire field of vision, including the central and peripheral areas. Levels of illumination do not have an effect on its acuity and this type of vision can be used without conscious awareness.

From ideas put forward by Gibson (1966), it seems that vision is not merely an exteroceptive sense, passively providing information about the environment. The visual system, through movement of the entire head or body, can provide information about the environment and in this way is also a proprioceptive sense.

## 1.2 Audition

Audition is classified as an exteroceptor which provides information about the nature of movements in the environment. Audition also provides information about the performer's own movements (Schmidt, 1988).

Movements produce sounds in the environment, such as the sounds of footsteps when running, the sound of a ball being hit. These sounds provide the performer with information about movement, such as the type of shot that has been made.

### 1.3 Vestibular Apparatus.

In the inner ear is a set of sensors that provide information about movements of the head and its orientation with respect to gravity. This information is provided by two small structures, the saccule and utricle. Also responsible for balance are the semi-circular canals, three fluid filled semi-circles. These canals are situated in each of the major planes of the body (frontal, saggital, horizontal) and are sensitive to movement in any direction (Schmidt, 1988).

### 1.4 Muscle Proprioceptors

Muscle proprioceptors in skeletal muscles are the muscle spindles and the Golgi tendon organs. The muscle spindle is a fluid filled capsule containing special receptors and interfusal muscle fibers. Spindle receptors are sensitive to stretch on a muscle and send information to the nervous system regarding the position of the muscle. The Golgi tendon organ is concerned with detecting and signalling tension on a tendon.

### 1.5 Cutaneous receptors.

These receptors are found near the skin and their stimulation produces sensations for touch-pressure, heat, cold and pain. The main kinds of cutaneous receptors are the Pacinian corpuscles, Meissner corpuscles, Merkel's discs and free nerve endings.

All these different types of receptors contribute to awareness of where the body is during movement. This has been termed kinesthesia (Schmidt, 1988), which is a person's perception of his or her own motion, both of the limbs with respect to each other and to the body as a whole.

Kinesthetic awareness assists the performer to obtain a feeling of when a particular movement is being carried out correctly. Kinesthesia is an important sensory modality for motor learning and performance (Sage, 1984)

## 2. PERCEPTION

The process by which sensory information is organized, integrated and interpreted to produce meaning of the incoming data involves perception (Sage, 1984). Perception is essentially an organizing process and past experiences are important for this process. The perception process involves the use of the following perceptual mechanisms (Nel, Bressan & Du Toit, 1990):

### 2.1 Detection (Obtaining information)

The two environments from which information is obtained about movement and performance are the external environment and the environment internal to the body. The receptors that provide this information are the exteroceptors and proprioceptors.

### 2.2 Discrimination (Organising information)

A performer could easily be overloaded by all the information from all the sensory receptors. To prevent this certain structures in the brain have the capacity to filter or organize sensory information into relevant information to be processed further and irrelevant information which will be ignored. The cortex inhibits or excites the reticular formation which in turn utilizes efferent pathways to filter the transmission of impulse information from sensory receptors.

### 2.3 Identification and recognition (Integrating and directing information)

Once information has been organised it can then be compared to information that has been stored in the memory. It is only by comparison with previous information and experiences that a performer can become accurate in identifying incoming information. Once the information has been recognized the thalamus then directs it to appropriate parts of the brain for subsequent conceptualization.

### 2.4 Conceptualization (Interpreting information)

The various association areas of the cortex work together to interpret the meaning of recognized information. The information is compared to past experiences and results stored in memory. Without any form of reference, it may be necessary to form some judgement and may result in incorrect interpretation.

The thalamus and association areas operate from a set of learned perceptual rules which decide how information should be sorted and interpreted. With time a perceptual trace is formed and new movements are compared to the perceptual trace until the correct association is made.

## 3. DECISION-MAKING (Central planning)

Once the information task has been interpreted and has meaning, the performer must then select an appropriate response (Gallagher, 1984). This response selection is a cognitive decision-making process and is also a memory-dependent process in which the response appropriate to a given stimulus is retrieved from the long term sensory memory or the short term sensory memory.

Once the process of perception has been completed, the performer has an understanding about the demands of the movement environment. Decision-making is based on the demands of the specific movement situation in terms of spatial, temporal and force aspects (Nel et al., 1990). This understanding may be accurate in which case the performer has the correct information on which to base the movement. If the movement is successful then it means that the performer has perceived correctly, planned correctly and performed correctly. If performance is unsuccessful then a breakdown has occurred in one of the three stages i.e. perception, planning or technical execution.

#### 4. MOTOR CONTROL

Historically, two explanations have been proposed for the control of movement, closed-loop theory and open-loop theory. The open-loop theory of motor control essentially proposes that movements are structured centrally within the central nervous system and executed without feedback (Sage, 1984). The central mechanism for open-loop control is called a motor programme. Keele (1973) describes a motor programme as an abstract memory structure that is prepared in advance of a movement.

Closed-loop control emphasizes the utilization of feedback and the initiating of corrective movements on the basis of feedback to achieve the movement goal. The first view of closed-loop theory was proposed by Adams (1981). He proposed that a reference mechanism, called a perceptual trace, is central to the closed-loop theory.

Past experiences with similar movements leave a memory trace or image and are used by the learner to modify subsequent movements. During the movement there is a comparison between the perceptual trace, a mechanism for evaluating the correctness of the response generated by the memory trace, and sensory feedback from the movement in progress. This closed-loop approach seems to be applicable to slow, self-paced movements where feedback is important in the production of each segment of the total movement.

The major difference between these two views is the role of feedback. Closed-loop theory specifies the need for feedback, while the open-loop theory does not rely on feedback. Support for motor control of movement comes from several sources (Sage, 1984). Evidence indicates that skilled movements can be performed in the absence of feedback, that for some movements feedback is not used even although it is present and that movements can be preprogrammed rather than controlled as the movement progresses.

However, Keele (1973) maintains that feedback has four important functions that operate before, during and after a movement. It gives information relevant to the starting position, acts as a motor programme monitor, assists in making fine adjustments during a movement and helps to construct motor programmes.

There are two issues that have caused controversy with regard to motor programmes. The first is the novelty problem and the second is the storage problem (Schmidt, 1988). The former is concerned with how performers can produce new movements without ever having done them before. The latter concerns how programmes are stored in memory.

Motor programme research implies that for every movement pattern there is a separate and specific motor programme that controls it. Given the vast amount of movements possible and variations in speed and force it would be impossible for the brain to store all the programmes.

In an effort to find answers to the problems discussed previously Schmidt (1988) proposed a generalized motor programme theory called the schema theory. This generalized motor programme is a set of preprogrammed central commands that carry out movement in open-loop fashion, in the absence of ongoing sensory feedback. Stored in memory are the unique parameters for every movement that define how the programme will be executed: initial conditions, duration and force parameters, environmental outcome of the movement, sensory outcome of the movement (Schmidt, 1988). All four sources are stored and the performer can define relationships or schemas between them.

This theory proposes the existence of two schemata, a recall schema responsible for the production of movement by way of open-loop programmes, and a recognition schema responsible for movement evaluation to determine the correctness of response by way of feedback mechanisms. According to the theory, rapid movements are produced by the recall schema and slow movements are controlled by the recognition schema.

## 5. MOTOR OUTPUT

The final process in the perceptual-motor model is the actual movement, the only part that can be seen by an observer. The activity of muscles and glands forms the observable part of the movement response that has been brought about by all the preceding processing activity.

## 6. MEMORY AND FEEDBACK

Memory and feedback provide the comprehensive communication network within the information-processing system in addition to supplying information about the external environment. These systems are interrelated and allow performers to control movement performance, to learn, correct performance errors, anticipate performance errors and make adaptations (Nel et al., 1990).

### 6.1 Memory

Memory is defined by Nel et al. (1990) as the capacity to retrieve information stores in the brain and is critical to the information processing system by allowing performers to store and retrieve information. According to Nel et al. (1990) there are four types of memory:

#### 6.1.1 Shortterm sensory storage

This form of memory consists of a sensory impression from all the stimuli. This impression consists of a huge amount of information most of which will never be processed. This sensory image is held sensory storage for approximately one second.

#### 6.1.2 Shortterm information storage

The information that is selected for further processing is held in shortterm information storage, also called shortterm memory for approximately thirty seconds.

#### 6.1.3 Shortterm operational storage

Once an idea for movement is conceptualised then motor commands are formulated to match the programme. This is then held in the shortterm operational storage.

#### 6.1.4 Longterm storage

Longterm storage is the relatively permanent storage of past experiences in the form of a type of schema which allows for storage of many different types of information.

#### 6.2 Feedback

Feedback is information received during or after a performance and feedforward is information received prior to initial motor performance (Nel et al., 1990). Feedback can be regarded as intrinsic or extrinsic depending on its source.

Intrinsic feedback is that information that is present during movement performance while extrinsic or augmented feedback is that information that is added to the movement environment by an outside agent like a teacher or coach.

### 7. AROUSAL

Arousal refers to the state of wakefulness or alertness of the individual (Sage, 1984). A certain amount of arousal is necessary for optimal perceptual-motor behaviour. Arousal facilitates the cortex and enhances transmission throughout the brain, making the entire information-processing system more effective. Arousal also activates various mechanisms in the body in preparation for movement execution.

Arousal can be thought of as a dimension that describes the extent to which an individual is energized and can range from deep sleep to a highly excited state.

## 8. ATTENTION

Attention may be defined as the ability to direct information processing, whether of an afferent or efferent nature (Nel et al., 1990). One of the most critical factors in motor behaviour is the ability to select and attend to the relevant stimuli and ignore irrelevant stimuli (Sage, 1984).

Nideffer (1986:257) agrees with the previous statement and states that "The ability to control thought processes, to concentrate on a task is almost universally recognized as the most important key to effective performance in sport."

An individual cannot consciously process all stimuli in the environment and subsequently only a limited range of stimuli is selected for attention out of the many impinging upon the sensory system. This process is called selective attention (Sage, 1984).

Nideffer (1986) identified eight principles that underlie the ability to control attentional processes as they relate to performance:

1. Performers need to engage in at least four different types of attention.
2. Different sporting situations will make different attentional demands on an athlete. Therefore, it is vital that the performer is able to shift types of concentration to match changing attentional demands.
3. Under optimal conditions, the average person can meet the attentional demands of most sporting situations.

4. There are individual differences in attentional abilities. Thus different performers have different attentional strengths and weaknesses.
5. As physiological arousal increases beyond an individual's optimal level, there is a tendency to rely on the most developed attentional ability.
6. The phenomenon of "choking" or having performance progressively deteriorate, occurs as physiological arousal continues to increase to a point where involuntary narrowing of concentration takes place causing attention to become internally focused.
7. Changes in physiological arousal affect concentration and the systematic manipulation of physiological arousal is a way of gaining control over concentration.
8. Changes in the focus of attention will affect arousal levels and the manipulation of attention is a way to gain control over arousal.

#### Research on related Cognitive-Behavioural Strategies

During closed skilled, self-paced sports the role of attention becomes important because in these activities the overlearned, automatic nature of the skill creates ample time and opportunity for attention to focus on other sources such as negative thoughts and irrelevant stimuli (Nideffer, 1976). Thus the task-facing closed skill sportsman is to effectively focus attention on task relevant cues while simultaneously ignoring irrelevant information. One effective strategy for dealing with these demands is the development of a pre-shot routine.

Top level golfers appear to do the same things in the same order and with the same timing (Crampton, 1989). Inexperienced players are not as complete in their preparation and it shows in the inconsistency of their performance. Crampton maintains that a pre-shot routine directly influences a golfer's confidence and concentration.

Crampton used micro-computers to develop pre-shot routines for golfers and discovered that once golfers have developed a pre-shot routine they have something to return their focus to in the event that they get distracted, better able to handle crucial shots and have something to base their confidence on.

Popular golf magazines have commented on the importance of pre-shot routines (Jewell, 1979; Wade, 1981; Yancey, 1977). Empirical support for the existence of these routines have come from Crews and Boutcher (1986) who used trained observers to record pre-shot routines of female professional golfers in tournament play.

They demonstrated that the players' pre-shot routines were remarkably consistent over many hours of play. Golfers repeatedly took the same amount of time and the same number of glances and practice swings before playing each shot.

These researchers suggest that pre-shot routines have been developed to divert attention from negative thoughts and irrelevant information and from the outcome of the actual task (Keele, 1973). They also suggest that the pre-shot routine may provide a way of reactivating the appropriate physiological and mental state before each shot (Schmidt, 1988).

Cohn et al. (1990) showed that cognitive-behavioural intervention improved adherence to preshot routines in golf. Cohn also discovered that performance increased in actual competition subsequent to intervention and in follow-up interviews golfers reported that the intervention improved concentration and confidence in deciding which club to select and which type of shot to hit.

Boutcher and Crews (1987) did an additional study to examine the effect of a pre-shot routine on putting performance. They tested golfers in a field setting and predicted that those in an experimental group would exhibit better performance on a putting task after undergoing a six week programme that trained them to use a pre-shot routine.

Collegiate golfers were used as subjects (N=12) and were randomly assigned to four groups: (a) male routine (MR), (b) female routine (FR), (c) male control (MC), and (d) female control (FC). Results indicated that focusing attention on specific words and thoughts and learning a set pattern of actions produced more consistent putting.

Singer and Cauraugh (1985) proposed a global strategy which could be applied to any self-paced sport. This strategy is recommended for all levels of skill and was formulated on the basis of interviews with many athletes, personal experience and research on selected aspects of the overall strategy.

The strategy includes five sequential procedures namely: readying, imaging, focusing, executing and evaluating. They recommend that this five-step procedure should be rehearsed repeatedly and with practice would become automatic in competition.

This procedure is aimed at controlling thought processes and thought content in learning and performance situations and it is proposed that these strategies increase consistency in these situations.

