Stress and anxiety in sport

Jan Graydon *looks beyond the yips and the jitters.*

TO any sportsperson the debilitative effects of high anxiety are only too familiar, and can range in severity from butterflies in the stomach to a full-blown panic attack. Over the years many hypotheses, theories and explanations have been advanced to try to describe and understand the relationship between stress, anxiety and performance in sport. In this article I assess the research and the comments of participants in sport themselves.

Arousal and performance

The longest-standing approach to the relationship between stress, anxiety and performance in sport is probably the inverted-U hypothesis, derived from the work of Yerkes and Dodson (1908). This hypothesis predicts that performance improves with increases in arousal until a peak is reached, after which further arousal leads to a deterioration in performance. Although arousal and anxiety are not seen as synonymous, they are taken as being interrelated – hence the hypothesis is often used to predict the effects of competitive anxiety on performance.

This hypothesis has also been linked with drive theory (Hull, 1943), which proposes that *performance* = *drive* x *habit strength*. Drive in this instance is seen as positively related to arousal. Thus as arousal increases so does performance, but only to a point: that point being determined by the habit strength of the skill. In other words, arousal can help if you are performing a task you are good at.

Despite having popular appeal, and being intuitively plausible, these traditional approaches have been criticised for oversimplifying the relationship between anxiety and performance. In addition, difficulties in the measurement of arousal and habit strength have limited the predictive validity and utility of the theories. Each approach relies on a unidimensional concept of anxiety, a concept that has been superseded – Davidson and Schwartz (1976) proposed that anxiety comprises both a physical or somatic component, and a cognitive or worry component. This work in turn led to the development of the Competitive State Anxiety Inventory-2 (CSAI-2: Martens *et al*., 1990), which measures somatic anxiety, cognitive anxiety and self-confidence in sporting contexts. These ideas were developed further by Hardy and Fazey (1987), who described the now popular ‘catastrophe’ model of performance in sport. This model predicts certain interactions between cognitive anxiety and physiological arousal and, in particular, performance decrements under conditions of high cognitive anxiety and high physiological arousal.

One of the most significant predictions of the theory is that there may be a sudden ‘catastrophic’ breakdown in performance from which the athlete may find it difficult to recover. Cognitive anxiety is seen as having the capacity to determine whether the effect of raised physiological arousal will cause minor or catastrophic performance effects. If cognitive anxiety is low, then the performance effects of physiological arousal will be low; but if it is high, the effects will be large and sudden. To test this hypothesis, Hardy *et al*. (1994) conducted a study where the cognitive anxiety levels and physiological arousal of experienced crown green bowlers were manipulated. The results, while not unequivocal, provide evidence in support of the model that is persuasive and also intuitively appealing.

The yips

It could be said that the ‘yips’ reflect this sudden or catastrophic breakdown in skilled performance. This rather strange phenomenon, characterised by the inability to perform a well-learned and well-practised skill, seems to strike suddenly from nowhere to severely debilitate an athlete – for months, years or even for a whole career. In golf it has been described by Smith *et al*. (2000) as ‘jerks, tremors or spasms’ affecting the lower arm, and similar phenomena seem to occur in other sports where precision and fine motor control are at a premium. Examples include cricket (bowling in particular), tennis, snooker and darts. The well-known darts player Eric Bristow is a prime example. At the height of his career Bristow one day found that he was unable to release the dart from his fingers (White, 2001), an affliction which took him 10 years to overcome.

In a recent unpublished study Chell, Graydon and Holder (2001) examined examples of sudden and severe performance breakdown among 10 skilled athletes. Common themes emerged from the athletes' reports, all centring on sudden lack of fine motor control. An example of this included a 22-year-old cricketer who vividly recalled an incident when he was aged 16:

> *I can remember running in to bowl and just not feeling my arm turn over, and the first ball shot over the batsman's head and the wicketkeeper's head and went for four byes… I eventually bowled six balls without bowling a legal delivery…my whole body felt numb.*

This situation has been termed 'choking' under pressure by Baumeister (1984) and certainly seems to accord with the sudden deterioration predicted by the catastrophe model.

However, explanations for its occurrence do not all accord with an explanation based on the interactive effects of cognitive anxiety and physiological arousal. For example, Smith *et al*. (2000) present evidence to suggest that the problem may have a neuromuscular as well as a psychological origin. Using the term 'focal dystonia', derived from the medical literature to describe similar conditions among musicians and typists, they postulate that it may originate in prolonged repetitive movements or abnormal posture. Over a professional sporting career, spanning in some instances several decades, it is certainly plausible to believe that an athlete will have performed similar repetitive movements thousands, possibly hundreds of thousands of times, the result of which may precipitate some form of neuromuscular dystonia.

