Chapter I

INTRODUCTION

Ever since the days of the Ancient Olympics, man has relentlessly tried to break one record after another. Thrusting his body ever faster/higher/farther, he has sought to outfox it, strain it, and push it to the limit - until one can go no further.

With their competitive zeal, strict discipline and gruelling training, the great athletes down the centuries have shown their disdain for any physical limits. Today, in virtually every sport, these supermen of the track and field continue to pit themselves against both their rivals and the apparent constraints of their own muscles and nerves in order to smash one record after another in bewildering succession. The ultimate limit of human performance is unpredictable.

It was believed for a long time that no man could run the mile in less than four minutes - until Roger Bannister broke that mark in 1954. These days in almost every international mile race, even the last man finishes the race in less than four minutes. The fact is that today's athletes are simply stronger, faster and more
efficient than yesterday's and tomorrow's may be even better. This fact can be further illustrated from the 1981 sport spectacle - running in the mile race in Zurich, English super-star Sebastian Coe breached the tape in 3 minutes 48.53 seconds. This was a world record beating the previous one set by another English athlete Steve Ovett a year earlier by 0.27 seconds. One week later, in West Germany Ovett recaptured his record by taking 0.13 seconds off Coe's timing. Two days later the spectators were stunned when, running in Brussels, Coe blazed yet another mile record, this time in 3 minutes 47.33 seconds or 1.07 seconds better than Ovett's still fresh mark.¹

Sports and games are full of such magnificent performances - Mark Spitz after being disappointed in 1968 at Mexico Olympics where he could win only one silver and one bronze medal, astonished the swimming world with his splendid performance in Olympics in 1972 by winning seven Gold Medals all in world record timings at Munich². Yet another example of the greatest ever feats is that of


Nadia Comaneci who amazed the spectators by her breathtaking performance at the Montreal Olympics where she won three golds, a silver, and a bronze, became the overall Olympic Gymnastics Women Champion and was the only girl to qualify for the finals of all four individual pieces of apparatus. She was also the first gymnast at the Olympics to score a perfect 10 out of 10 and she achieved it 'seven times'. Since then she has been dubbed "Little Miss Perfect" and "Princess" of the sports world.\(^3\),\(^4\)

The world was once again astounded by Carl Lewis (U.S.A.) the greatest athlete of all times, who won a triple victory - 100 m., Long Jump, and 4 x 100 m. Relay at the First World Athletics Championship held at Helsinki. The most interesting feature of his performance was winning two gold medals in one day, reeling off one victory after the other. Long Jump competitions coincided with 4 x 100 m. semi-finals and finals in which Lewis ran the anchor man. At present he has the best ever non-altitude marks in three events: 100 m. - 9.97 sec., 200 m. - 19.75 sec., and Long Jump - 8.79 m., as compared to the present world

\[^3\]John Crumlish, "Nadia: Gearing Toward 84"  

\[^4\]Peter Tatlow ed. *The World of Gymnastics*  
records of 9.93 sec., 19.72 sec., and 8.90 m., in respective events all created at high altitude.\(^5\) (Carl Lewis equalled stalwart Jesse Owens' feat of winning four Olympic golds at Los Angeles).

Edwin Moses, an electrical engineer from California (U.S.A.) has dominated 400 m. Hurdles since 1976. Since winning the 1976 Olympics in a world record time of 47.63 seconds, Moses has lost only one race out of more than 100. By October, 1983 he had a winning streak of 87 consecutive races, including the world championship at Helsinki. During his winning streak, Moses broke the world record three more times most recently in August 1983, when he was clocked at 47.02 seconds at Koblenz, West Germany.\(^6\) (His winning streak reached 105 consecutive races at Los Angeles Olympics).

International Tennis Federation consecrated Bjorn Borg as the World's best by naming him World Tennis Champion 1978. This was the highest honour for a player who embodied the grit, courage and valour of the best in


sport. Borg had won the Wimbledon title in 1976, 1977 and 1978, making him the first ever player in 42 years to take the Wimbledon crown thrice consecutively. This feat caused Britain's ordinarily restrained tennis writers to pull out the stops. London's 'Sunday Express' called Borg "the unchallenged king of Tennis".

Don Schollander - winner of four gold medals at the Tokyo Olympics has written in his book "Deep Water" that in competitions like the Olympics, a race is won in the mind - winning is 20 percent physical and 80 percent mental.

The Soviets proved this after Montreal Olympics. They divided equally their Olympic team as follows:

Group one - Total physical training.
Group two - 25 percent psychological and 75 percent physical training.
Group three - 50 percent psychological and 50 percent physical training.
Group four - 75 percent psychological and 25 percent physical training.

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7 George Feifer, "Bjorn Borg: The King of Tennis" *Health Fitness and Sports* (1983):54.
The most effectively trained group was found to be group four, then three down to the least effectively trained group one.