Singer and Suwanthada (1986) carried out a study to determine the effectiveness of the global five step strategy on the skill attained in one primary task and two related ones. Subjects performed underhanded dart throwing as the primary task, "jart throwing" (similar to dart throwing) as the directly related task and soccer foul shooting as the slightly related task. The results confirm the hypothesis that a pertinent learning strategy can assist in the learning and performing of a primary task as well as transfer to future related learning situations. The formulation of the content of pre-competition and competition thinking has been termed strategy development by Rushall (1984). Studies carried out by Rushall (1979) indicated that detailed competition plans enhanced confidence and increased coping ability to handle competition problems.

## SECONDARY STRATEGIES

Current thinking in applied sport psychology depicts a certain psychological profile that is linked to successful performance. Williams (1986) proposed the following general profile of characteristics:

Self-regulation of arousal (energized yet relaxed, no fear)  
Higher self confidence  
Better concentration (being appropriately focused)  
In control, but not forcing it  
Positive preoccupation with sport (imagery and thoughts)  
Determination and commitment

The fact that these common psychological qualities have led many researchers to conclude that the presence of the right emotional state helps mobilize physiological reactions that are essential for peak performance. Achieving an ideal internal psychological state is not a simple task and Rushall (1979) maintains that inconsistencies in performance standards are not precipitated by physiological factors or by sudden reductions in skilled abilities but rather by psychological factors.

According to Loehr (1984) an ideal performance state does not happen involuntarily. The mental skills and strategies needed to create and maintain this Ideal Performance State (IPS) are learned through knowledge and practice just as the physical skills and strategies are learned. It appears that some gifted athletes are able to perfect these mental strategies on their own but most athletes need to be taught specific mental strategies.

This section of the literature study addresses the psychological states and techniques that are associated with peak performance and how to achieve these states. It is also well known that during competition performers are under pressure to perform well. Psychological stress affects all athletes in some way and can disrupt the creation and/or maintenance of an Ideal Performance State. Therefore this section will explain the factors that cause competitive stress, how stress is manifested in the performer and the techniques that are able to manage stress and maintain the ideal performance state.

## 1. CAUSES OF COMPETITIVE STRESS

Martens defines stress as follows:

Psychological stress occurs when athletes perceive that there is a substantial imbalance between what they perceive is being demanded of them and what they are capable of doing, and the outcome is important to them.  
(Martens, 1986:93)

Martens (1986) goes on to state that stress contains three elements: the environment, your perceptions, and your responses to these two elements in the form of arousal. It is not the environment itself that leads to the occurrence of stress but rather how the environment is perceived. One competitor might think when seeing many spectators, "What will all these people think if I play badly in front of them?" while another person on the same playing field might think, "This is a chance to show them how good I really am." It is the same environment but one performer perceives the situation positively and the other negatively.

It seems then that stress is the result of a performer's negative perception and changes in arousal in response to a particular competitive situation. However, McKay, Davis and Fanning, (1981) have identified two types of stress depending on whether the negative perceptions or arousal occurred first. These two formulas of stress are illustrated in Figure 2.4. It is noticeable that in both formulas the environment is not the cause of stress but the interpretation of the environment that caused the situation to be seen as stressful. It is true that some situations and environments are more likely to produce negative perceptions than others but are not stressful until interpreted and perceived negatively.

When a performer perceives a situation negatively the resultant response is a change in the arousal level of that particular performer. The relationship between arousal level and its effect on performance will be discussed in the next section.

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Stress formula 1						
Environmental stimulus		Arousal		Negative thoughts		= Stress
(E)	+	(A)	+	(NT)	=	(S)

Stress formula 2						
Environmental stimulus		Negative thoughts		Arousal		= Stress
(E)	+	(NT)	+	(A)	+	(S)

---

**Figure 2.4** Two formulas for stress (Martens, 1986:112)

## 2. AROUSAL-PERFORMANCE RELATIONSHIP

When referring to motor performance one of the most frequently used psychological constructs is arousal (Landers, 1980). In scientific literature arousal is used as a motivational construct and according to Murray (1964) is defined as the internal factors that arouse, direct and integrate a person's behaviour. Sage (1984) describes arousal as an energizing function that is responsible for the harnessing of the body's resources for intense and vigorous activity.

Motivation has two components: intensity of behaviour and direction of behaviour (Gill, 1986). Arousal is the general term for the intensity dimension of behaviour and refers to the state of alertness of the performer. A certain amount of arousal is necessary for any behaviour. Arousal facilitates the cortex, which enhances neural transmission in the brain. This has a dual effect on the body, preparing the performer to receive and process incoming sensory information from the sporting environment and also to activate the muscles which are responsible for the execution of the movement (Sage, 1984).

## 2.1 NEURAL MECHANISMS OF AROUSAL

Moruzzi and Magoun (1949) first discovered the neuroanatomical basis for arousal. From their research it is now clear that the reticular formation is of prime importance in arousal and is involved in sleeping, wakefulness and different levels of attention.

The reticular formation is divided into two functional systems: the brainstem reticular formation and the diffuse thalamic reticular system. The difference between these two systems is the type of arousal response produced by each.

The brainstem reticular system produces a widespread activation of the cortex that is prolonged and intense while the diffuse thalamic system produces a phasic, short-lived activation to specific areas of the cortex (Sage, 1984). The reticular formation can be stimulated in three ways: by almost any kind of sensory input from receptors like the muscles, skin, eyes and ears, by a hormone called epinephrine (adrenalin) and directly and consciously from the cortex.

Other structures that are involved in controlling arousal the cortex, the hypothalamus and the limbic system. These structures interact with the adrenal medulla and the somatic and autonomic systems to determine overall arousal (Landers & Boutcher, 1986).

Landers and Boutcher demonstrate the integration of these different systems in the following example.

A field hockey goalie sits in the dressing room minutes before an important match. She is worried about the upcoming game because she doubts her ability to play well in the biggest match of the season. These thoughts lead to anxiety about performance. Her worrying may not be realistic, but to her body, that does not matter. The cortex sends signals to the hypothalamus, which in turn releases hormones that activate the pituitary gland. The pituitary gland releases a hormone (ACTH) that triggers the adrenal glands to pour epinephrine and norepinephrine (adrenalin) into the bloodstream. These hormones together increase activity of the autonomic system, prepare her body for an emergency "fight or flight" situation. Heart rate, blood pressure and breathing increase and muscles in general begin to tighten. Blood vessels in the hands and feet close down, and their blood supply is shunted to the larger, deeper muscles. The hockey goalie is now in an overly aroused or anxious state. Needless to say we would not expect this athlete to perform well in this condition. (Landers & Boutcher, 1986:165)

## 2.2 AROUSAL-PERFORMANCE THEORIES

In related scientific literature two theories have been advanced to explain the relationship between arousal and performance:

### 2.2.1 Drive Theory

The drive theory as developed by Hull (1943) and modified by Spence and Spence (1966) predicts that performance (P) is a multiplicative function of habit (H) and drive (D):

$$P = H * D$$

Essentially, the drive theory proposes that as arousal or drive increases, learned behaviours are more likely to occur. This statement suggests that an increase in arousal results in an improvement in performance. The basic arousal-performance relationship is linear which means that as arousal increases, performance increases. However, performance predictions within the drive theory state that the performance of the individual's strongest most dominant response increases as arousal increases. Thus, performance would only increase if the strongest and dominant response is the correct one. Increases in arousal during initial skill acquisition would therefore impair performance but as the skill becomes well learned, increases in arousal facilitate performance.

The problem with this theory is that many sporting situations are highly structured and complex, involving processing of information and subsequent decision-making to ensure success in the performance of the motor skill and high arousal levels affect these highly complex processes negatively (Landers & Boutcher, 1986).

Freeman (1940) has shown in research studies that with high levels of arousal reaction times are slower than when arousal levels are moderate. On a golf swing, for example, many incorrect responses are possible and unless the golfer has a "grooved" swing the dominant response will probably not be a correct effective swing. It is doubtful whether a linear relationship between arousal and performance can be found for an accuracy task like putting a golf ball. However, Oxendine (1984) argues that a linear relationship exists for gross motor activities that involve strength, endurance and speed. These types of activities are overlearned, not very complex and have strongly formed habit patterns.

Gill (1986) summarizes the drive theory effects on performance as follows:

- \* Increased arousal increases the likelihood that the dominant response will occur
- \* If a skill is simple or very well learned then the dominant response will be the correct one and thus increases in arousal will improve performance.
- \* If a skill is complex and not well learned then the dominant response will be the incorrect one and thus increases in arousal level will impair performance.

### 2.2.2 The Inverted-U Theory

An alternative explanation of the arousal-performance relationship is the inverted-U theory. This theory proposes that performance is optimal at a moderate level of arousal.

In other words, performance progressively declines as arousal increases or decreases from a moderate level. Thus, this theory suggests that behaviour is directed toward some kind of balanced or optimal state (Landers & Boutcher, 1986).

It makes sense that athletes need some kind of arousal to perform at their best and very low levels will lead to subpar performances. However, with too much arousal athletes may be overanxious, tense and prone to errors. Inverted-U relationships have been found in research studies carried out by Fenz and Epstein (1969) on parachutists, by Martens and Landers (1970) on a tracking task and also by Klavora and Daniel (1979), Sonstroem and Bernado (1982) with studies on basketball players. Weinberg and Ragan (1978) also tested this hypothesis using three different levels of stress while test subjects performed a throw-for-accuracy task. Results indicate clear support for the inverted-U model.

### 3. OPTIMUM LEVELS OF AROUSAL

Different types of motor skills are performed under conditions of varying arousal levels in order to produce optimal performance. This optimal level is a fluctuating one depending on a wide variety of factors. Therefore, a more detailed examination of the effects of arousal on performance is necessary. Four factors are of importance when considering optimal levels of arousal.

#### 3.1 Task Demands

The characteristics of a skill or task have a substantial effect on the level of arousal that is most beneficial to achieving peak performance. As early as 1908, Yerkes and Dodson discovered that the optimal level of arousal varied amongst different tasks and skills.

Using laboratory animals Yerkes and Dodson found fewer errors in performance when a electric shock of medium intensity was applied to mice than when shocks of high or low intensity were applied. When the complexity of the task increased, the optimal shock for optimal behaviour was discovered to be progressively weaker. Simply stated, the Yerkes-Dodson law proposes that the decrement in performance under increased arousal conditions occurs earlier for more complex tasks than it did for less complex tasks.

It would be to the performer's advantage to analyze the characteristics of a motor skill to determine the optimal arousal level. For example, optimal golf putting requires a low arousal level and even slight increases in arousal may disrupt concentration and performance. In contrast, optimal weight lifting requires a high optimal arousal level and thus weight lifters would need much more arousal than golfers to perform at their best.

Oxendine (1970) offered the following guidelines for determining the optimal arousal levels of different sport tasks:

- \* A high level of arousal is needed for optimal performance in gross motor activities involving strength, endurance and speed.
- \* A high level of arousal interferes with performances involving complex skills, fine muscle movements, coordination, steadiness and general concentration.
- \* A slightly above average level of arousal is preferable to a normal or subnormal arousal state for all motor tasks.

### 3.2 Skill Level of the Performer.

The optimal level of arousal for a particular task is dependent upon individual differences in skill level. A given level of arousal that might disrupt performance for a beginner might improve performance when the same person becomes skilled at the task. Thus it would seem that the skillful performer is more likely to offset the detrimental effects of increased arousal than a less skillful performer (Landers & Boutcher, 1986).

Research on social facilitation provides the most information on the effects of arousal on people who are new to a task. Social facilitation refers to the effect of the presence of others on individual performance. Zajonc (1965; 1966) proposed the first general theory of social facilitation. This theory suggests that during the early stages of learning performers' dominant responses are mostly incorrect. Therefore, wrong responses are dominant and strong during early learning. However, once individuals have mastered a task, correct responses become dominant.

Assuming that the presence of others causes increases in arousal levels and arousal enhances the transmission of dominant responses, it is clear that during early learning wrong responses will occur more often in the presence of others. But if the dominant response is the correct one, as with skillful performers then the presence of others will enhance performance.

Cottrell (1968) put forward a refinement of Zajonc's theory to account for research that did not account for results of studies that did not support the theory that mere presence of others is necessary for social facilitation to occur.

Cottrell suggested that the source of arousal is not due the presence of others but rather due to the anticipation of positive or negative reactions in the presence of others. Both Zajonc and Cottrell agreed that the effects of arousal will be the dominant response by the performer.

This research area has taken a new development with the focus on attention as a mediating factor in the arousal-performance relationship. This view will be discussed in detail later in this literature study.

### 3.3 Individual Variations in Inverted-U Patterns

According to Landers and Boutcher (1986) the biggest factor that can cause a difference in an individual's optimal arousal level is the level of trait anxiety. In other words, the level that produces the best performance varies from person to person. A highly competitive anxious athlete has a lower optimal arousal level than a low competitive anxious athlete has in any given competitive situation.

Spielberger (1966) designed an instrument for measuring general arousal states called Spielberger's state-trait inventory. Research in this field shows that there are individual differences in trait anxiety. Spielberger called these differences trait anxiety, which according to him is "acquired behavioural disposition that predisposes an individual to perceive a wide range of objectively nondangerous circumstances as threatening and to respond to these with state anxiety reactions disproportionate in intensity to the magnitude of the objective danger." This indicates that people high in trait anxiety respond to certain situations with greater amounts of arousal than people low in trait anxiety.

Evidence, that differences in trait anxiety are related not only to general arousal but to arousal responses to specific stimuli during performance comes from personality theorist Eysenck (1967). He identified two independent dimensions of personality:

1. extraversion-introversion and
2. stable-neurotic.

