



Stress Good or bad?

You hear footsteps behind you in a dark alleyway – Is it a threat or not?

Key words

stress
anxiety
memory
examinations

You are walking down a street late at night in the dark and you hear footsteps coming up behind you. Your heart starts to race, your breathing accelerates and you begin to sweat. You are experiencing the classic symptoms of the ‘fight-or-flight’ response.

You have purchased a lottery ticket and are listening to the results and your numbers are being read out one after the other. Again your heart starts to race, your breathing accelerates and you start to sweat. It’s that ‘fight-or-flight’ response again.



He can't believe it – all his lottery numbers are coming up.

Does it sound strange to experience the same symptoms for two different events, when one is fearful and one is exciting?

This should not surprise you if you think about the purpose of the ‘fight-or-flight’ response. The aim is to make your body ready for the activity that might be needed to cope with the stress of the event. Whether you need to run away or stand your ground and deal with the event, your body will be admirably ready to expend extra energy.

This is achieved using both the hormonal system and the nervous system working together. **Figure 1** illustrates this complex mechanism.

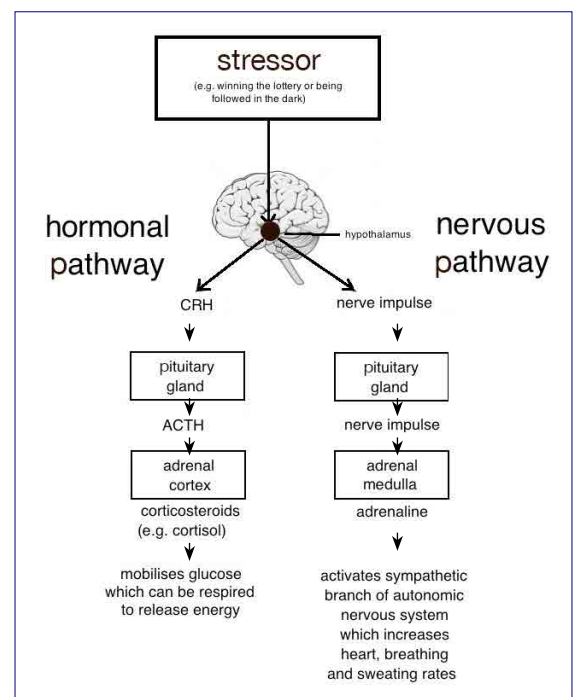
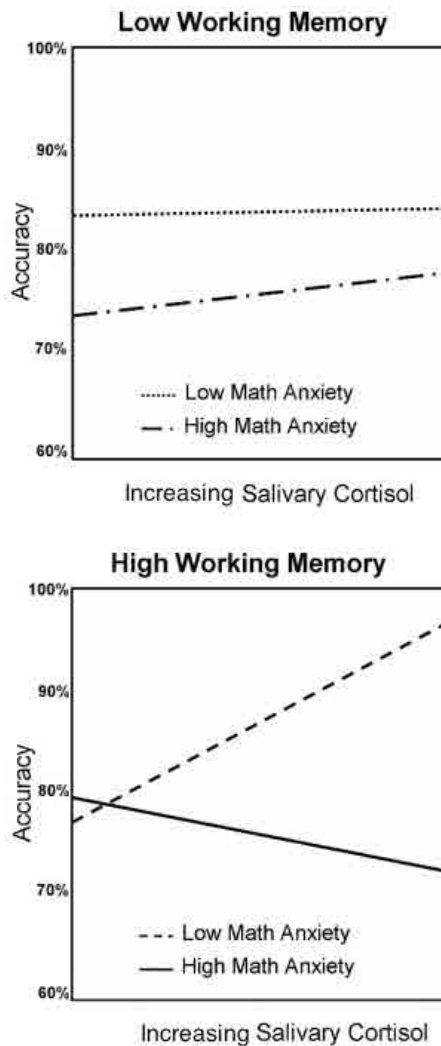


Figure 1 The fight-or-flight response involves both hormonal and nervous responses.

The brain perceives a stressor and the hypothalamus simultaneously initiates a hormonal and a nervous response. The hormonal response involves a sequence of chemicals released by several glands. The hormone CRH (corticotropin-releasing hormone) is released by the hypothalamus and acts on the pituitary gland to produce ACTH (adrenocorticotrophic hormone). ACTH targets the adrenal cortex to release a range of corticosteroids, which act on several organs. One crucial outcome is the mobilisation of glucose as a source of energy.

