

chamber (figure 9.16). The underlying theory behind this practice is rather simple. The athlete breathes in pure oxygen and this significantly increases the oxygen concentration levels of arterial blood. The increase in blood oxygen levels produces a subsequent increase in the oxygen diffusion gradient between the blood and muscle cells. Supposedly, the more oxygen that can be delivered to fatigued muscle cells the more rapid the recovery process. However, the scientific evidence of the effects of hyperbaric oxygen therapy in promoting faster recovery rates after exercise is still rather limited and inconclusive. Some studies have indicated potential benefits, but others have reported little or no benefit. For example, a study presented in *Medicine and Science in Sports and Exercise* (33:1; 36–42, 2001) concluded that hyperbaric oxygen therapy was not effective in the treatment of exercise-induced muscle damage in a group of twenty-one college athletes. However, these mixed results have not prevented many of the world's big-name sporting clubs and teams from obtaining hyperbaric oxygen chambers for use by their players during competitive seasons.

Figure 9.16:

NSW rugby star Trent Barrett undergoing treatment in a multi-person hyperbaric chamber. Single-person chambers are also available.



■ Psychological factors that impact on training, performance and recovery

Sports psychology is the sport science that seeks to understand psychological and mental factors that affect performance in sports, physical activity and exercise, and apply these to enhance individual and team performance. Sports psychology is now so important to performance at the top level of sport that most elite sporting clubs and individuals employ sports psychologists to work with them.

There are four major performance skills for all elite sportsmen and women, these being technical, physical, tactical and mental. The latter skill is one that can make the crucial difference for athletes performing consistently to their abilities. Sport psychology has played a significant role in the understanding, training and ultimately the use of mental skills for peak performance.

John Buchanan, former coach of the Australian cricket team



Figure 9.17:
Former world and Olympic swimming champion Ian Thorpe believes that sports psychology played a crucial role in his success.

Sport psychology gives me an advantage over myself that no physical training can ever provide. Sport psychology allows the athlete to use all of their mental strengths. This gives them a huge advantage over their opponents, as usually their biggest opponent is themselves.

Ian Thorpe, former world and Olympic swimming champion

The work of sports psychologists tends to focus on techniques that athletes can use in competitive and training situations to maintain control, concentration, confidence and commitment (the four 'Cs') and so optimise their performance:

- **control** — the ability to maintain emotional control regardless of distraction
- **concentration** — the ability to maintain focus
- **confidence** — the belief in one's own abilities
- **commitment** — the motivation to continue working to agreed goals.

Control

An athlete's ability to maintain control of their emotions in the face of pressure or adversity and remain positive is essential to successful performance. Performance (or competitive) anxiety and arousal levels are two emotional control factors that can impact on performance.

Performance anxiety

Anxiety can be defined as a maladaptive emotional state that is typically associated with heightened arousal and the interpretation of a situation as threatening and/or dangerous. Performance or competitive anxiety can cause athletes to react both physically and mentally in a manner that can negatively affect their performance. Performance anxiety can manifest itself in two ways:

- **physical (or somatic) anxiety** — butterflies, sweating, nausea, needing to go to the toilet
- **mental (or cognitive) anxiety** — worrying, negative thoughts, confusion, lack of concentration.

A range of psychometric tests or sport anxiety questionnaires (SAQ) have been used by sports psychologists to understand and measure competitive anxiety. The *Sport Competition Anxiety Test (SCAT)* is one such test.

To help the athlete control competitive anxiety, a range of somatic techniques such as progressive muscle relaxation and cognitive techniques such as mental imagery can be used (these are discussed in some detail later in the chapter).

Arousal and performance

Arousal in sport can be defined as the degree of activation (both physiological and psychological) that an individual experiences when faced with a sporting situation or task. It can be viewed as a continuum ranging from drowsiness/sleep to a psyched-up, hyperactive state.

In the field of sports psychology, many models have been created to explore arousal levels as they relate to athletic performance. These models include the following.

1. Drive theory: According to **drive theory**, if an athlete is appropriately skilled it will help them to perform well if their drive to compete is aroused; that is, they are 'psyched up'.
2. Inverted-U hypothesis: The **inverted-U hypothesis** predicts that the relationship between arousal and performance approximates an inverted U shape (see figure 9.18). The theory is that as arousal is increased, performance improves but only to a certain point (top of the inverted U).