Extraversion refers to the outgoing, uninhibited, impulsive and sociable person and introversion refers to a quiet, introspective and anxious person. Eysenck provided evidence that level of arousal is related to degree of introversion in that the introvert is higher in normal arousal levels and will respond with higher levels of arousal to stimuli and take longer to return to normal levels of arousal. People with high neuroticism scores respond more strongly to stimuli, show greater variability of response and take longer to return to a normal level of arousal.

These individual differences in performers will have a definite effect on the arousal-performance relationship proposed by the inverted-U hypothesis. Since high and low trait anxiety people respond with different amounts of arousal to identical stress situations, these different levels of arousal cause the two types of people to perform differently in similar situations.

Research by Carron (1968) supported this notion by indicating that high trait anxiety enhances performance when the task is very simple but highly anxious individuals tend to do worse on complex tasks, especially if novel tasks are required.

### 3.4 Physical Fitness.

Various studies have shown that when tasks are performed during or immediately after strenuous activity, groups with a higher level of physical fitness perform better (Gutin & DiGennaro, 1968; Reynolds, 1976; Stockfelt, 1970).

These differences in performances are related in part to the effects of exercise on arousal levels (Sage, 1984). During physical exercise the physically fit person is probably closer to an intermediate level of arousal than the less fit, whose level of arousal is quite high. The reason is that physical exercise will not alter physiological mechanisms of arousal as much for the fit as for the unfit. Therefore, it would seem that one of the consequences of a conditioning programme is physiological adaptation that makes a given amount of exercise less stressful.

## 4. EXPLANATIONS FOR THE AROUSAL PERFORMANCE RELATIONSHIP

Hebb (1972) proposed that during low arousal levels cortical transmission is poor and with high arousal it is too good allowing too many messages to get to the cortex and causing conflicting cortical activities.

Similarly, Welford (1976) suggested that when arousal is very low the nervous system will be inert and stimuli are likely to be lost in the perception stage. Deterioration of performance during high levels of arousal is due to cortical cells not only being facilitated but actually activated and the amount of impulses impinging on the cortex becomes so intense that effective functioning is difficult.

Using a different perspective, Easterbrook (1959) proposed his cue-utilization hypothesis which relates to arousal and performance. This hypothesis states that at low levels of arousal, irrelevant cues are being attended to while an increase in arousal will reduce the attention to irrelevant cues and increases attention to relevant ones, resulting in improved performance. However, very high levels of arousal narrow the attentional focus resulting in important cues not being processed causing a decrement in quality performance.

This view is very similar to the idea of perceptual narrowing described by Kahneman (1973). Kahneman suggested that there is a narrowing of attentional focus, with a progressive elimination of input from the periphery of the environment. In addition to the narrowing of attention Nideffer (1976) has considered how arousal affects direction of attention.

## 5. IDENTIFYING OVERAROUSSED PERFORMERS

Three changes are associated with abnormal states of arousal namely; physiological, psychological and behavioural. Table 2.1 summarizes the changes in performers (Martens, 1986:112).

**Table 2.1.** Changes associated with increased arousal levels

PHYSIOLOGICAL	PSYCHOLOGICAL	BEHAVIOURAL
Increased heart rate	Worry	Rapid talking
Increased blood pressure	Feeling overwhelmed	Nail biting
Increased sweating	Inability to make decision	Foot tapping
Increased brain wave activity	Feeling confused	Muscle twitching
Increased pupil dilation	Inability to concentrate	Pacing
Increased respiration	Inability to direct attention	Scowling
Decreased blood flow to skin	Not feeling in control	Increased blinking
Increased muscle tension	Feeling different	Yawning
Increased oxygen uptake	Narrowing of attention	Trembling
Increased blood sugar		Broken voice
Cotton mouth		
Frequent urination		
Increased adrenalin		

## 6. AROUSAL MANAGEMENT TECHNIQUES

Experienced, highly skilled performers are able to bring arousal under control when they perform. Fluctuations in performance are generally caused by fluctuations in mental control. Sportsmen do not lose and gain stamina, skill, strategy or conditioning during competition. What they do lose is control over cognitive factors such as the ability to concentrate, to process relevant cues, to attend selectively, etc. In fact, the root cause of the problem is that the performer is inappropriately aroused. Gill (1986) examined four types of management techniques:

### 6.1. Educational techniques

An effective anxiety management technique is to educate performers about the nature of arousal and its impact on performance. Many performers mistakenly believe that high arousal is necessary and the correct way to prepare for competition is to get "psyched up". Information about the negative effects of arousal and the importance of creating an awareness of the desired psychological state for competition may help many performers.

### 6.2. Relaxation techniques

Green and Green (1977) studied the influence of mental control of bodily functions on yogis from India. They discovered that yogis were able to voluntarily alter brain waves, heart rate, breathing, blood pressure, body temperature and other processes that are normally regulated by the autonomic nervous system. They also discovered that the ability to control these processes could be taught to others in a relatively short period of time.

These researchers pointed out that a highly sophisticated and integrated network exists between mind and body and every change in the mental-emotional state is accompanied by a corresponding change in the bodily state. This is the basic principle of learning how to regulate arousal.

Learning to relax is essential to regulating the overarousal response discussed in the previous section. When a muscle tenses up, as it does with overarousal, it contracts and shortens. Muscles can only pull, which they do by shortening and thickening. In order to make movement possible muscles are arranged in pairs. For example, when the biceps contract and shorten, the forearm bends and when the triceps contract and shorten the forearm straightens again. When the forearm is held somewhere in between, both muscles of the pair must pull against each other to produce the proper amount of tension and to keep the limb in a certain position.

When a muscle tightens as a result of anxiety, its opposite of the pair sets up a counter tension to hold that particular segment of the body in place. This double pull can build up tension in the body yet remain unidentified. When these muscles work full time without rest, pain and soreness result and a classic example of this is a tension headache.

The principle of the double pull (Harris & Harris, 1984) has great significance for the performer. The more muscular tension in the body, the more difficult it is to execute the proper coordination in a movement task. To learn to avoid excess tension sportsmen need to be taught how to relax. Total relaxation means letting go so that there is no tension in the muscle whatsoever and so that no messages are travelling to and from the brain.

It is true that a certain degree of arousal is necessary for performance. However, by training the muscles to relax totally performers can develop a reference as to what a "zero arousal" level feels like. Once this reference point is known it is possible to become aware of bodily responses and associate them with certain types of performances. It also provides an opportunity to increase awareness of physical and mental processes.

According to Harris (1986) the ability to relax produces a positive, pleasurable and beneficial experience that provides the central nervous system with rest and allows regeneration of physical, mental and emotional states with the athlete in control. Most importantly, the ability to relax provides the foundation for learning the skill of relaxation during practise and competition. This allows for reduction of overarousal at any point and a return to control over movements.

A motor skill accuracy task involving fine muscle coordination, putting a golf ball, was utilized by Murphy and Woolfolk (1987) to study the effects of two different cognitive strategies on performance. Sixty-one undergraduates participated in the study and were randomly assigned to one of three experimental conditions: (a) a cognitive-behavioural relaxation group, (b) an arousal group and (c) a control group. The cognitive behavioural group showed significantly greater reductions in anxiety during performance than did the other groups. A non-significant trend emerged on performance scores in that only subjects in the arousal group failed to improve their performance.

This study provides some evidence for Oxendine's (1970) theory that complex skills requiring fine muscle movement, steadiness and concentration (e.g. putting a golf ball) will be facilitated by low arousal but adversely affected by high levels of arousal. Weinberg and Genuchi (1980) provided additional support for the above theory in a study involving the relationship between competitive trait anxiety, state anxiety and golf performance in a field setting.

In general the techniques of relaxation can be divided into two categories: muscle to mind and mind to muscle.

#### 6.2.1. Muscle to mind.

##### Breathing Exercises.

Breathing properly during competition not only relaxes the performer but also facilitates performance by increasing the amount of oxygen in the blood (Mason, 1980). Effective breathing carries more energy to the muscles and facilitates the removal of waste products. By learning to take deep, slow breaths performers can trigger a relaxation response. Mason suggests the following specific breathing exercises to increase relaxation:

##### Complete breath.

Correct breathing comes from the diaphragm, which is the thin muscle that separates the lung and abdominal cavities, so it is vital that the lungs are filled from the bottom. In order to do so the diaphragm must be pushed down, forcing the abdomen out. Once the diaphragm is full the chest cavity can be filled. The breath should be held for several seconds before exhaling by pulling the abdomen in. After learning the procedure at least thirty to forty breaths should be taken each day.

Sighing with exhalation.

Sighing aids in reducing tension levels. Instruct the player as follows: "Inhale slowly and then hold your breath for 10 seconds, feeling the tension building in the throat and chest. Exhale through the mouth with a slight sigh as you let go of the tension in the rib cage. Do nothing about inhaling, let that happen naturally. Hold your breath and repeat the sigh with the exhalation as you force the air out of the lungs."

Rhythmic breathing.

Rhythmic breathing involves inhaling to a count of four, holding for a count of four, exhaling to a count of four and pausing for a count of four before repeating the sequence. The rhythm of breathing can be changed by changing the count.

Concentration breathing.

The object is to focus attention on the breathing rhythm. If attention wanders to some other thought between inhaling and exhaling attention must be redirected back to the next breath, letting the thought disappear. With each exhalation the person becomes more relaxed.

Progressive Relaxation (PR) Exercises

Working under the assumption that an anxious mind cannot exist within a relaxed body, Jacobson (1938) developed the concept of scientific neuromuscular relaxation or progressive relaxation. This skill is learned by inducing as much tension into a muscle group as possible, identifying what the tension feels like then releasing the tension. Attention is focused on a muscle group and becoming sensitive to any tension in any muscle. Once the skill is learned tension is not induced into a muscle group but simply identified and released.

There are different adaptations of the PR technique namely (Harris, 1986):

- a) Active PR
- b) Differential active PR
- c) Abbreviated active PR
- d) Passive PR
- e) Quick body scan
- f) Neck-shoulder check.

#### 6.2.2. Mind to muscle.

This category includes the cognitive or mental approaches to relaxation. Benson's (1975) relaxation response, meditation, autogenic training (Schultz & Luthe, 1959), hypnosis and visualization all fit into this category. Biofeedback training is also a useful technique for teaching people to reduce arousal. Biofeedback is the presentation of information to an individual about physiological processes such as muscle tension, heart rate, temperature and brain waves. People can be taught to self-regulate the processes that control arousal states in this way.

Sometimes it is necessary for sportsmen to be able to increase arousal and activation. Harris (1986) identifies nine specific skills and strategies that can be used to increase activation and arousal:

1. Breathing
2. Using energizing imagery.
3. Formulating energizing verbal cues.
4. Transferring energy.
5. Storing excess energy for later use.
6. Using the environment.
7. Listening to music.
8. Improving pacing.
9. Using distractions.

### 6.3. COGNITIVE TECHNIQUES

The cognitive technique that is most popular with athletes, coaches and sport psychologists is mental imagery or mental practice. Early research by Clark (1960) provided significant impetus to the study of mental practice and motor skill performance. Clark's study involved 144 high school male basketball players who were similar with respect to factors such as arm strength, intelligence and competitive experience. These athletes were evaluated on free throw shooting proficiency according to whether they had been assigned to a fourteen day physical practice or a fourteen day mental day practice group. In most cases Clark found that mental practice was as effective as physical practice.

Jones (1965) found that directed and undirected mental practice resulted in improved tennis skills. Shick (1970) also proposed that mental practice was effective in improving the skill of volleyball serving. An investigation was carried out by Woolfolk, Murphy, Gottesfeld and Aitken (1985) concerning the effect of imagery instructions on a simple motor skill accuracy task (putting a golf ball). Male college students (N=50) were assigned to one of six experimental conditions in a design that allowed the presence or absence of mental rehearsal of the physical movements involved in the task to be crossed with the imaginal depiction of a successful or unsuccessful task outcome. Results reflected the deterioration of performance in the conditions employing negative outcome imagery. The findings of this study are consistent with research showing that negative cognitive activity prior to an athletic activity produces deterioration of performance.

To be able to use imagery effectively it is important that underlying processes are understood. Vealey (1986) maintains that there are three keys to understanding imagery.

First, in order for imagery to be effective it should involve all the senses. The visual, auditory, olfactory, taste, tactile and kinesthetic senses are all important. For example, a golfer uses his visual sense to read the line of a putt, tactile sense to feel the grip of the club and kinesthetic sense to feel the putt that he is about to make. The emotions associated with experiences in sport are also important in imagery (Martens, 1986). In using imagery to control arousal, pain, anger or anxiety those emotions must be recreated in the mind.

Secondly, through imagery images can be recreated. It is possible for performers to watch a demonstration of a new or well executed task and to memorize the skill and recreate it at a later stage. Imagery can also be used to create new events in the mind. The brain is able to put pieces of an internal picture together in different ways and programme an image from various pieces of memory.

The final key to understanding imagery involves two theoretical explanations of how imagery works.

#### Psychoneuromuscular theory

As sportsmen engage in motor tasks impulses are constantly being transmitted from the brain to the muscles for the execution of movements. This theory suggests that similar impulses occur in the brain and muscles when mentally rehearsing a movement.

Jacobson (1931) first supported this phenomenon by demonstrating that the imagined movement of bending the arm created contractions in the flexor muscles of the arm. This study was replicated and supported by Hale (1982).

This theory was supported by Suinn (1980) after studying the electrical activity in the leg muscles of a downhill skier. Suinn found that a printout of muscle firings during imagery mirrored that of the actual ski run. The thought is that imagery may actually strengthen neural pathways for movement tasks.

#### Symbolic learning theory

This theory was first proposed by Sackett (1934), who stated that imagery enables performers to rehearse the sequence of movements as symbolic components of a task. All movements must be encoded in the central nervous system and this theory proposes that imagery facilitates performance by coding movements into symbolic components. This has the effect of making movements more familiar and automatic.