The nervous response is fast and involves an impulse going to the adrenal medulla causing

Figure 3 Scores on a maths test depended on the students' working memory as well as on their degree of anxiety.



The message then is this: if you have a high WM capacity and have developed a good skill in mathematical tasks using your WM, then getting stressed during a maths task is detrimental to your performance. If you wish to maintain your high level of mathematical ability you need to conquer the anxiety stimulated by such tasks.

Individuals with lower working memory capacity do not seem to be bothered as much by their level of anxiety. This is probably due to the fact that they employ strategies that do not require as much from their WM and so stress will not hinder them in the same way.

From the description of the stress response you might think that this is impossible since it is an automatic biological response. However you will note that the response (both nervous and hormonal) was initiated by the hypothalamus and this is in communication with the cerebral cortex, which is the 'thinking' brain. In practice, the hypothalamus will not trigger the stress response unless the cortex perceives the stimulus as a stressor. So if the higher brain says you are not stressed you aren't stressed! If you change your attitude to the problem by reducing your perception of it as being anxious then you will allow your working memory to get on and deal with the problem to the best of its ability.

Conquering stress

There are physical methods of reducing your stress level, such as progressive muscle relaxation and controlled breathing.



Some schools include yoga in their curriculum to help students reduce stress levels.

Another way to reduce anxiety is to increase 'self-efficacy', increasing one's thoughts and beliefs about having the personal power or capacity to produce a desired effect. Academic self-efficacy refers to a learner's judgment about higher capability to solve a problem successfully. In other words, learn to believe in your abilities!

Cognitive behavioural therapy (Figure 4) challenges people to control their negative thoughts, such as "I'm not good enough," or "I'm going to fail" with more positive ones such as "I can do this," or "I have the ability...".

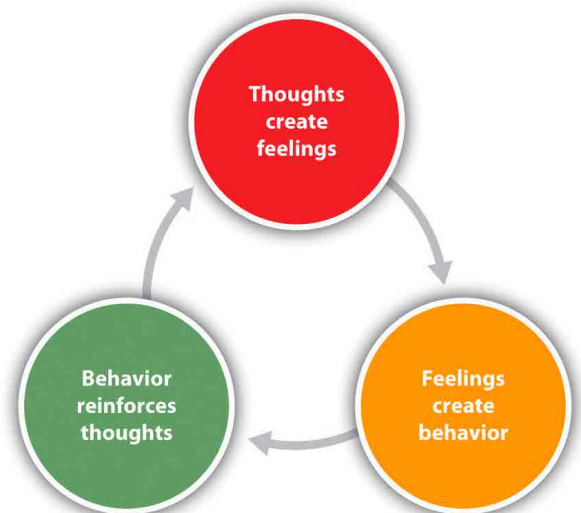


Figure 4 Cognitive behavioural therapy (CBT) aims to break the vicious circle of negative thoughts and feelings.

Finally then, stop saying you are 'rubbish' at a task and learn to control those negative thoughts by believing in yourself and take positive action to overcome your anxiety.

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adrenalin to be released. This stimulates various responses in the autonomic nervous system, such as an increase in heart, breathing and perspiration rates, along with a decrease in digestive processes.

So after the stress response has been activated the body is 'prepared' for activity.

The positive side

Stress is so often viewed negatively but you can see that it is actually in your interest for the stress response to be initiated at the appropriate time. What can be a problem is for the response to be initiated when you can do nothing about it, such as in a road-rage situation.

A certain amount of stress is actually beneficial and the term 'eustress' is given to this. It 'wakes us up' and makes us alert to our surroundings. However there are problems as stress levels rise.

The stress-response can overpower the ability to think straight and much research has been carried out on people's performance in examinations. There are some people who crumble in the examination room and experience a mental block, which decreases their performance. Whilst other people thrive on the challenge of examinations and, under stress, their performance increases.

Not too much, not too little

Psychologists Robert M. Yerkes and John Dillingham Dodson in 1908 devised a law relating performance to the level of arousal. **Figure 2** shows this relationship and is called the Yerkes-Dodson law. It states that performance increases with physiological or mental arousal, but only up to a point. There is an optimum and if the stress levels exceeds one's own optimum then performance will suffer.