At the same time, the experiences of the young cricketer described above may not unequivocally support this proposal. When asked to describe how he felt prior to the event, he detailed a lack of confidence at the time (he was only 16 years old and opening the bowling in an under-21 side) together with increased feelings of anxiety:

> *I did feel extra anxiety. There were lots of things that day that were anxiety inducing for me.*

If anxiety does contribute to this sudden and catastrophic decline in performance, the question remains as to how its effects are mediated. The various approaches outlined earlier appear to provide only a description of the effects that arousal or anxiety may have on performance rather than an explanation. In contrast, Baumeister (1984) has proposed a model to help explain the choking process. He asserts that the pressure to perform causes performers to become self-conscious and to direct their attention towards attempting to control a motor task by conscious effort.

We can understand this self-consciousness in terms of the three-stage process model of skilled performance (Fitts & Posner, 1967). The first phase is termed the cognitive stage whereby the performer, learning a new skill, attempts to verbalise the process of skill acquisition and 'talks his or her way through it'. As skill develops, the individual passes through an associative phase where the skill becomes more automatic, until finally reaching an 'autonomous' stage where skills are executed without the intervention of conscious control. Thus the expert squash player would not have to think about where to place his or her feet relative to the ball, nor when and how to bring the racket back when preparing for a backhand drive. It 'just happens'.

Baumeister's (1984) proposal suggests that when under pressure, the expert reverts to a novice level of performance by attempting to invest an automatic process with conscious control. This destroys the fluidity of the skill, and has been termed by Deikman (1969) as 'deautomatisation'. Supporting studies (Hardy *et al.*, 1996; Masters, 1992) show that performers provided with explicit coaching points during acquisition of golf putting skills perform worse under pressure than those not provided with explicit knowledge. However, these studies did not show a catastrophic breakdown in performance sometimes reported. It must be remembered though that these experimental studies have mainly involved novices: typically up to only 400 acquisition trials are provided. It is arguable how many repetitions of a skill, whether it be golf putting, cricket bowling or dart throwing, would occur over a sports career. If the 10-year rule of Eriksson *et al.* (1993) is accepted (i.e. that 10 years or so of intensive practice is needed for exceptional levels of performance to develop), then one would suspect many hundreds of thousands of trials are needed to reach the automaticity of the expert. Intriguingly, perhaps you have to be an expert before a catastrophe can occur.

An expert tennis player interviewed by Chell, Graydon, Crowley *et al*. (2001) commented when experiencing a severe breakdown in forehand performance (ball hitting the back netting without bouncing):

> *Suddenly I will have in my head, OK I must rotate…when I'm playing*

nervously I tend to think about, oh I need to turn or take the ball earlier.

This player's experiences would support Baumeister's (1984) proposals about regression to conscious processing.

Two recent studies by Mullen and Hardy (reported in Hardy, 1999; Mullen & Hardy, 2000) used skilled golfers and trampolinists to study the conscious processing hypothesis of skill breakdown in experienced performers. Both studies provide some support for the hypothesis. Interestingly, one study also attempted to investigate a rival theoretical position proposed to explain the effect of anxiety on performance, namely processing efficiency theory (posited by Eysenck and Calvo, 1992). Briefly, this theory suggests that when suffering from anxiety the performer strives to maintain performance by investing extra effort. Thus, there is no measurable effect on performance, but because of the extra effort involved performance efficiency is affected. This works up to a point however, until it is perceived that the resources needed are too great and the performer 'gives up'. There have been investigations of this theory in sport, but the quantification of 'effort' remains a major stumbling block.

Deautomatisation, or extra effort?

It would seem wise to consider whether the two positions should be seen as rival or complementary. There may be individual differences that mean that different individuals are susceptible to breakdown for different reasons. Studies have shown that individual differences relating to our predisposition to 'reinvest' conscious control in a motor skill are important in influencing the extent to which an individual will suffer skill impairment under conditions of stress (e.g. Chell, Graydon, Crowley *et al.*, 2001; Masters *et al.*, 1993). The same may very well be true for effort investment. An additional proposal could simply be that the perception of effort described could be the result of conscious processing attempts.

Furthermore, there is the unwritten implication in many studies of skilled performance that the components of performance are the same or similar. It may not be sensible to assume that the components of performance prone to a breakdown in cricket would be the same as those in cycling or rugby. It may be the fine motor control needed by the cricket bowler or golfer is what breaks down, whereas it may be the speed or decision-making skills of the rugby fly-half.

As stated previously, the yips seem to be peculiar to certain precision-type sports. Each sport makes particular demands on the individual's coordination, precision of execution and force generation, as well as making many cognitive demands such as those on perception, memory, planning and tactics. Research in cognitive psychology has long since recognised task demands on the various components of working memory and the influences of anxiety on these (Eysenck, 1982). From the point of view of an applied sport psychologist, the main thrust of this work is of course to understand what processes underpin breakdown, whether catastrophic or not, so that the performer is aided either to avoid it or to recover quickly from it. Suggestions for applied practice may only emerge when a more detailed analysis of the task demands and the performer's resources to meet them is undertaken.

■ *Dr Jan Graydon is Head of the School of Sport, Exercise and Health Sciences at University College Chichester. Tel: 01243 816 320; e-mail: j.graydon@ucc.ac.uk.*

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