Studies by Feltz and Landers (1983), and Ryan and Simons (1981) have supported this theory by demonstrating that greater performance improvement has been observed in tasks that require cognitive coding as opposed to pure motor tasks.

This 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 movement behaviours.

Vealey (1986) provides a few suggestions that will increase the effectiveness of imagery use:

1. Relaxation should precede imagery.

Research by Kolonay (1977), Suinn (1980), Weinberg, Seaborne and Jackson (1981) indicates that imagery combined with relaxation is more effective than imagery alone.

2. Imagery should be practised from an internal perspective.

Mahoney and Avenier (1977) classified imagery as internal or external. Internal imagery means that visualization of an competition image takes place from behind their own eyes as opposed to an external perspective from which they see the image from outside their body. Hale (1982) found that internal imagery produced more electrical activity in the biceps than external imagery when subjects imagined flexion of the forearm.

3. Imagery should be practised with realistic expectations.

Unrealistic fantasizing is not the way to practice imagery. Physical, technical and tactical limitations must be taken into account when practicing imagery.

4. A quiet, comfortable setting will facilitate imagery.

A quiet, relaxed, comfortable setting that is free of distractions will assist in practicing imagery successfully.

#### 6.4. COGNITIVE-BEHAVIORAL MANAGEMENT PROGRAMMES

In an extensive review Feltz and Landers (1983) concluded that mentally practising a skill enhances performance more than no practice at all. Corbin (1972), also in review of mental practice, concluded that studies in this area contained too many methodological, task and individual differences to draw definite conclusions. Wollman (1986) concluded that the effects were too inconsistent to guarantee success in a motor performance situation.

Recent research by Andre and Means (1986) suggests that there is no guarantee that mental practice alone will enhance performance in a motor task. There seems to be a tendency to use a combination of psychological skills (Hall & Rodgers, 1989). Two psychological skills often used in combination with imagery are relaxation and self-talk (Rushall, 1979; Vealey, 1986).

The use of imagery and mental practice became more specific and Suinn (1976) developed a psychological intervention technique called Visio-motor behaviour rehearsal (VMBR). This technique involves the use of progressive relaxation and covert visualization of specific images. Studies carried out by Suinn (1977) and Weinberg, Seaborne and Jackson (1981) demonstrated that imagery when combined with relaxation is more effective than imagery alone. It is proposed that relaxation enhances the clarity of the imagery.

Several studies have utilized VMBR techniques as an intervention strategy designed to improve performance. Titley (1976) did a case study on a football place kicker trained in VMBR. Impressive post-intervention data were reported with the subject. In competition the player kicked nine out of nine extra point attempts and one out of one field goal attempts in the game following the first three treatment sessions. The subject went on to kick consistently throughout the season, including a 1974 NCAA record setting field goal kick of 63 yards.

Kolonay (1977) investigated the effectiveness of VMBR by examining the foul shooting percentages of four groups of college basketball players each receiving a different treatment: VMBR training containing both relaxation exercises and imagery rehearsal, relaxation training only, imagery rehearsal training only and no treatment.

The results of the study calculated on proportions of the before and after foul shooting scores found that only the VMBR trained group to have improved significantly. On this basis combined relaxation and imagery exercises were deemed necessary for successful treatment.

An investigation carried out by Weinberg, Seabourne and Jackson (1981) attempted to determine whether imagery combined with relaxation (VMBR) proved to be more effective in facilitating karate performance than either imagery or relaxation alone. The results showed only partial support for the effectiveness of VMBR in enhancing karate performance.

Lane (1980) employed VMBR techniques with three high school basketball players. Two of the three players improved their foul shooting proficiency by 10% at home games and 15% at away games; both significant differences based on comparisons with previous years' statistics. Lane (1980) also reports several case study results of successful implementation of VMBR with athletes competing in various sports at competitive levels ranging from elementary school through to professional sportsmen and sportswomen.

Noel (1980) conducted a more controlled study of the effectiveness of VMBR with male tennis players involved in a tennis tournament. A group of fourteen subjects was equated for skill level and divided into two; one group receiving VMBR while the control group did not receive any training or rehearsal. The VMBR programme in this study focussed on the tennis serve under tournament conditions.

Subjects practiced VMBR seven days prior to the first tournament match. The first three days involved practicing a relaxation technique and during the final four days both relaxation and visualization were practiced following typed instructions that were provided to the subjects. The results indicated that the serving performance of high ability players improved with VMBR while the performance of low ability players actually decreased with VMBR practice.

The covert strategies utilized in VMBR represent one method of cognitive intervention that appears to have the potential to facilitate skill performance in competitive settings. Another technique that appears in sport psychology literature applies cognitive behaviour modification (CBM) techniques (Silva 1982). These techniques differ from VMBR in that a significant emphasis is placed upon cognitive restructuring and self-instructional imagery.

A CBM approach was used by Meyers and Schleser (1980) with a collegiate basketball player who was having difficulty with field goal shooting. The player was provided with seven sessions over a three week period during which relaxation procedures and imagery sequences were developed. Successful performances were imagined first and problematic situations introduced later.

Coping self-instructions were introduced to the subject for the problematic situations imagined. This self-talk was task orientated and attempted to minimize self-critical statements for performance errors. The subject's performance during seven post-intervention games was compared to seven pre-intervention games.

The results indicated a significant improvement in field goal percentage (42.4% to 65.6%) and a significant improvement in the subject's points per game average. These improvements occurred for the subject while the performance of other regular team-mates showed no significant change over the same period.

Silva (1982) in a study of university level basketball players reported the successful use of CBM techniques. A college basketball player who suffered from poor free throw shooting all his career improved his shooting by 21.05% following fourteen days of intervention training. Team-mate improvement during the same period was only 2.7%.

Weinberg, Gould, Jackson and Barnes (1980) designed a study to determine the effects of various cognitive strategies on the tennis serves of advanced and beginner tennis players. The four strategies included imagery, positive self-efficacy statements, attentional focus and a control condition. The results showed that none of the cognitive strategies facilitated performance. The lack of significant effects could be due to the fact that the subjects did not receive prior training in using these strategies.

Wrisberg and Anshel (1989) examined the relative effectiveness of various cognitive techniques on the basketball free throw shooting of young players. Forty boys rated as good free throw shooters were randomly assigned to one of four training conditions, received instructions and practiced the respective techniques. The results suggested that mental imagery combined with arousal adjustment enhances free throw shooting performance.

Price and Braun (1983) used undergraduate college students to compare three methods of acquiring basketball free throw shooting skill: (a) relaxation, visualization and body rehearsal intervention (RVR); (b) traditional repetition; (c) a combination of the two. The investigators deduced that RVR was as efficient as repetition and a combination of the methods was superior to the methods used separately.

Meacci and Price (1985) replicated this study using the same variables and treatment of variables in an attempt to evaluate the effectiveness of RVR intervention for learning aggressive golf putting. The results of this study supported those of other experiments which demonstrated that cognitive interventions are associated with significant skill acquisition.

Kirschenbaum and Bale (1980) devised a cognitive-behavioural training programme to facilitate golf performance. The programme included training in: deep muscle relaxation, planning, imagery, positive self-monitoring and positive self statements. Golfers were instructed in the above-mentioned procedures during a two hour small group session. Three follow-up meetings were held to assist with the implementation of these techniques.

Studies over two years with the Cincinatti golf team reflected that the programme had potential beneficial effects but that additional research was necessary. The reliability of this study must be questioned in that only six subjects were used. Another point that emerged was that better control was necessary in order to determine the treatment effects.

## SUMMARY

It appears that, in general, primary and secondary strategies are effective in enhancing the achievements of performers in closed skill, self-paced sports. A synopsis of the literature appears in a paper written by Weinberg (1982) in which he proposes a set of guidelines with regard to the use of mental strategies:

1. Psyching-up effects appear to be task specific, strength and endurance tasks requiring high arousal and complex skills with fine muscle movement facilitated by low arousal (Oxendine, 1970).
2. The attentional requirements of different sports are important in that performers need to attend selectively to relevant task related cues.
3. High levels of anxiety can cause attentional focus to narrow and lose flexibility causing athletes to "choke" in pressure situations.
4. Confidence is crucial to achieving maximum performance and a number of techniques have been identified to help build confidence.
5. Relaxation techniques are effective in reducing high levels of anxiety that may interfere with performance.

The implications of these guidelines with regard to this particular study are that if a cognitive strategy is to be effective then all the above factors need to be taken into consideration. In addition a detailed task analysis needs to be undertaken in order to determine exactly what techniques would be most beneficial to the performer.

Primary and secondary strategies provide cognitive control over performance and athletes that possess effective strategies are able to attend and cope with situational demands (Singer, 1984).

While it is generally accepted that the above-mentioned strategies enhance performance it is apparent that researchers have concentrated their efforts in either the use of primary or secondary strategies.

When reviewing related literature it is noticeable that there is a distinct lack of studies that combine secondary and primary strategies into a single composite strategy. Singer and Cauraugh (1985) have formulated a global strategy which can be applied to any self-paced, closed skill. This study has included both types of strategies but the emphasis is on whether it can be used and adapted to any closed skill sport. Singer and Suwanthada (1986) tested the generalizability of the strategy and results indicate that the transfer value to related task appears to be beneficial.

Singers' Five-step strategy is useful as a broad outline for the formulation of task specific strategies and in particular self-paced, closed skilled sports. This study involves putting a golf ball for accuracy which is a closed, self-paced skill and therefore the Five-step strategy will be adapted to suit the needs of this particular study.

This modified Five-step strategy will include three separate strategies namely; Visio-Motor Behaviour Rehearsal developed by Suinn (1976), Nideffer's Centering technique and a detailed pre-shot attentional routine.

## CHAPTER THREE

### METHOD AND PROCEDURES

#### INTRODUCTION

This study primarily concerns the formulation of cognitive learning and performance strategies applied to the game of golf and specifically to golf putting. A review of related literature clearly indicates that there is a need for field research in this particular study area.

When referring to field studies regarding sport, Whiting remarked that:

...these kinds of approaches are likely to make a greater contribution to the understanding of the practical acquisition of skill in sport than many of the studies emerging from the more restricted tasks of the experimental psychologists' laboratory.  
(Whiting, 1982:10)

A laboratory can be almost anything according to Singer (1980). Traditionally it implies an area where situations can be controlled fairly effectively. Although control is optimal in the research laboratory, usually the realism of the situation is lost. Behaviour may or may not be the same as the real life situation.

On the other hand the field situation displays less artificiality but there is a loss of experimental control over the subjects and conditions. For these reasons this study aimed to reproduce a laboratory situation which was as realistic as possible but which also allowed for maximum control of experimental variables.

By constructing an artificial putting surface inside a laboratory there is a high degree of internal validity. It ensures control of as many external variables as possible. This aspect is of prime importance to the study in that if internal validity is not properly controlled, the change in the dependent variable may be difficult to attribute to the manipulation of the independent variable (Thomas & Nelson, 1985).

External validity is also of importance to this research and for this reason every attempt was made to ensure that the conditions in the laboratory setting were as close to the competition environment as possible. This would allow for greater generalizability of results (Thomas & Nelson, 1985). A limited field study on local professional golfers will also help to assess results more accurately.

All three groups used in the study were subjected to a pre-test before the onset of the experimental programme. After being exposed to the experimental programme for a period of five weeks the entire group was then subjected to a post-test. These tests served as the dependent variable. The dependent measure was the success rate of putts made from various distances.

Two experimental groups were exposed to two different types of cognitive strategies in workshop type situations over the five weeks. These strategies represent the independent variable. The control group received no treatment at all but simply took part in the pre-test and the post-test.

## SUBJECTS

The sample consisted of 25 male golfers between the ages of 15 and 35 from the Stellenbosch Golf club. These golfers were at the time actively involved in competitive golf and were all single figure handicap golfers. These subjects have reached an advanced stage in skill acquisition and it was assumed that no subject had a vast advantage when it came to technical execution. The subjects were divided at random into three groups: a Control group (n=9); Experimental group A (n=8); and Experimental group B (n=8).

## TESTING PROCEDURES

The test required each subject to putt a golf ball at the hole from eight different distances of 1 metre, 1.3 metres, 1.6 metres, 1.9 metres, 2.2 metres, 2.5 metres, 2.8 metres and 3.1 metres. These distances were marked on the surface of the putting carpet and arranged in a fixed pattern around the hole.

The test comprised of sixteen trials and all subjects had two attempts from the eight distances measured out on the carpet. The sequence of the putts was standardized for all subjects. Subjects were tested individually and were provided with standardized instructions on how to perform the task. These instructions were read out by the experimenter. All subjects were allowed four practice trials to familiarize themselves with the task and the conditions. The number of putts that were successful or unsuccessful were recorded on a form designed for this purpose.

## APPARATUS AND FACILITIES

The test was conducted inside a laboratory at a time when no external factors could interfere with testing procedures. Testing indoors eliminated variables such as changes in climate. The test was carried out on an artificial putting surface specifically made for the experiment. The reasons for using an artificial green was to prevent any changes that might have occurred in a grass putting surface over a period of five weeks. In addition a level surface was necessary to ensure that results were consistent.

This surface was 5.4 meters long and 3.6 meters wide with a golf cup that conforms to specifications of the R and A Golf Club, which is the ruling body of golf. The surface was made of chip board with a green ozite carpet as the covering. The surface was level and had no uneven areas to make putting results consistent. The subjects used their own golf putter and golf ball of their choice as would be the case in normal competition.

## PILOT STUDY

Three subjects of average ability were used in the pilot study. The main problem encountered by the experimenter was the distances of the putts to be used in the test. Long putts would yield low scores and if the putts were too short it led to an unrealistic success rate. The ideal was to have putts that were challenging but not too difficult. For this reason the three subjects were tested over different distances to determine the optimal distance.