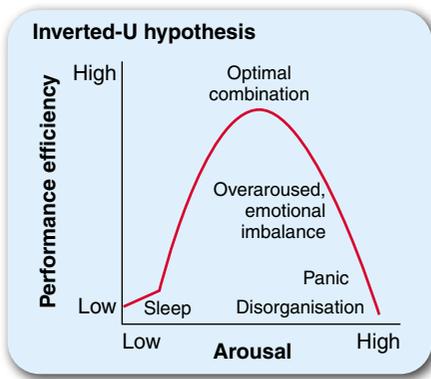


Figure 9.18:
The inverted-U hypothesis proposes that increases in arousal have a positive effect on performance up to a certain point, after which continued increases in arousal detrimentally affect performance.

If the athlete's arousal is increased beyond this point then performance diminishes. A moderate degree of arousal is seen as being optimal to performance.

3. Catastrophe theory: **Catastrophe theory** is a variant of the inverted-U hypothesis, which predicts that an increase in arousal beyond an optimal point leads to a symmetrical, orderly decline in performance. The inverted-U model suggests that a slight increase in arousal will lead to a slight deficit in performance. Catastrophe theory proposes that when an athlete goes beyond the optimal point, a large and dramatic decline in performance ensues, a 'catastrophe' from which it is very difficult for an athlete to recover.
4. Optimum arousal theory: According to the **optimum arousal theory**, there is substantial individual variability in arousal–performance relationships. Each athlete will perform at their best if their level of arousal or competitive anxiety falls within their optimum functioning zone. Some athletes perform best under conditions of high arousal, some when arousal is moderate and some when it is low. To maximise performance, an athlete needs to find his/her optimal level of arousal.
5. Multi-dimensional arousal–anxiety theory: **Multi-dimensional arousal–anxiety theory** is based on the distinction between cognitive anxiety and somatic anxiety. The theory hypothesises a powerful negative linear relationship between cognitive anxiety and performance and a less powerful, inverted-U relationship between somatic anxiety and performance. In other words, as cognitive anxiety increases, athletic performance decreases. Also, as somatic anxiety increases from low to moderate levels, there is an associated improvement in performance. Performance level decreases, however, once somatic anxiety levels exceed this moderate range.

Until recently, the inverted-U hypothesis had been the primary model used by sports psychologists to describe the arousal–performance relationship. However, many sports psychology researchers have challenged this relationship, and the current trend is a shift towards the more 'multi-dimensional' view of arousal–anxiety and its effects on performance.

The following techniques can be used by athletes and coaches to increase or decrease arousal levels:

- **progressive muscle relaxation (PMR)** — athletes undergo a series of exercises that lead to progressive muscle relaxation and eventually total body relaxation. This technique is based on the simple premise of tensing, or tightening, one muscle group at a time followed by a release of the tension. Through repetitive practice athletes quickly learn to recognise and distinguish the associated feelings of a tensed muscle and a completely relaxed muscle. With this simple knowledge, athletes can then induce physical muscular relaxation at the first signs of the tension that accompanies over-arousal and associated anxiety. This physical relaxation can then help to induce a state of mental relaxation and calmness in many situations.
- **centred breathing** — breathing to release tension and anxiety before or during performance. This technique helps develop a focus for the athlete while preparing for the next action.
- **reading their body** — athletes can learn to recognise cues that inform them of their readiness for competition. These may be physical indicators such as heart rate and breathing rate, or mental cues such as attention and concentration levels.
- **pre-competition 'psyche-up'** — used to raise arousal levels to desired performance levels through the use of warm-up exercises, motivational addresses, music and video footage etc.

Concentration

Concentration (or attention) is the mental quality to focus on the task at hand while ignoring distractions. The capacity to concentrate is widely regarded by athletes, coaches and sports psychologists as one of the keys to successful performance in sport. Coaches have long been concerned with how concentration or attention levels among athletes can be improved and maintained and how distractions can be avoided. Common distractions appear to be anxiety, skill errors and mistakes, fatigue, weather, public announcements, opposition players, 'sledging' and negative thoughts.

Research on concentration and attention suggests that coaches can assist athletes to improve their level of attention by:

- assessing the attentional strengths and weaknesses of their athletes — coaches should encourage athletes to think about when and where they displayed good concentration and under what conditions or situations their concentration tends to wander
- assessing the attentional demands of a given sport — each sport is different in terms of its attentional demands. The demand for attention varies from sport to sport and even from skill to skill:
 - sustained attention: distance running, cycling, tennis, squash
 - short bursts of attention: cricket, golf, shooting, athletic field events
 - intense attention: sprinting events, bobsleigh, skiing.