One recent study, carried out at the University of Chicago, has shown that the level of mathematics anxiety can interact with the completion of a mathematical challenge in varying ways.

Sian Beilock, author of *Choke: What the secrets of the brain reveal about getting it right when you have to*, and associate professor in psychology at University of Chicago says, "We found that cortisol, a hormone released in response to stress, can either be tied to a student's poor performance on a math test or contribute to success, depending on the frame of mind of the student going into the test."

The research group looked at cortisol levels before and after attempting a demanding mathematical problem in students with varying working memory abilities. Working memory (WM) is a short-term system, which is involved in the control and maintenance of a limited amount of information that is needed to complete a task. They categorised students as either possessing low WM or high WM and found that, for higher WM individuals, their performance on a challenging maths task decreased if they suffered from high maths anxiety. In contrast, for higher WM individuals lower in maths-anxiety, the higher their salivary cortisol concentrations, the better their performance – see **Figure 3**.

It appears that higher WM individuals employ strategies during problem solving which are cognitively demanding. This gives them the ability to perform well and achieve a higher level of performance than individuals with low WM capacity. However, when a task is demanding anxiety can lead to distraction away from working memory. This would explain why individuals who are maths anxious *and* have high WM capacity perform less well than low maths anxious people with high WM capacity.

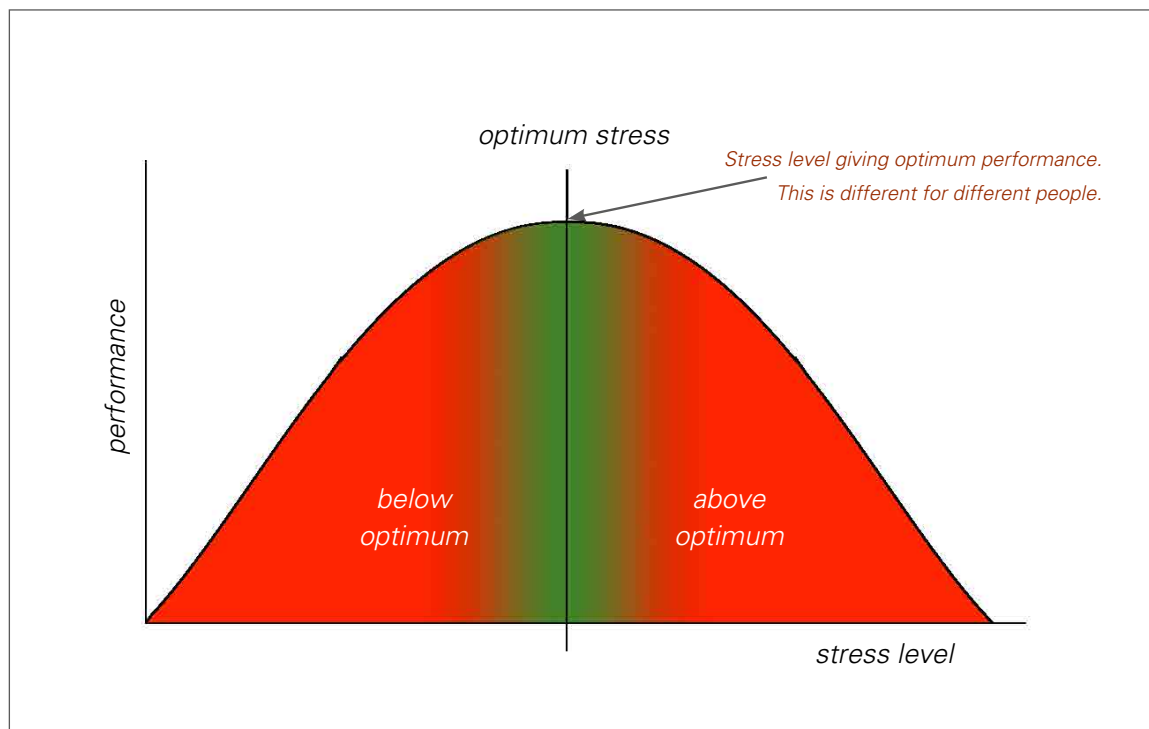


Figure 2 The Yerkes-Dodson law proposes that there is an optimum level of stress which produces the best response.