The number of trials, number of practice trials and the time taken to complete the test was also considered in the pilot study. This proved helpful when designing the test as the subjects in the pilot study took longer than initially anticipated.

Another factor that needed to be tested was the type of situation that would place the subject under competitive conditions. From this it was decided that having the subject alone with the experimenter would be most realistic as additional observers in the laboratory could behave inconsistently and have inconsistent effects on the subject taking the test.

Two of the three subjects were then exposed to the experimental programme. From feedback received changes were made to the programme. This also enabled the experimenter to work on the presentation of the programme.

#### EXPERIMENTAL DESIGN

All three groups took part in the pre-test and the post-test which served as the dependent variable in the experiment. Experimental group A took part in a experimental programme while experimental group B simultaneously took part in a different programme. These programmes are the independent variable in the experiment. Control group C received no treatment whatsoever (see Figure 3.1).

VARIABLES	Experimental Group (A)	Experimental Group (B)	Control Group (C)
Pre-test, dependent variable	* (X1)	* (Y1)	* (Z1)
Independent variable, Experimental programme 1	*	-	-
Independent variable, Experimental programme 2	-	*	-
Post-test, dependent variable	* (X2)	* (Y2)	* (Z2)

**Figure 3.1** The experimental design

#### EXPERIMENTAL PROGRAMME

Two experimental groups were subjected to separate strategies. For the purpose of this study these groups will be labelled EG A (n=8) and EG B (n=8). EG A had five lectures and EG B had seven lectures. These lectures took the form of a workshop type situation where the different strategies were explained, demonstrated, learnt and practiced. A detailed description of these lectures and strategies can be found in Appendix A.

The basis of the strategies employed by both groups is Singer's Five Step Strategy (Singer, 1986). EG A adopted a pre-shot routine that focused mainly on mechanical aspects. In addition EG A was taught Nideffer's centering technique which is part of his Attentional Control Training programme (Nideffer & Sharpe, 1978).

EG B applied the identical procedures used by EG A but it included the Visio-Motor Behavior Rehearsal (VMBR) method popularized by Suinn (1976). This technique involves training in relaxation and imagery skills. The process that was followed in the strategies was aimed at focussing attention on task relevant cues so that task irrelevant thoughts and negative images were prevented from disrupting the subsequent performance. The centering and VMBR techniques would assist in maintaining attentional control in potentially stressful competition situations. It is hypothesized that EG B by using an additional cognitive strategy, Visio-Motor Behavior rehearsal (VMBR), would be more successful than EG A.

Because Experimental Programme A (EP A) is identical to Experimental Programme B (EP B) aside from the VMBR technique, the instruction variables of EP A will be discussed first with reference to the outline of a pre-shot routine. EP A had a total of five lectures in the five-week period. These lectures varied between thirty and forty-five minutes each. At each meeting subjects in the group were given typed handouts of the techniques covered in the lecture on that particular day and the theory behind the technique. The first session was devoted to explaining the objectives of the exercise and providing some theoretical background as to the reasoning behind why this particular treatment was being carried out.

The subjects in EG A were introduced to Nideffers' theory of attentional control and taught the centering technique. The importance of switching attentional focus was explained and in order to ensure that all stages of the movement was processed a detailed pre-shot routine was recommended. All subjects had a written copy of the pre-shot routine and the centering technique at their disposal so that they were able to practice. One lecture was devoted to the practical application of these techniques.

The treatment for EG B was different in that they had seven lectures which varied between thirty and forty-five minutes. The first lecture was also devoted to explaining the theory behind the strategy. This group was then exposed to the relaxation and mental practice techniques used in the Visio-motor Behavior Rehearsal method. The aim was to master the relaxation aspect so that subjects could utilize relaxation procedures in a very short time for use in the experimental programme. The relaxation aspect was introduced by means of a tape recording and subjects were required to practice daily to improve and master this procedure.

After the relaxation the subjects in EG B were then instructed in the technique of mental rehearsal. The objective was to teach the subjects mental rehearsal techniques which they can subsequently use in putting a golf ball and in so doing improve their performance.

In order to achieve this the group was first taught general imagery skills which involved using all the senses. This was then adapted to include general golf imagery and finally just putting imagery. A imagery tape was made up including all the aforementioned and given to each subject in the group for individual practice.

The ultimate aim was for the subjects to become proficient in this technique so that it could be used during the pre-shot routine while in a competition environment.

The subjects in EG B were then instructed in the pre-shot routine that included relaxation, imagery and the centering technique. The last lecture was devoted to the practical application of these techniques. The subjects in EG B were also provided with a written copy of the pre-shot routine and centering technique so that subjects were able to practice on their own.

To determine the effects of each cognitive strategy subjects were asked to complete a questionnaire after the five week period.

#### FIELD STUDY

A field study was carried out on professional golfers (N=57) who participated in the South African TweeJongezellen Masters Professional Tournament in Stellenbosch. One hundred and forty-four golfers qualified to play in the tournament and as many as possible were approached and requested to complete a questionnaire.

The questionnaire was designed to determine the extent to which professional golfers employed certain psychological techniques and whether these techniques were used within a pre-shot routine. A copy of the questionnaire is included in Appendix F.

The results of the questionnaires are divided into two, a successful group and a unsuccessful group. One hundred and forty-four golfers played the first two rounds of the tournament and after two rounds (36 holes) the best 66 qualified for the remaining two rounds of the tournament. In golfing terms this is known as "making the cut".

The successful group represents 29 of the golfers that made the cut and the unsuccessful group (n=28) are amongst those golfers who missed the cut. This cut is important for professional golfers because of two reasons. Firstly, it means that the successful golfer will have automatic entry into the next tournament. The golfer who makes the cut is also guaranteed of financial reward after 4 rounds (72 holes).

The reason why these results are divided into two groups based on performance scores is to try and determine if those golfers who performed better in terms of performance scores in a particular tournament have different approaches in terms of pre-shot routines and mental strategies. The mean scores of these two groups are presented in Table 5.1.

## CHAPTER FOUR

### RESULTS, DISCUSSION AND CONCLUSION

#### RESULTS OF EXPERIMENTAL STUDY

The research hypothesis stated that learning and performance strategies would assist performers to attain higher levels in technical and mental skills with a resultant improvement in performance. In order to test this hypothesis the effect of two such strategies was tested on two experimental groups of golfers. Experimental group A was exposed to a behavioural pre-shot routine treatment programme for a period of five weeks. Experimental group B received the same treatment as group A but also received additional training in visualization and imagery.

The first analysis performed on the data was a one sample hypothesis test for matched pairs between pre-test and post-test scores within groups A, B and C. The t-test was used because the scores within each sample were not independent as subjects were measured on a before-after basis. Therefore only matched pairs tests for non-independent samples are valid.

From this test it could be deduced whether exposure to the experimental programme had a significant influence on the dependent variable for either of the groups. The results are presented in table 4.1.

**Table 4.1** Pre-test and Post-test scores

SUBJECTS	GROUP A		GROUP B		GROUP C	
	Pre	Post	Pre	Post	Pre	Post
1	10	10	10	14	8	10
2	10	12	9	12	8	13
3	9	8	5	12	8	12
4	11	9	10	11	10	7
5	11	10	8	8	10	10
6	9	11	10	11	10	9
7	7	11	6	5	9	8
8	11	11	8	11	9	8
Mean	9.75	10.25	8.25	10.50	9.00	9.625
SD	1.3887	1.2817	1.9086	2.7775	0.9258	2.0658
t	0.7072		2.4962		0.6372	
F	0.5		6.2308		0.4060	
p	0.5024		0.0412		0.0544	

The results (Table 4.1) show that there was no significant difference ( $p=0.5024$ ) between the pre-test and post-scores of Experimental group A. The fact that EG A did not improve significantly can be attributed to the absence of visualization and relaxation techniques in the treatment. This result indicates that a purely mechanical routine is not sufficient to produce consistently good performance scores. It would seem that the cognitive content of a strategy is very important for success.

The results of Experimental group B accepts the research hypothesis that a performance strategy which combines a behavioural pre-shot routine together with cognitive techniques, in this case visualization and relaxation will improve performance scores significantly ( $p=0.0412$ ). The results in table 4.1 show quite clearly that the scores of all the subjects barring one improved significantly and this can be attributed to the experimental programme that they were exposed to.

To establish whether there was any difference in the control group scores the same test was carried out. The results indicate that this group showed no improvement between pre-test and post-test, which was expected ( $p=0.5443$ ).

A one-way analysis of variance was conducted on the difference scores between the three groups. The finding was that there is no statistical difference between the mean scores of the three groups ( $p=0.3050$ ). Group B shows a tendency to differ from groups B and C scores. An examination of the scores shows that group C data are highly positively skewed. This indicates a few outliers and the non significance of the findings can in part, be attributed to these outliers.

#### ASSESSMENT OF EXPERIMENTAL PROGRAMME

In order to assess the subjects' perception of experimental strategies they were asked to complete a questionnaire on completion of the experimental programme. The responses were on a seven point Likert scale ranging from 1 to 7 and the means for each group were calculated. Descriptive data are presented in Table 4.3. A copy of the questionnaire is included in Appendix E.

The results of the manipulation check clearly indicate that Experimental Group B perceived their programme to be more beneficial than did Experimental Group A. Although none of the differences are significant, the means of EG B are higher than EG A with the only exception of the final question which enquired as to the complexity of strategy. Both groups found the strategy to be relatively simple and the fact that EG B was slightly higher than EG A can be attributed to the fact that the strategy for EG B included relaxation and imagery techniques. Apart from making the strategy longer and more involved these techniques were also novel and this factor could have influenced the subject response.

The fact that EG B found the strategy to be more helpful must be attributed to the relaxation and imagery techniques. EG A received the identical treatment but for the aforementioned techniques. These results support those of the experimental test and will be discussed in detail in the next section.

Overall the data showed that those who participated in the Experimental Programme profited from the experience. From the comments of the participants it was clear that they enjoyed the programme and felt that it added a new dimension to their game. Some subjects even felt that it had improved their actual golf scores in competition.

It is interesting to note that one of the subjects in EG B became the South African Universities Strokeplay champion only two months after participating in this programme. This subject felt that the experimental programme had improved his putting tremendously.

**Table 4.2** Manipulation check questions and mean scores

QUESTIONS	GROUP A		GROUP B	
	M	SD	M	SD
Will learning about the nature of anxiety and its impact on performance be beneficial to your performance?	6.25	1.16	5.86	0.99
Does the centering technique help your balance?	5.25	0.87	4.88	0.87
Does the centering technique help to focus your attention?	6.25	0.87	5.38	0.74
Does the pre-shot routine improve consistency of your performance?	6.00	1.41	5.75	1.39
Does the relaxation technique assist in controlling tension levels?	5.25	1.16	-	
Does imagery give you better results during performance?	5.38		-	
Will this strategy help you to handle "pressure" situations in competition?	6.25	0.71	5.75	0.71
Does this strategy increase control and confidence?	6.38	0.74	5.6	1.07
Is this strategy too complicated?	2.50	1.20	2.3	1.13

## RESULTS OF FIELD STUDY

Results from this questionnaire show that the two groups differ significantly only with regard to their perception of the importance of the psychological aspect of golf to performance. The successful group placed more importance on the psychological aspect (80%) than the unsuccessful group (73%) (see table 4.3).

The fact that the majority of the successful group includes the older more experienced golfer could be a reason why this group sees the mental aspects as more important. The experienced professional golfer has realized after a few years on the tour that it is not simply hours and hours of physical practice on the practice tee that will ensure success in competition. Many of these experienced players accept the fact that when they perform at their peak they are concentrating well and work out strategies to try and maintain this concentration in all types of competitive situations. This is essentially a learning process and some learn quicker than others while some have difficulty throughout their careers.

From various discussions with the players participating in this tournament it is clear that although they do place a high value on the importance the psychological aspect of golf they do not have any real knowledge of how to prepare mentally for competition. Golfers spend vast amounts of time studying the mechanics of the swing and are very knowledgeable as regards the technical aspects. The amount of time devoted to mental preparation is also minimal when compared to the physical aspect.

**Table 4.3** Comparative scores of professional golfers

QUESTIONS	SUCCESSFUL		UNSUCCESSFUL	
	GROUP		GROUP	
	N=29		N=28	
	M	SD	M	SD
What percentage of golf do you consider to be psychological?	* 80%	9.35	73%	13.59
Are you satisfied with the consistency of your performance?	3.35	1.17	3.47	0.94
Do you have problems focussing your attention before a shot/putt?	3.76	1.30	3.76	1.68
Are you able to control tension levels in pressure situations during a round?	4.31	1.30	4.59	0.80
Do you consciously use a pre-shot routine before every shot/putt?	5.13	2.03	5.18	1.59
Is your pre-shot routine identical for every shot/putt?	5.20	1.37	5.12	1.40
Does the routine include any form of visualization/mental imagery?	5.60	1.35	5.59	1.23
Does the routine include some form of relaxation?	4.47	1.30	4.89	1.31

\*  $p < .05$

Both groups indicated that they were not satisfied with the consistency of their performance and scores of 3.35 and 3.47 on a seven point Likert scale bear this fact out. The main complaint with regard to this question was that the golfers could not understand why they would perform so differently during practice and during competition.

This statistic reinforces the fact that few local golfers have sufficient knowledge of mental preparation and do not spend time preparing for different situations that might affect their ability to perform to their physical peak. Adequate mental preparation will result in golfers being able to perform more consistently.

The results also show that both groups have difficulty focussing their attention before any type of shot, both groups scoring 3.76 on the seven point scale. This effectively means that golfers often have problems focussing attention during a round before executing a shot or a putt. Focussing or paying attention to a task is according to Nideffer (1986) the most important key to effective performance in sport. In spite of the tremendous importance placed on concentration and attention in sport golfers do not know how to train to concentrate more effectively.