Strategies for improving concentration and attention

A variety of techniques have been formulated to help improve concentration and attention. These techniques should be implemented after considering the athlete's attentional strengths and weaknesses in addition to the sport-specific attentional demands. These techniques or strategies include:

- centred breathing
- mental imagery and rehearsal (visualisation)
- positive self-talk and cue words (practice using words such as relaxed hands, knees together etc.)
- utilising a clear pre-performance routine — this is seen when golfers follow a set routine before driving off the tee; basketball players as they step up to the free-throw line; tennis players before serving; and footballers when kicking for goal.

Mental imagery (visualisation)

Mental imagery or visualisation is one of the simplest and most tried-and-true methods for psychologically preparing athletes to perform. Mental imagery involves athletes visualising themselves performing a skill or competition event flawlessly, such as sinking a putt in golf or successfully throwing a free-throw goal in basketball. There are a variety of techniques that involve the use of mental imagery:

- **mental practice:** used for a specific movement or skill, such as a penalty kick in soccer
- **mental rehearsal:** used for a complete athletic performance. The athlete must create as detailed an image as possible and visualise themselves performing flawlessly in a game environment.
- **mental review:** used to recount the occurrences of a past performance. It is important to learn from any negative aspects, yet move past them to focus on positive results.
- **self-affirmation:** use imagery to improve self-confidence by imagining successful performances.

Confidence

Confidence results from the comparison an athlete makes between the goal and their ability. The athlete will have self-confidence if they believe they can achieve their goal. When an athlete has self-confidence they will:

- persevere, even when things are not going to plan
- show enthusiasm and motivation
- be positive in their approach and take their share of the responsibility in success and failure.

To improve their confidence, an athlete can use mental imagery to visualise previous good performance and to remind them of the look and feel of successful performance, and to imagine various scenarios and how they will successfully cope with them.

Commitment

Successful sports performance depends on the athlete being fully committed and motivated towards achieving their goals. **Motivation** may be defined as ‘the causes of the initiation, maintenance and intensity of behaviour’ (Geen, R. G. 1995, *Human motivation: A social psychological approach*. Belmont, CA: Cole). In other words, motivation is a reason for participating in an activity, learning the skills involved, training and practising and dedicating effort to improvement. It is also linked to the satisfaction gained from participation and from achieving ambitions.

Athletes with high levels of motivation often exhibit the following characteristics:

- a desire for success
- a willingness to take risks
- an acknowledgement of their own ability as crucial to their success
- an ability to increase their effort and concentration as the task difficulty increases.

Athletes who do not have this level of motivation are less likely to perform successfully and less likely to achieve elite levels. Therefore, coaches have been greatly concerned with what optimally motivates athletes. One of the most widely used methods of achieving this is through the use of goal setting.

Goal setting

Goal setting is an extremely effective motivational technique. Through goal setting athletes are able to work towards achieving specific and beneficial objectives and results. However, to be a successful tool, goals must meet the following criteria based on the acronym *SMARTER*:

- *Specific*: athletes and coaches should make their goals as specific and detailed as possible
- *Measurable*: goals should be measurable and assessed against a standard or previous performance, otherwise there is no way of determining whether or not they were achieved
- *Accepted*: all of the parties involved in the setting of the goals (the athlete, the coach, the manager, family members etc.) should accept them
- *Realistic*: goals need to be challenging, but also achievable. Goals should be framed in a positive manner and should not be related just to winning, but more importantly, to improvement.
- *Time-framed*: short-term and long-term goals should be set and there should be a specific date for when they will be achieved
- *Exciting*: the goals set should challenge, excite and inspire the athlete
- *Recorded*: the agreed goals should be recorded by the coach and the athlete to provide a constant reminder and to act as a source of motivation.

Intrinsic and extrinsic motivation

Motivation may be either intrinsic or extrinsic. **Intrinsic motivation** comes from within and occurs when factors such as enjoyment, satisfaction, improvement and enhanced feelings of self-worth are the primary motivation for performance. **Extrinsic motivation** has an external focus and usually involves some form of material benefit, such as financial reward (prize money), awards and trophies, glory and recognition. Most researchers agree that intrinsic motivation to perform is more desirable than extrinsic motivation, as it will serve as a more powerful and sustainable source of motivation.