Ulrike Meyforth, the high jump world record holder (2.02 m.) crossed 2.00 m. first time in a sports festival at Munich. Then she tried world record of 2.02 m. but could not make it. She later said, "that after crossing the 2.00 m. barrier I was mentally not prepared to cross 2.02 m. although I came very close to making a world record."

Therefore, the modern sports training places a greater emphasis in preparing the athletes psychologically than physically, and thus lot of emphasis is being given to the psychological research dealing with psychological characteristics of top level athletes, mental rehearsals of the training task etc. Not only that, a new field of psychology which has come up very fast and still progressing in leaps and bounds is that of "Sports Psychology."

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In spite of all this the incredible complexity of properly preparing the athlete for high performance competitions is particularly overwhelming when one considers the hundreds of variables underlying any athletic performance. In fact, to attempt even a descriptive delineation of these factors and the dimensions along which they lie would be a mammoth undertaking in itself, while to attempt an analysis and explanation of how they integrate with each other resulting in a peak performance would probably be a stupendous task. However, from psychological point of view, there are some major features of the phenomenon of 'peaking' perfect state of physiological and psychological readiness of an athlete for a specific competitive event about which we either know something or suspect that something is probably true. 'Peaking' is based on 'tapering' the final stage of mental and physical training over a specific period of time just immediately prior to the competition. The 'tapering process' is complicated coaching phase entered into in a very personalized way both by the coach who is so dependent on past experiences and trial and error techniques, and the athlete who believes that without all this psychological preparation there is little chance of success in the big event. The final preparations of the athlete are thwarted with physical and psychological dangers some of which rest
within the attitudes of the athlete himself while the majoriy will be hidden in the competitive situation which can upset the winning edge.10

The job of the coach is to try and control as many of these factors as possible as they appear in the tapering situation or in competition or at best to manipulate them to athlete's advantage. This requires an intimate knowledge of the athlete and his or her reactions in competitively stressful situation and an understanding of the demands of the particular competitive event. If the challenge for the athlete is too great and the athlete's self esteem unbearably threatened then states of over anxiety, nervousness, overstress etc. will either be expressed in various forms of abnormal tension or be evident in the void area of distraction causing the athlete to withdraw partially or totally from the reality of the situation. It is important to know whether the athlete is prone to be overanxious in certain situations. The coach must be well equipped to avoid as far as possible those same situations and try to teach the athlete how to control

his or her own emotions and attitudes. At the same time
the coach should be aware of the many and variable factors
that will upset performance and cause inconsistent
behaviours failing adaptation to any change in the regimen
of training, excessive fatigue and muscular tension,
boredom, loss of keenness etc.\footnote{Ibid.}

Therefore, the 'tapering' and the 'peaking' pro-
cesses should always be directed at each individual
performer and not towards group as a whole; first because
of the individual differences in natural capacity etc.,
and second because in team sports specially each position
makes different demands of fitness. So if the same load
is administered to the team as a group, for a few it may
be adequate load while for others it may be an overload
or underload. Thus for some of the athletes or team
members the same load may become quite stressfull and
they may get fatigued and their performances may get
impaired as compared to their true performances during
training or competition.

Hence, while coaching at various levels (periods
of training) for high level competitions if any imbalance
is caused between the training load and the training state of the athlete many psychophysiologica...mput both psychological and physiological stresses on the sportsmen, and the problems like physical and mental fatigues may set in, which may impair the overall performance efficiency of the athletes by affecting the variables like reaction time, speed of movement, steadiness, visual perception etc.

**Statement of the Problem**

The purpose of the study was to investigate the effects of induced physical and mental fatigues on selected psychophysiologica...n high and low fitness groups.

**Delimitations**

1. The study was delimited to the male students of classes 9, 10 and 11 of the Kendriya Vidyalaya No.1, Gwalior.

2. The study was confined to the following psychophysiologica...as they are not motor activities in view of the fact that these do not involve big muscle activities.
a) Reaction Time
b) Speed of Movement
c) Hand Steadiness
d) Depth Perception

**Limitations**

1. Non-availability of sophisticated instruments was considered a limitation for the purpose of this study.

2. The lifestyle, daily routine of activities and the dietary habits of the subjects being different, the heterogeneous nature of the subjects was recognised as another limitation of this study.

3. The effect of uncontrollable factors, that might have influenced the selected psychophysiological variables was also accepted as a limitation.

**Hypotheses**

On the basis of the knowledge reflected by the available literature, research findings and the scholar's understanding of the problem it was hypothesised that:

1. Induced physical fatigue will adversely affect the performances of subjects on the psycho-
physiological variables of reaction time, speed of movement, hand steadiness and depth perception.

2. Induced mental fatigue will impair the performances of subjects on the selected psychophysiological variables.

3. The high and low fitness groups of subjects will exhibit significant differences between themselves on the selected psychophysiological variables before and after the induction of physical and mental fatigues.