The results of this study provide strong support for the existence of consistent pre-shot routines in both groups of golfers. It is also clear from the results that both groups use some form of mental imagery/visualization within their pre-shot routine.

This is not surprising as many golf books and magazines have advocated the use of these routines. Jack Nicklaus was one of the first golfers to use a pre-shot routine together with visualization and in his book *Golf my way* he describes this as "going to the movies in your head". Since then many articles have appeared supporting mental practice to enhance performance. It seems, however that very few golfers have progressed past the initial stage to actually spending time training to visualize more effectively or expanding knowledge about visualization.

In a very recent article published in the *Golf Digest*, Greene (1989) states quite unequivocally that visualization is a skill that requires four steps in order for it to be effective.

These four steps include a relaxation phase in which he states that visualization is more effective when a golfer is relaxed. The second step is a warm-up phase in which the golfer prepares himself to visualize. The third phase is the actual visualizing of a golf round including parts of the pre-shot routine. The fourth step to effective visualization is to improve the ability to control images. Greene emphasizes attention to three key areas when measuring improvement.

The first is vividness of the image. Is the image a series of pictures or one long, moving picture? The second is perspective. Can the image be seen from an internal perspective and an external perspective? The third area is the frequency, intensity and duration of visualization.

The results show that there is also some support for the use of relaxation during the pre-shot routine although this is not as strong as for the use of imagery. Golfers who participated in the study admitted that they had no idea how to control physiological and psychological stress levels during competition.

The findings of this study clearly indicate that there is a need for an in depth study into the mental preparation of South African golfers. Most have no or very little knowledge of how to prepare mentally for competition or how to achieve peak performance consistently during competition. There is also a complete lack of local literature and expertise available to golfers to assist them to train mentally in this country.

This research has highlighted the areas that need attention and also provided a framework around which future research can be done. It can be recommended that similar research be carried out on a smaller sample of professional golfers over a period of six months or even a year. Regular meetings and interviews with golfers of varying ability could lead to discovery of important and helpful strategies that would ultimately benefit all golfers.

## DISCUSSION

This experiment examined the effect of two different treatment strategies on putting performance. The results reveal that the group which was exposed to the treatment strategy combining both an attentional pre-shot routine, relaxation and imagery (VMBR) improved performance significantly.

The probable reasons for the significant difference in the improvement of the cognitive-behavioural group can be attributed to a number of factors. Firstly, the pre-shot routine enables the golfer to focus thoughts on a series of well rehearsed cues and reduces the possibility of focussing on negative feedback (Crews & Boutcher, 1986).

By occupying processing space with a well learned sequence of behavioural routines and images, the performer is unable to pay attention to any negative, superfluous information (Keele, 1973). This view is further backed up by the theories on capacity for attention and information processing.

Schmidt (1988), in a review of attentional theories regarding capacity to handle information from the environment or from memory makes the following observations. If an activity requires attention then some or all of this limited capacity must be allocated to its performance and control. Because of this limited capacity for attention, any other activity that requires part of this capacity could affect the actual task by decreasing performance speed and/or quality of performance. This is especially relevant for those activities that require very specific processing of information, response selection and response programming.

The literature study provided a background as to how different attitudes, thought processes and perceptions can affect a performer. The nature of sport is to place the performer under pressure during competition. The game of golf is no exception and this fact is exacerbated by the amount of time that a golfer has to think during a round of golf. Putting seems to place golfers under immense pressure due to the finality and seemingly simplicity of the task.

These factors lead to what is known as sporting circles as choking. Nideffer (1986:265) defines choking as "when their performance seems to be progressively deteriorating and when they seem incapable of regaining control over performance on their own."

Figure 5.1 illustrates the interaction that occurs between physiological and attentional processes during stressful competition conditions. This figure also shows how the changes that occur affect performance. The situations that lead to choking are highly individualized but it is generally accepted that the more important the competition event is to the performer the greater the potential for choking to occur (Nideffer, 1986).

Morley (1976) supports this basic model in his book called *Golf and the mind* and uses Jack Nicklaus as an example of how to control stressful situations. Morley states that the tempo and pace of the golfer must be consistent to ensure good performance and that many golfers allow themselves to swing the club a little faster and prepare for the shot quicker resulting in a loss of rhythm, coordination and timing. This also will cause a decrease in the information processing effectiveness.

This speeding up of pace is due to the increase in heart rate, respiration rate and muscle tension. This is also due to the psychological fear of failing and wanting time to speed up so that the situation can have passed as quickly as possible. A detailed pre-shot routine such as that which Nicklaus uses enables him to maintain a consistent pace and therefore a consistent performance.

## SITUATIONS LEADING TO CHOKING

### PHYSIOLOGICAL CHANGES

1. Increases in muscle tension
2. Increases in heart rate
3. Increase in respiration rate

### ATTENTIONAL CHANGES

1. Narrowing of attention
2. Internal focus

### PERFORMANCE PROBLEMS

1. Disturbances in fine muscle coordination and timing.
2. Rushing.
3. Inability to attend to task relevant cues.
4. Fatigue and muscle tightness.

**Figure 5.1** Interaction of physiological and attentional processes under stressful conditions (Nideffer, 1986).

The principles underlying Nideffer's Attentional Control Training (1978) which was part of the experimental programme suggest that by creating changes in the physiological and attentional processes associated with the downward spiral of choking the performer can regain control. Therefore, if performers have the ability to eliminate excessive muscle tension and increased heart and respiration rate, reduce attentional distractors and improve the ability to concentrate, then the chances are that choking is less likely to occur.

The strategy which proved effective in improving golf scores could be divided into two basic parts, the mechanical pre-shot routine and the cognitive part which involved the use of relaxation and visualization. It is proposed that these two parts work together in allowing the golfer to perform better in the following way.

Nideffer (1986) has shown in Figure 4.1 that physiological changes and attentional changes can destroy performance. Effective use of relaxation, centering and visualization prevent increases in muscle tension, heart rate and respiration which in turn prevent performance problems. A structured pre-shot routine forces the golfer to engage in the four types of attentional focus discussed in the literature study. This results in the golfer absorbing all the relevant information from the movement environment necessary to ensure effective programming of the subsequent movement. In this way the golfer can prevent rushing of the shot and decreases the inability to attend to task relevant cues.

Under ideal conditions the performer would be able to prevent choking from ever occurring. This is unrealistic and the aim of a performance strategy is to reduce the tendency to choke and to be able to recognize and control the symptoms of choking before it can spiral out of control. The mere fact that the golfer understands the process, can recognize the symptoms and has a strategy to counteract the downward spiral will in itself provide confidence. In this way a golfer can maintain a consistent performance standard.

Secondly, learning a behavioural routine and imaging the shot beforehand will prevent the performer from focusing on specific parts of the task or skill, such as the position of the hands or the take-away of the club, may prevent smooth, coordinated performance. For instance, focusing attention on hand movements while playing the piano has been found to detract from the quality of performance (Schmidt, 1988).

This idea has been discussed since the turn of the century and has resulted in what is known today as the Bliss-Boder hypothesis due to the research that Bliss and Boder carried out in this field.

Another area of research that relates to this idea is the concept of stages of motor learning. Described by Fitts and Posner (1967), the stages of motor learning include the cognitive phase, the associative phase and the autonomous phase. The concept of stages of skill acquisition suggests that the beginner requires more conscious thought related to the sequencing of movement, the intermediate performer in the associative stage would incorporate cognitive strategies to make minor adjustments needed to learn the task. The advanced performer in the autonomous stage would require less cognitive processing related to the actual movement and therefore could become involved in other strategy related aspects like a pre-shot routine (Schmidt, 1988).

Thirdly, this strategy may provide a way for the performer to achieve the right "set" for the execution of skills which take place over many hours and in many different pressure situations. This set hypothesis has emerged from studies examining the warm-up decrement phenomena (Schmidt, 1988). The warm-up decrement simply means that there is a decrement in performance after a brief rest period.

Two explanations have been put forward to explain the warm-up decrement. The earliest explanation to be considered is that the warm-up decrement is a form of forgetting or loss of memory for the skill. The improvement in performance with practice is a result of relearning the skill that was lost in memory during the rest period.

The second explanation expresses the view that decrements in performance is related to the loss of some temporary internal state or set that underlies and supports the skill (Schmidt, 1988). This hypothesis suggests that memory is not lost over the rest period, or that if very small memory losses do occur then they are far too small to account for the large decrements seen in performance. With resumed practice on the task the performer regains the lost set and performance is improved.

Nacson and Schmidt (1971) did extensive research in this specific area and all the experiments are consistent in saying that the warm-up decrement is caused by some loss of internal adjustments or set during the rest period. These adjustments seem to be critical to effective performance but it is not clear at this stage exactly what is being adjusted. Candidates are level of arousal, rhythm and timing of the trial cycle, the attention to proper sources of feedforward and feedback.

These findings have considerable relevance for elite performers and especially for golfers in a sport where there is relatively large time gaps between shots and also major changes in task requirements. The nature of the game of golf requires that performers have different sets for driving, long irons, short irons, chipping and putting.

Even within these different sets one expect to have slight variations in the set depending on the demands of the particular shot. For example, in putting, the same basic set would be used for every putt but the force variable would change for every putt depending on the task demands and the conditions. Failure to adopt the proper set could result in ineffective performance.

The question that must be asked is, "can performers adjust their own sets?" It would seem that if the performer engages in some preliminary activities like a performance strategy which includes an attentional pre-shot routine, relaxation and imagery the effects of the warm-up decrement would be reduced and even done away with completely. It would appear from the findings of this study that mental imagery has the effect of recalling the correct set before the movement task.

Possibly the most important theory that underlies the use of pre-shot routines and strategies is the schema theory (Schmidt, 1988). The schema theory holds that motor movements are stored in memory in the form of a generalized motor pattern that can be recalled and executed. A generalized motor programme is a set of preprogrammed central commands that execute a movement in an open-loop fashion, in the absence of feedback during the movement.

Four sources of movement information are stored in memory for a short period of time (Schmidt, 1988):

1. initial conditions (body positions, weight of implement);
2. specific duration and force parameters;
3. environmental outcome of the movement;
4. sensory outcome of the movement (feelings, sounds, visual senses).

The performer defines relationships, or schemas between this information. According to Schmidt two schemas are formed in memory: recall schemas and recognition schemas. The recall schema defines the production of movement and controls movement. Recognition schema evaluates the response by comparing the actual sensory feedback to the expected sensory feedback.

Pre-shot routines allow golfers to form a recall schema by setting up the initial conditions and response parameters needed to run the motor programme. Based on past experience, the specific force and duration parameters are initiated that provide the closest match to the desired environmental outcome.

It is thought that visualization will assist in recalling and defining the appropriate parameters that will achieve the motor response. The use of visualization in pre-shot routines also facilitates the execution of selected motor programmes by running off the intended programme by way of covert processes and in so doing allows the neural pathways to be stimulated immediately prior to the movement (Cohn, 1990).

#### CONCLUSION

In past years, it was relatively easy for single individuals or even countries to dominate a specific sport simply because they put maximum effort into that sport on an international basis. Once other countries began serious, year round training and competition in a particular sport domination became more difficult. Skills at the top level began to equalize and it became increasingly difficult to become an outstanding performer.

Performance improvements are mainly due to the application of sport sciences like physiology, biomechanics and psychology. In competitive situations it is difficult to determine if performance improvements occurred because of changed fitness levels (physiological), improved skill level (biomechanical) or improved behavioural/cognitive factors (psychological).

Rushall (1989) puts the value of sport sciences into the following context. Physiology develops the energy base for performance but is limited and does not change its potential for effect after a relatively short period of time. Biomechanical returns also level out after a certain period of time if no new skills are introduced. However, psychology determines how well the finite contributions of physiology and biomechanics are used. According to Rushall (1989), it is the critical sport science for governing the level of performance.

Orlick (1986), states that there are four basic human requirements for excellence: talent, hard work, simulation and psych. He agrees with the above statement by Rushall and comments that although many champions have been produced through a combination of talent, hard work and simulation he also maintains that refined mental training will be the final prerequisite. Orlick (1986), emphasizes that to excel, athletes must develop a refined mental plan to be used before, during and after the event.

In the introduction of this study it was recognized that there was a need for the structuring of various psychological techniques into sport specific strategies that could enhance performance. This study provides one example of how the task demands of a movement should be taken into account when implementing a mental strategy.

Many theories have been put forward as to why this particular experimental programme proved successful for golfers. It is impossible to say which one is more influential than the other but it is clear that the combination of different techniques enhance the processes that are required to produce an effective movement.

The content of sport specific routines is influenced by a number of factors. Cohn (1990), in a review of pre-performance routines states that the following should be considered when structuring routines:

- (a) the sport and nature of the required task;
- (b) the skill level of the person;
- (c) individual preferences.

Finally, it is obvious from this study that knowledge and insight can be gained from in-depth studies of individuals who participate in a specific sporting field.

#### FUTURE RESEARCH

Further applied research which explores mental strategies and plans is necessary to enable us to understand human performance. This particular research attempted to simulate competition conditions as closely as possible in a laboratory situation. Although this proved reasonably effective it is no substitute for real competition conditions.

The next logical step would be to follow up this research with a number of case studies involving professional golfers. In this way one could monitor whether mental strategies affect a professional golfers performance over a competitive season. Strategies could also be used for all types of golf shots and not only for putting. A question that must answered is whether or not strategies should differ for different types of golf shots?

Further research is necessary to determine the relationship between attentional styles and success in golf. Another area that could be explored is some type of biofeedback to control tension levels.

Many amateur and professional golfers suffer from what is commonly known as the "yips" which causes an uncontrolled stab at the golf ball on the putting green. This problem certainly warrants further research.

