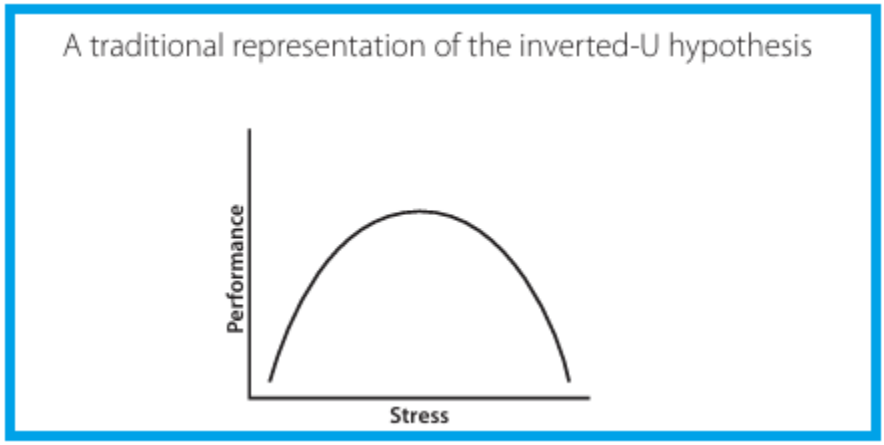
Fazey & Hardy (1988)

The inverted-U hypothesis originated from a study of habit-strength formation in mice under different conditions of punishment stimulus frequency (Yerkes and Dodson, 1908) and was built upon by Oxendine (1970) to describe the relationship between arousal and motor performance in a range of different conditions. The idea behind this is that performance will gradually tail off once optimum peak performance has been achieved.



Fazey and Hardy suggest there are three big problems with the hypothesis, namely: There are difficulties with the basic constructs of the hypothesis, a lack of consideration of situational specificity and the multidimensionality of the stress response, and a lack of supporting evidence from Sport Psychology.

An alternative idea is the catastrophe model (Thom, 1975) which claims that increased arousal and high cognitive anxiety can lead to a sudden and dramatic drop in performance rather than a gradual decline. Fazey & Hardy examined the relationship between cognitive anxiety, physiological arousal, and performance and proposed that when an athlete experiences both high arousal and high cognitive anxiety, their performance can unexpectedly plummet.

This study considers these issues and proposes two catastrophe models of motor performance under anxiety which describe the relative contributions to performance of cognitive anxiety, 'on the day' physiological arousal, task difficulty and self-confidence.

The study is a monograph, which is a specialist work of writing on a single subject which identifies and considers the three problem areas with the hypothesis. The authors also propose an alternative model and a number of testable hypotheses of the model are stated and an extension of the model.

Difficulties with the basic constructs

Two questions in relation to the inverted-U hypothesis need to be addressed:

- If physiological arousal is a unitary construct, then is it related to performance by an inverted-U function?
- Does this say anything about a systemic relationship between stress and performance?

Difficulties with the corroborative evidence

No previous research has considered the influence of the different anxiety systems on the stress response, or the possibly different effects of increasing and decreasing stress levels. There is still little convincing, sound experimental evidence for the inverted-U hypothesis as a model of the relationship between stress and performance.

Difficulties in applying the model

Fazey and Hardy present three major criticisms of the inverted-U hypothesis:

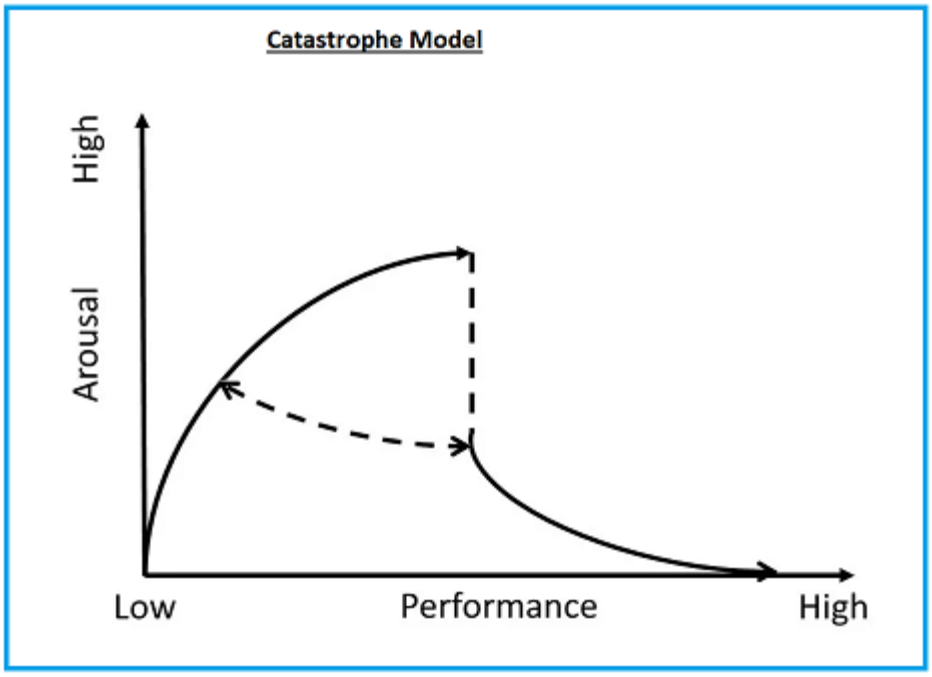
- The failure to recognise the multidimensionality of the anxiety and arousal systems.
- The general lack of sound experimental support for the detailed predictions of the hypothesis.
- The apparent lack of predictive validity in practical situations.