Definitions and Explanation of Terms

Psychophysiological Performance

A performance based on the interaction and interrelations of psychic and physiological factors is termed as psychophysiological performance.\(^\text{12}\)

Eventhough all the bodily processes are dependent upon the interaction of psychological and physiological factors, but for the purpose of this study the psycho-

physiological performance refers to the performance of those variables which are not motor or big muscular in nature and which are predominantly psychic rather than physiologic such as reaction time, speed of movement, hand steadiness and depth perception.

Physical Fatigue

Physical fatigue has been defined as a condition of impaired efficiency, resulting from prolonged activity, usually removable by rest.\(^\text{13}\)

Physical fatigue is a rather nebulous term. There is no specific definition of this term but there is general agreement as to what it encompasses. Bartlett as referred by Singh\(^\text{14}\) in his study propounds an idea which appears to include the considerations of many research scholars. According to him physical fatigue is a term used to connote all those discernable changes in the expression of an activity which can be traced to continuing exercise of that activity under its normal

\(^{13}\) *Encyclopaedia Britannica* 69th ed., s.v. "Fatigue", p.112.

\(^{14}\) Arnold Ivan Clifford Singh, "The Effects of Four Levels of Stress on Signal Detection Performance Between Active and Sedentary Individuals" *Dissertation Abstracts International* 38:7 (January 1978):4028-A.
conditions, which can be shown to lead, either immediately or after delay, to deterioration in the expression of that activity, or more simply to results within the activity that are not wanted.

Physical fatigue is not an all or none proposition in that it may occur to various degrees, and the results of this fatigue may not be readily observable. Within the framework of this definition the subjects were fatigued by subjecting them to a fatigue task which required each subject to pedal a bicycle ergometer at a prescribed workload for a period of time till his pulse rate went up between 150 and 170 bpm. (Continuous Loading Method).\(^\text{15}\)

Mental Fatigue

Mental fatigue has been defined as a condition of impaired efficiency, resulting from prolonged mental activity, usually removable by rest.\(^\text{16}\)

In case of mental fatigue, it is not the


difficulty of the mental task in the usual sense which determines the severity of the fatigue decrement, but rather its sameness, continuity and uninterestingness.\textsuperscript{17}

Thus the mental fatigue was considered to be induced in the subjects when they completed a mental task involving continuous multiplications over a period of 20 minutes which was arrived at through a pilot study.

Reaction Time

According to Morehouse and Miller\textsuperscript{18}, reaction time is the time elapsing between moment of application of the stimulus and movement response.

Phillips and Hornak\textsuperscript{19} have indicated that the reaction time is the delay in time between the presentation of a stimulus and the initiation of a volitional response.

Reaction time refers to the ability of an

\textsuperscript{17}Ibid.


individual to respond to an external stimulus i.e. the time from the occurrence of a stimulus to the completion of a simple muscular contraction is called reaction time.

**Speed of Movement**

Speed of Movement has been defined as "the rate at which a person can propel parts of his body through space."\(^{20}\)

It refers to the time taken from the presentation of a stimulus to the completion of a small movement and is equal to the sum of reaction time and movement time.

**Hand Steadiness**

Hand steadiness is a measure of motor control and in the present study it is expressed in the form of values of hand shakiness as measured by Steadiness Tester.

**Depth Perception**

Depth perception refers to the ability to

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distinguish the distance of the objects or to make judgements about relative distances. The capacity, also called distance perception, adds the third dimension to height and width.\textsuperscript{21}

\textbf{Significance of the Study}

Physical, physiological and psychological variables are the underlying factors in various tasks performed by the individual. However, in the field of games and sports where an individual has to perform complex motor tasks, an integrated functioning of these variables is of paramount importance. The ability of an individual to perform a task effectively is an interaction between one's physical and mental capabilities. Both mental and physical faculties of the individual are so closely linked with each other that along with competing mental tasks one often has to cope up with the demands of physical tasks and vice versa. When an individual undertakes concurrent physical and mental tasks no deterioration will normally be observed in either task until the processing capacity of the individual is exhausted. When the demands of one task increase and begin to exceed certain limit the performance on one or

both of the tasks begins to deteriorate.

In games and sports the performer is often required to perform certain mental tasks while under stressful physiological conditions such as fatigue, exertion etc. Studying the effects of artificially induced physical fatigue and mental fatigue on the selected psychophysiological variables will, therefore, to a great extent simulate the real game like conditions in which the performance may be expected, and also the results of the study will be of significance in the following ways:

1. The study will help the physical educators and coaches by highlighting the effects of induced physical and mental fatigues on selected psychophysiological variables of reaction time, speed of movement, hand steadiness, and depth perception.

2. The study will add to the knowledge of physical educators and coaches by pointing out the differential effects of artificially induced physical

and mental fatigues on reaction time, speed of movement, hand steadiness, and depth perception.

3. The study will reveal the differences, if any, in the effects of artificially induced physical fatigue and mental fatigue on subjects belonging to high and low fitness groups.