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## APPENDIX A

### MENTAL SKILLS PROGRAMME

#### INTRODUCTION

Most golfers agree that success in golf is largely due to mental factors. The higher the skill level, the more important the mental aspect becomes. Few people are able to perform consistently in serious competition. The fact that we can play well one day and badly the next day is cause for great concern. Between two performances there is no change in physiological or skill level so it obvious only psychological factors have changed. In *Golf my Way*, Jack Nicklaus states that mental preparation is the single most critical element in peak performance.

Mental aspects of golf cannot be separated from the physical yet most golfers spend time practising and preparing their shotmaking and rarely if ever take the time to prepare mentally. Applied sport psychologists maintain that there is an ideal body/mind state associated with performing at your peak. This ideal state does not just happen. Top golfers have identified their own ideal performance state and have learned to create and maintain this state voluntarily so that their talents and physical golf skills can reach their potential. The mental skills needed to trigger this ideal performance state are learned through knowledge and practice just as the physical skills and strategies of the game are learned. Some people can perfect these mental techniques on their own but most people need to be taught specific training techniques.

Knowledge in applied sport psychology has advanced to the point where these techniques are available. Some of these techniques have been applied to an aspect of golf which many golfers find frustrating - putting. This strategy is aimed at improving consistency in putting under competition conditions.

Why did Doug Sanders miss a short putt on the last hole in the British Open when normally he could make that kind of putt with his eyes closed? Why do we have days when nothing can go wrong and our confidence is sky high and then when we really need to win a vital game or make a vital putt we make errors that normally would never happen?

The answer is simple - PRESSURE!

The nature of sport however, is to put pressure (stress) on those who take part, to make demands on your physical and mental energies. Anxiety is a reflection of pressure and is an emotional response which is characterized by feelings of worry and tension. Anxiety may be no more than a fleeting moment when you have missed a short putt and are faced with another of similar length or it may develop into a long term thing like the "yips." As anxiety increases and self-belief decreases the putt seems to be longer and more difficult and the hole seems to shrink. The effect on your game could be disastrous.

Anxiety is highly individualized but here are some factors that could have an impact on your own anxiety level:

1. The importance of the game.
2. The size and supportiveness of the crowd.
3. Fear of failure.
4. Fear of success.

The important factor is not the amount of stress but the response to it. Stress results in two related but separate responses, a physiological one and a psychological one. The physiological responses that occur in the body are increases in heart rate, respiration and muscle tension. These changes result in an increase in arousal. Research has shown that high arousal levels have a negative effect on golf performance. This factor causes muscle tightness, disturbs muscle coordination and timing. A low level of arousal is necessary to be able to perform effectively.

The psychological responses result in a narrowing of attention and a tendency to be distracted by negative, task irrelevant thoughts and feelings. With increases in arousal you lose the ability to effectively organize and integrate information. You become internally focused and are distracted by feelings of tension and negative thoughts. This leads to an inability to focus on and attend to task relevant cues. In addition you start to rush both your preparation and execution. All these factors once again lead to an increase in physiological anxiety and arousal causing performance problems.

All this information might sound extremely negative but it is important that you are familiar with these processes so you are able to cope with any stressful situation that might arise. It is quite normal to experience stress and to have negative thoughts during competition. All people have times when they suffer from the effects of overarousal and anxiety. If negative thinking serves to help motivate you and focus your attention then it is not a problem.

On the other hand, if it distracts you and keeps you in your head, preventing you from performing to your potential then it is a problem. Your goal should not be to stop negative thinking but rather to learn how to let the negative thoughts go and redirect your attention towards your performance.

The key is to be able to regain control when you feel that you might be losing it. In order to regain control it is necessary to be aware of tension and to have some coping strategy that can reduce tension and arousal levels and help you to concentrate on the task relevant cues. This programme will expose you to techniques that will enable you to achieve this.

#### RELAXATION TECHNIQUES

You may wonder why a golfer needs to be completely relaxed? What has relaxation got to do with golf? According to research golfing skills need to be executed with a minimum of arousal. Many golfers have high levels of tension when they play a round and this has a detrimental effect on performance. When a person is anxious or tense there is a corresponding physical reaction in the body. Increases in heart rate, respiration, muscle tension and blood pressure are common. Excessive muscle tension is a golfer's biggest enemy.

Muscle tissue can only work in one direction; it can only pull, which it does by shortening and thickening. Because of this muscles are arranged in pairs so that movement is possible. When a muscle tightens its opposite sets up a counter tension to hold that particular part of the body in place.

This is known as the principle of the double pull. This double pull has the effect of interfering with coordination and timing. As timing and coordination are interfered with mistakes are made in the execution of golf skills. In extreme cases this can lead to what is called the "yips."

Relaxation techniques are able to reduce high levels of tension and allow the body to perform at its peak. Relaxation is a skill that must be learned. In the process you will develop a much greater sensitivity to bodily feelings and responses.

The ability to relax completely produces a positive, pleasurable and beneficial experience that provides the central nervous system with a rest. It will also give you a reference point as to what it feels like to be completely free of tension or anxiety. This experience allows for the revitalizing of physical, mental and emotional states with the golfer in control.

The ability to relax will provide the foundation for learning the skill of "instant" relaxation during competition. This is important for you as a golfer so that you are able to reduce any excess muscle tension at any time during a round of golf and allow your body to perform to its fullest potential.

## RELAXATION EXERCISES

### 1. Relaxation tape

This tape was pre-recorded and given to members of both groups to improve the ability to relax.

## 2. Specific relaxation

Sit or lie in a comfortable position. Close your eyes and take a long, slow, deep breath as you were taught to do. Take another deep breath and let the day's tensions and problems drain out of you as you exhale. [Pause.] Relax as much as possible and try not to think of relaxing, just let it happen.

This relaxation exercise is aimed at relaxing the muscles that you would use when playing golf. As you relax identify the muscles that you use when playing golf. [Pause.] Let us begin with the hands.

Tighten the muscles in your right hand, hold it and feel the tension, now relax the hand letting your fingers open by themselves, feeling yourself letting go of the tension. Notice the difference between tension and relaxation. [Pause.] Now repeat this procedure with the left hand taking a deep breath and exhaling the tension.

Now turn your attention back to the right arm. Flex your elbow and tightly contract your biceps muscle...hold it and feel the tension...slowly release and relax and feel the tension drain out of your arm. Repeat with the left arm concentrating on the difference between the feeling of tension and relaxation. Deep breath.

Raise the shoulders upwards towards your ears, tensing the muscles and hold it for 10 seconds. Note the tension sensation as golfers often have tension in these muscles...take a deep breath, exhale, relax and let your shoulders droop. Drain all the tension from the shoulders and neck as you exhale.

Now relax all the muscles of the body...let them go limp. Concentrate on your breathing, slow and deep. Let all the last traces of tension drain out of your body. Scan your body for places that still feel tense. If you feel tension in any muscle or muscle group repeat this procedure. [Pause.]

You may now notice a sensation of warmth and heaviness throughout your body as though you are sinking deeper and deeper into the chair or floor. You may feel as though you are as light as air, as though you were floating on a cloud. Go with any feelings you have...enjoy the sensation of relaxation and remember what it feels like. [Pause.] Before opening your eyes, take a long, deep breath and feel the energy flowing into your body...stretch your arms and legs if you wish. Open your eyes when you are ready.

### 3. "Instant" relaxation

This is specifically for use when approaching a putt. Stand away from the putt, hold the putter with both hands and tense hand, arm and shoulder muscles for ten seconds. Take a deep breath as you do so. Now exhale slowly and feel the tension draining away from those muscles. It is important that as you exhale you get the feeling of "letting go" of all the tension in your muscles. Do a quick body scan to check for any other sources of tension and repeat process if necessary.

### MENTAL IMAGERY AND REHEARSAL

Most of us daydream and re-experience situations in our imagination in a uncontrolled and unplanned way. The fact that we can remember previous experiences in detail is why imagery and mental rehearsal or mental practise works for all sportsmen.

Virtually all good sportsmen have used imagery at some stage even if they were not aware of it. For full benefit however, it is important to learn and control imagery.

The key to understanding imagery involves an analysis of how it works. It is natural to ask yourself at this stage why or how imagining in the mind will improve your golfing ability? How can imagining a golf swing, a ball in flight or a ball rolling into the cup help you to perform better? In applied sports psychology there are two theories that explain how and why imagery works.

The first theory is called the Psychoneuromuscular theory. This sounds very complex but the theory is actually very simple. When you hit any type of golf shot the brain is transmitting impulses to the muscles for the execution of the shot. This theory suggests that similar impulses occur in the brain and muscles when you imagine a golf shot. Therefore, by simply imagining that you are playing a shot you are actually "grooving" that particular shot. Think of it as building a mental machine.

The second theory sounds equally as intimidating but is also just as simple. It is called the Symbolic learning theory. What this means is that all movements that we make must have a blueprint or plan in our central nervous system. Imagery helps us to blueprint or code certain movements, like a golf shot, into symbolic components making these movements more familiar and more automatic when you need to recall them from memory.

Few people have been given instruction and guidance in ways to gain all the potential that mental imagery and rehearsal can offer. Jack Nicklaus said that hitting a good shot combines ten percent swing, forty percent stance and setup and fifty percent consists of the mental picture one has of how the swing should occur.

Nicklaus talks of "movies in his head" when he plays a shot and says that he never hits a shot, not even in practice without having an picture of how to execute the shot. Nicklaus begins his imagery by seeing the ball land in the target area. He then pictures the flight of the ball to the target area and finally imagines himself using the type of swing that is appropriate for that particular shot.

Many other famous athletes have used imagery to achieve success in their sport. Greg Louganis, three time gold medal winner at the Olympics for diving, Edwin Moses, unbeaten for a decade in the 400m hurdles, Chris Evert-Lloyd, Ivan Lendl, Martina Navratilova, Jean Claude Killy are all athletes that attest to using imagery to facilitate performance. Many top professional golfers have realised the value and importance of these techniques and are now using them extensively.

Imagery is a mental technique that helps the mind to respond as planned. Research supports the use of imagery as an aid to improving performance but like physical skills the psychological skill of imagery requires instruction and practice to be effective. We will first do some basic training in imagery and then progress to mental rehearsal that will be helpful in golf competition.

## USING MENTAL IMAGERY

Mental imagery is not daydreaming about the great golfer that you would like to be. It is a learned skill that requires great effort, concentration and discipline to acquire. The following are suggestions that will help you to know how to practice, when to practice and how to apply imagery and rehearsal skills to different situations.

### Learning and Practising Skills:

1. Relaxation should always precede imagery.
2. Mental imagery should be used for practice and competition.
3. Mental imagery can be practiced anywhere at anytime. A good time to do mental practice is just before falling asleep.
4. For golfers it is vital to do an imagery routine before playing a shot.
5. The skill should be rehearsed at the same rhythm and tempo as the actual performance.
6. Include smells, sounds and images of the environment as well as sensations of how the muscles feel when making a shot or putt.
7. The mental rehearsal should be successful but realistic.

## IMAGERY AND MENTAL REHEARSAL EXERCISES

### 1. General Imagery Exercise

Once you have completed your relaxation concentrate on your breathing. Pay attention to your body and to sensations such as exhaling and inhaling. Notice any thoughts that come into your mind and let them pass without attending to them. This is an exercise to teach you to visualize using all your senses:

Picture in your mind...a sunset over the sea...white clouds in the sky...a famous golfer...the face of a good friend...your favorite golf course.

Now imagine...the sound of rain on a roof...church bells ringing in the distance...the roar of a crowd after a home team has scored an important try...the voice of a friend or relative.

Now imagine...feeling the sun on your back on a hot day...jumping into a cold shower or swimming pool...tightening the laces on your golf shoes...the feel of a golf club in your hands.

Imagine...the smell of a gymnasium change room...grass that has just been cut...the smell of bacon cooking on the stove...the smell of a brand new pair of leather shoes.

Now imagine...the taste of bacon you have just cooked...the taste of a fresh piece of fruit...the salty taste of sweat...the taste of your favorite drink after exercise.

## 2. Golf Imagery

Before beginning make sure you have done relaxation and are in a comfortable position...take a deep breath...and feel your body relax as you exhale. Repeat if necessary. Picture yourself at a golf course. Try and imagine these scenes as if you were looking at them through your own eyes.

Now imagine that you are standing on the first tee just before you are about to tee off. See the clubhouse in the background and imagine the people that you are playing with. Imagine now that you are about to tee off. You tee up the ball and then stand back behind the ball feeling the sensations in your body. You may notice your heart pounding...your arms and shoulders feel stiff and tense...and you may even notice that everything is quiet and you might even feel their eyes on you.

Now imagine that you are taking a deep breath and feel yourself relaxing...you tighten the tense muscles voluntarily and hold them for ten seconds...take another deep breath and feel the tension drain away as you exhale. Now as you step up to the ball you picture where you want the ball to land...see it landing there...bouncing and coming to rest...now see the ball in flight and then feel the type of swing that you want to make...feel the smooth rhythmic movement. Now you actually address the ball...breathing easily and focus on the ball letting your body take over and play the shot.

3. Repeat above exercise but picture yourself on a putting green lining up to make a crucial putt to win a game. As you study the line you scan your body for tension...taking a deep breath.

Hold your putter tightly and tense the arms and shoulder muscles for ten seconds...relax them as you exhale. Once you have selected the line see the ball rolling along the line and into the hole.

#### ATTENTION CONTROL TRAINING

The ability to concentrate, to pay attention, to avoid being distracted by irrelevant matters is the key to success in almost any situation. In golf the overlearned, automatic nature of the game and the time that you have between shots creates ample opportunity for attention to focus on other sources such as negative thoughts and irrelevant matters. Therefore the key for golfers is to focus attention on the shot at hand and also to screen out and ignore irrelevant information. Attentional Control Training will teach you how to control your attention and concentration using a strategy called "centering."