Fazey and Hardy discuss two alternative approaches that have been used to study the effects of stress upon performance. These ideas have been used to develop the 'catastrophe' model of anxiety and performance. The model states that anxiety has at least two components, cognitive anxiety and the physiological arousal response. Physiological arousal is the degree of generalised sympathetic physiological response reflected by somatic anxiety or other physiological changes. Cognitive anxiety determines whether the effect of physiological arousal is smooth and small, large and catastrophic, or somewhere between the two.

This model fits with existing data which shows a negative relationship between cognitive anxiety and performance and mixed positive and negative effects for physiological arousal upon performance during high cognitive anxiety. But how does cognitive anxiety alter the effect of physiological arousal on performance? It may be that higher levels of performance are shown under conditions of high physiological arousal in simple or well learned tasks. It is possible that cognitive anxiety disrupts this control by distracting the individual's attention and by creating doubt about what is a beneficial physiological effect and what an adverse effect is. As a result, physiological demand is high and the cognitive control demand is low. Cognitive anxiety might lead to enhanced performance when physiological arousal is high. Conversely, in tasks with a low physiological demand but a high control demand, cognitive anxiety would usually lead to a drop in performance when physiological arousal is high.

Fazey and Hardy's proposed catastrophe model hypothesises that:

- Physiological arousal is not necessarily detrimental to performance, but it will be associated with catastrophic effects when cognitive anxiety is high.
- During high cognitive anxiety, hysterics will occur, i.e. performance changes as physiological arousal increases, compared to when physiological arousal decreases. During low cognitive anxiety, hysterics will not occur.
- Intermediate levels of performance are most unlikely in conditions of high cognitive anxiety.



Higher dimensional catastrophes – Although the catastrophe model is able to describe the roles of cognitive anxiety and physiological arousal in performance under stress, other factors such as task difficulty and self-confidence may also play a part. Therefore, the model has been extended to a higher-order butterfly catastrophe which explains the influence of these two factors. Task difficulty is known as a bias factor and self-confidence as a butterfly factor.

Physiological arousal level at which catastrophes occur in cognitively anxious individuals gradually shifts to the left as cognitive processing demands of the task increase, which supports the inverted-U hypothesis and research into the effects of arousal and anxiety on tasks with differing cognitive processing demands (Humphreys and Revelle, 1984). However, self-confidence allows the cognitively anxious performer the possibility of regaining the smooth stable area of performance; this is increased when self-confidence is very high and/or when anxiety is not extreme.

The extended catastrophe model (Butterfly catastrophe model) predicts that:

- Difficult tasks with a high processing load shift the hysteresis loop to the left, while simple tasks shift the loop to the right.
- When cognitive anxiety is at an intermediate level, individuals with a high degree of self-confidence will demonstrate a trimodal distribution for performance. At more extreme levels of cognitive anxiety, the same individuals will produce bimodal performance-distribution curves. In particular, intermediate levels of performance are possible only for confident performers or at relatively low levels of cognitive anxiety.

When applied to sports performance, it shows that if as athlete is experiencing high levels of cognitive state anxiety, and arousal rises towards the athletes threshold, the athlete experiences a dramatic drop in performance. This theory does rely on the need for both arousal and cognitive anxiety to achieve optimal performance.

Fazey and Hardy suggest that the inverted-U hypothesis is flawed: 'The real catastrophe would be for Sport Psychology to remain tied to the inverted-U hypothesis as the only plausible model of the stress performance relationship'. Catastrophe models of motor performance under anxiety can be applied to describe the relative contributions to performance of cognitive anxiety, 'on the day' physiological arousal, task difficulty and self-confidence. There are a number of plausible models to explain the stress-performance relationship. Most notably, stress and performance can be explained through the application of a catastrophe model.