The concept of centering comes from the martial arts and refers to a process used to create feelings of being calm, relaxed, receptive and clear in thought. Being centered is the opposite of being anxious, confused and tense which causes you to feel unstable and uneasy and you do not feel as solid or as in control as normal. This is as a result of increase in muscle tension, heart rate and hyperventilation. When you are centered, your knees are slightly bent, your muscles are loose, breathing is steady and weight is evenly distributed between both feet.

In most sports good balance is important but in golf good balance is critical. Even in putting balance is vital as it only takes a slight movement over a putt to make the ball go off line.

When you are choking you are being knocked off balance by your own thoughts, you have shaky, unstable thoughts even when you are standing still. Chances are that your breathing has changed, you are breathing up in your chest and more rapidly and shallow. There has probably been an increase in muscle tension throughout your body. In addition, attention will become internally and negatively focused which leads to further problems. The technique of centering will help you to counteract these problems.

#### ATTENTIONAL FOCUS

Attention, rather than concentration, is the term that is used in psychology to describe the processing of information from the outside world. In sport different types of situations make different attentional demands on sportsmen. An example from golf will illustrate the point.

When you as a golfer step up to the ball prior to hitting a shot, you start off with a fairly broad-external type of attention. You need to take in different types of information. Golfers need to be aware of hazards, wind conditions, position of the flag and how the ball is lying. Once this information has been gathered you then shift your attention to a broad-internal focus to plan the shot. You would recall past similar situations, remembering them and what the results were. Once all this information has been analyzed you are then able to select a club and decide how you are going to hit the shot.

Once you have decided how to hit the ball your focus will shift to a narrow-internal type of attention to monitor tension and picture the shot you want to hit. Finally, you will shift to a narrow-external focus as you address the ball and begin your backswing. At this time attention is on the ball as other thoughts will interfere with the execution of the shot.

You might be thinking to yourself that this is a very complex process but how often do you execute a shot and then ask yourself why you did not take the wind or the slope of the green into account. The reason for this is that when you are under pressure you tend to rush and not take all the information into account. The mind is similar to a computer when it programmes a specific movement. Without all the correct information the mind is not able to programme the correct shot. So when you rush you leave out vital pieces of the programme and mistakes are made. In order to ensure that all the information is processed you will be taught a detailed attentional pre-shot routine which will improve the consistency of your putting.

## ATTENTION CONTROL PROCEDURES

### CENTERING

Begin by standing with your feet shoulders' distance apart. Keeping that separation, place one foot slightly in front of the other (six inches or so). Now let your arms hang loosely at your side...they should be relaxed and limp. Bend your knees slightly, just enough to feel the tension in your calf muscles.

### BREATH 1

Inhale deeply...and slowly...through your mouth. Notice how your body seems to lift up. The tension in your chest and upper body causes you to rise up...to feel lighter...almost as if you are going to be lifted off the floor.

Exhale slowly...as you do, relax the muscles in your arms and shoulders. Notice the feeling of heaviness and how solid your body feels, as gravity pulls you down...you feel your weight pushing down equally between both legs.

### BREATH 2

Inhale again slowly...this time keeping the shoulders, arms and chest relaxed. Breathe from your abdomen, let your diaphragm do the work...feel your stomach expand...you continue to feel solid.

Exhale slowly through your mouth and notice the pleasant feeling as you become even more anchored...more firmly relaxed. Your muscles in both arms and legs and in your shoulders are relaxed and your weight presses down from one point between both legs.

### BREATH 3

Inhale slowly...breathing from deep down rather than up in your chest. Exhale slowly...as you do, let your mind and thoughts center on the one spot in your abdomen just behind your navel...relax and feel centered. Enjoy the feeling of being solid, steady...of being balanced and ready.

## ATTENTIONAL PRE-SHOT ROUTINE

Elite golfers all seem to have a well learned and highly consistent routine which they use before every shot. Research has proved that a consistent pre-shot routine improves the consistency of performance. By consciously adhering to a pre-shot routine golfers can directly influence their confidence and concentration. Golfers who do not have detailed pre-shot routines will easily lose concentration, have trouble handling "pressure situations" and will not feel as confident as they should. After you develop a pre-shot routine you will find that you have something to return your focus to if you get distracted. Your ability to handle pressure shots will be better because you have something to control and focus your attention on when playing shots.

Simply stated, a pre-shot routine is a task related collection of thoughts and movements which are aimed at achieving the necessary mind set, concentrational focus and physical readiness for each shot. A summary of a pre-shot routine is as follows:

### Centering

#### Broad External (BE)

- study the line of the putt

#### Broad Internal (BI)

- decide on the line and strength

#### Narrow Internal (NI)

- breath deeply and center

#### Narrow External (NE)

- focus on ball to execute putt

## APPENDIX B

### OUTLINE OF A PRE-SHOT ROUTINE

#### EXPERIMENTAL PROGRAMME A

1. While reading the green and preparing to putt get centered
  - breath 1
2. Stand behind the ball
  - make a positive decision on the line
  - breath 2
3. Stand next to ball and take standard number of practice strokes while glancing at the hole
  - try to feel the strength of the putt
4. Place putter head behind ball on correct line and place right foot in position
  - look at hole
5. Step into ball with left foot and focus on balance
  - look at hole
6. Focus on back of ball and look at hole for last time
  - breath 3
7. Pull the trigger
  - firm squeeze away leads into execution of putt
8. Evaluate
  - learn from available feedback information
  - assess outcome and effectiveness of each step in the routine

OUTLINE OF A PRE-SHOT ROUTINE WITH RELAXATION AND VISUALIZATION

EXPERIMENTAL PROGRAMME B

1. While reading the line get centered
  - tense your arms and shoulder muscles for ten seconds  
tensing and relaxing is performed
  - breath 1
  
2. Stand behind ball
  - make a positive decision on the line NB!
  - visualize the ball rolling along the line into the hole
  - breath 2
  
3. Stand next to ball and take standard number of practice strokes while glancing at the hole
  - try to feel the strength of the putt
  - see the line of the putt
  
4. Place putter head behind ball and place right foot in position
  - see putter striking ball and ball rolling along line into hole
  
5. Step into ball with left foot and focus on balance
  - look at hole
  
6. Focus on back of ball and look at hole for last time
  - breath 3
  
7. Pull the trigger
  - firm squeeze away leads to execution of putt

8. Evaluate

- learn from available feedback information
- assess outcome and effectiveness of each step in routine

APPENDIX C

PROGRAMME FOR EXPERIMENTAL GROUP A

MON 3 SEPT - PUTTING TEST

WED 5 SEPT - INTRODUCTION TO STRATEGY

WED 12 SEPT - ATTENTION CONTROL TRAINING

WED 19 SEPT - CENTERING TAPE

WED 26 SEPT - CENTERING AND PRE-SHOT ROUTINE

WED 3 OCT - PRACTICE ROUTINE AND CENTERING

TUES 9 OCT - PUTTING TEST

NB! - ALL LECTURES WILL TAKE PLACE AT 6 PM IN THE SAME VENUE.

IF YOU HAVE ANY PROBLEMS PLEASE PHONE ME AT 900717 - THANKS.

PROGRAMME FOR EXPERIMENTAL GROUP B

MON 3 SEPT - PUTTING TEST

TUES 4 SEPT - INTRODUCTION TO STRATEGY

THURS 6 SEPT - RELAXATION TAPE

TUES 11 SEPT - RELAXATION

THURS 13 SEPT - INTRODUCTION TO IMAGERY  
- GENERAL AND SPECIFIC PUTTING IMAGERY

TUES 18 SEPT - ATTENTION CONTROL TRAINING  
- CENTERING

THURS 20 SEPT - ATTENTIONAL PRE-SHOT PUTTING ROUTINE

TUES 25 SEPT - PUTTING ROUTINE WITH RELAXATION & IMAGERY

TUES 2 OCT - PRACTICE ROUTINE

TUES 9 OCT - PUTTING TEST

NB! - ALL LECTURES WILL TAKE PLACE AT 6 PM IN THE SAME VENUE.

IF YOU HAVE ANY PROBLEMS PLEASE PHONE ME AT 900717 - THANKS.

## APPENDIX D

### PUTTING TEST INSTRUCTIONS

In order to explain the procedure to you I will read out instructions. Due to the nature of the study I am not allowed to answer any questions during the test so it is important that you understand the instructions before beginning.

This is a putting test designed to see how many putts you are able to make from distances varying between 1 metre and 3.1 metres. Before you begin the actual test you may have four practice putts from any of the spots marked 1 - 8 on the green. The ball must be placed exactly on top of the number.

You may begin the practice putts.

The test will now begin. The purpose of the test is to make as many putts as possible from the different spots. If you miss the first putt it is not required to finish the hole. I will tell you after every putt the next spot that you must putt from.

Do you understand the instructions?

You may begin by putting from spot

5...1...7...3...8...4...6...2

5...7...1...3...6...4...8...2

Thank you for your time.

APPENDIX E

MANIPULATION CHECK

EXPERIMENTAL GROUP A

NAME:

AGE:

Below are some questions concerning the programme in which you have taken part. Please read each question carefully and answer by circling a number on the scale from 1 to 7. Your honest, objective opinion will be appreciated.

1. Will learning about the nature of anxiety and its impact on performance be beneficial to your performance?

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

*Of no use*

*Very useful*

2. Does the centering technique help your balance?

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

*Not at all*

*Very much*

3. Does the centering technique help to focus your attention?

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

*Not at all*

*Very much*

4. Does the pre-shot routine improve consistency of your performance?

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

*Not at all*

*Very much*

5. Does the **relaxation technique** assist in controlling your tension levels?

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

Not at all

Very much

6. Does **imagery** give you better results during performance?

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

Not at all

Very much

7. Will this strategy help you to handle "pressure" situations in competition?

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

Not at all

Very much

8. Does this strategy increase your control and confidence?

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

Not at all

Very much

9. Do you find this strategy too complicated?

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

Not at all

Very much

**Comments:**

EXPERIMENTAL GROUP B

NAME:

AGE:

Below are some questions concerning the programme in which you have taken part. Please read each question carefully and answer by circling a number on the scale from 1 to 7. Your honest, objective opinion will be appreciated.

1. Will learning about the nature of anxiety and its impact on performance be beneficial to your performance?

1-----2-----3-----4-----5-----6-----7  
*Of no use* *Very useful*

2. Does the centering technique help your balance?

1-----2-----3-----4-----5-----6-----7  
*Not at all* *Very much*

3. Does the centering technique help you to focus attention?

1-----2-----3-----4-----5-----6-----7  
*Not at all* *Very much*

4. Does the pre-shot routine improve consistency of your performance?

1-----2-----3-----4-----5-----6-----7  
*Not at all* *Very much*

5. Will this strategy help you to handle "pressure" situations in competition?

1-----2-----3-----4-----5-----6-----7  
*Not at all* *Very much*

6. Does this strategy increase your control and confidence?

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

Not at all

Very much

7. Do you find this strategy too complicated?

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

Not at all

Very much

**Comments:**

APPENDIX F

FIELD STUDY QUESTIONNAIRE

Name:

1. What percentage of golf do you consider to be psychological?

10—20—30—40—50—60—70—80—90—100%

2. Are you satisfied with the consistency of your performance?

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

Never

Always

3. Do you have problems focussing your attention before a shot\putt?

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

Never

Always

4. Are you able to control tension levels in pressure situations during a round?

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

Never

Always

5. Do you consciously use a pre-shot routine before every shot\putt?

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

Never

Always

If yes, please complete the following questions:

6. Is your pre-shot routine identical for every shot\putt?

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

Never

Always

7. Does the routine include any form of visualization\mental imagery?

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

Never

Always

8. Does the routine include some form of relaxation?

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

Never

Always

APPENDIX G

LETTER TO SUBJECTS

82 Peeka Street  
Die Werf  
Stellenbosch  
7600  
Tel: 900717

Dear

I am conducting research on the effects of psychological strategies on the performance of golfers. I require 30 participants for this study which is towards a Master's degree.

These 30 golfers will be divided at random into three groups. Two groups will be exposed to two different psychological strategies while the third group will merely be a control group. The two groups that are exposed to the strategies will be required to attend eight one hour workshop-type lectures, in which these strategies will be learnt and practised.

The initial test for all will take place on 3 September 1990 and the final testing takes place on 27 September 1990. The workshops for the two experimental groups will take place on every Tuesday and Thursday between these dates. These tests and workshops will be held at the Department of Human Movement Studies.

I would be very grateful if you could see your way clear to assist me with my study.

Kind regards

Kelly Fairweather

Peekastraat 82  
Die Werf  
Stellenbosch  
7600  
Tel: 900717

Geagte

Ek is tans besig met 'n ondersoek na die effek van sielkundige strategieë op die prestasie van gholfspelers. Ek benodig 30 deelnemers vir hierdie studie, wat gedoen word met die oog op die behaling van 'n Meestersgraad.

Die dertig gholfspelers sal ewekansig in drie gelyke groepe ingedeel word. Twee van die groepe sal aan twee verskillende sielkundige strategieë onderwerp word, terwyl die derde groep bloot as kontrolegroep sal dien. Daar sal van die twee eersgenoemde groepe verwag word om agt werksessie-tipe lesings, wat elk een uur lank sal duur, by te woon. Die strategieë sal tydens hierdie lesings aangeleer en ingeoefen word.

Die aanvanklike toets waaraan alle deelnemers onderwerp sal word, vind op 3 September 1990 plaas. Die finale toetsing sal op 27 September 1990 plaasvind. Die werksessies waaraan die twee eksperimentele groepe moet deelneem, sal elke Dinsdag en Donderdag tussen bogenoemde twee datums gehou word. Die toetsing en werksessies sal by die Departement Menslike Bewegingskunde geskied.

Ek sal dit baie waardeer indien u sou kans sien om my met hierdie navorsing van hulp te wees.

Vriendelike groete

Kelly Fairweather