



Fear response- what goes on in your brain and body when you are under threat

By Ole Boe and Jon Hegan

Imagine the following scenario: You've just had a shower after a good training session and are now walking back home with, it has to be said, some considerable swagger in your stride after having successfully beat up or tapped out most of your training partners that evening. It's getting late and as you turn a corner you find yourself in a familiar but dimly lit street. You've heard that there's been some trouble around here recently, but because you save a couple of minutes on your way home you make a quick decision to take this route tonight. Because you are tired, but also on a high from training (your body has released endorphins that gives you a feeling of happiness) you now have a lower degree of awareness about your environment than you normally do. This is perhaps why you didn't notice the three youths leaning against a wall in the distance. You continue to walk straight ahead but also don't assess the situation as you normally would. Just when you're about to pass them, they spread out in front of you. How would you react? Do you think you would freeze or quickly run away from the whole situation? Would you have the time to consider whether you should attempt to defend yourself against three seasoned street robbers should it now become necessary?

This situation may solve itself. It could turn out that the circumstances were not so threatening as you first imagined it to be and instead the three youths just wanted to ask an innocent question. Regardless of what happens your body has already mobilized extra resources and energy. If nothing happens, you will not have the opportunity to use these extra resources that your body has mobilized and it will take some time until you are able to function as normal again. This is because your

body cannot cope with all the different substances that were released into your brain and body as a response to what you considered to be unsafe. You are now jam-packed full of chemicals and these chemicals have no where to go, this is the reason why your hands are shake after being threatened, or after near miss with a car. If you instead had to defend yourself or throw yourself away from an oncoming car, your body would very quickly have used the extra resources that were mobilized. If this had happened, your body will return to a more normal state much faster afterwards.

Recognizing fear

How likely are you to find yourself in a situation that you perceive as threatening or dangerous? Even if your job does not involve an element of conflict with the public, the chances of at least once in your lifetime being exposed to a violent situation is unfortunately relatively high. Nowadays you must be mentally prepared that if you found yourself in such a dangerous situation you may have to fight for you and possibly someone else's life. It is therefore necessary to be fully aware of what goes on in your brain and body before and during a violent confrontation. This knowledge is vital for you to be able to function as effectively as possible. If you already have experienced such a situation, it is still useful to learn about what really happened to you in and how you can be better prepared the next time. Knowledge about these reactions is not new. In 490 BC the famous Chinese philosopher and martial artist Sun-Tzu wrote in "The art of war" that your most difficult enemy is yourself. If you learn about how you react in stressful situations, your possibilities to survive a dangerous situation will increase. Consider Sun Tzu`s brilliant saying:

"So it is said that if you know others and know yourself, you will not be imperilled in a hundred battles; if you do not know others but know yourself, you win one and lose one; if you do not know others and do not know yourself, you will be imperilled in every single battle."

What happens in your brain when you are exposed to a threatening situation?

Under potential combat stress, several processes take place in your brain and body within a very short period of time. Many studies have revealed that large and unavoidable changes will take place when you are exposed to high amounts of stress, for instance, when somebody threatens your safety. When we experience a danger, the different processes that take place in the brain and body are referred to as "the

fear response". This fear response consists of four elements. These are called the cognitive, somatic, emotional, and behavioural elements.

The cognitive elements

The cognitive elements of fear consist of your expectations of an impending or imminent danger. A cognitive process simply means that you try to perceive, process, store, or retrieve information. The formation of sensory impressions and ideas are part of a cognitive process. When the three youths suddenly stood in your way, you created a picture of the situation. You perceived that they were preventing you from passing, and as a result of this you thought that "they may want to rob me". Even though the situation in itself may not be so threatening, i. e. you did not see a knife or any other weapon; but you still perceived the situation as dangerous. This type of mental representation, meaning that you created a picture of the situation and interpreted it as threatening, released the somatic reactions in your body. The result could be that you stopped walking forward, and that you "froze".

A more complicated explanation is the following description of what takes place in your brain: The picture you just have seen of the three suspect youths is received and transformed into the brain's language in order to make you aware of what you see. The signals from your sensory organs, the eyes (and eventually the ears if you hear any sounds) reach a part of the brain known as amygdala. Amygdala quickly examines everything that happens in order to discover something that can be perceived as threatening. Amygdala belongs to a more primitive part of the brain referred to as the limbic system. Amygdala acts as a mental security guard and simply has the job of asking only one question, namely the following question, "is what you see something to be afraid of". At the same time as amygdala poses this question, certain parts of the memory systems in your brain are activated. This is automatically done in order to retrieve the most relevant memories and knowledge concerning the situation you now find yourself in. The brain compares the present crisis with memories of similar previous situations so that it can decide as quickly as possible if there is anything immediately to be afraid of: If the answer is yes, amygdala reacts with lightning speed and sends alarm signals to all the other parts of the brain. The brain in its turn sends signals to release about 30 different stress hormones in order to prepare the body for the imminent danger. Another part of the brain, known as the grey substance (yes, you read it correctly, there is a part of the brain that is referred to as the grey substance) consists of nerve cells that control the muscles. These nerve cells start to release adrenaline and other hormones and this makes your muscles tighten. Even the muscles of your vocal cord tighten, making

your voice higher when you are under stress. The hormone nor-adrenaline rushes through your brain. Nor-adrenaline increases your propensity to react and results in a sharpening of your senses. Often you are unaware of being afraid because most of these changes take place on an unconscious level. During this period your brain also releases dopamine, a signal substance in the brain. This release of dopamine results in that your attention becomes fixated on what caused you to become afraid, in this specific case, the three in front of you (this can be known as having tunnel vision). Amygdala also sends signals to the visual processing area in the back of your brain making your vision seeking to find the most relevant thing in the present situation. It is when all these signals have been sent away from your brain that the fear starts getting a hold on you.

What happens in your body when you are exposed to a threatening situation?

The somatic elements

The reactions and changes that occur in your body during the fear response, are referred to as the somatic elements of the fear response. The bodily reactions that arise in a situation where you get afraid can be divided into two groups of changes, internal and external changes. A person often undergoes dramatic changes when he or she gets scared. The most salient reaction is that fear can be seen very clearly in the face. If you become scared, sweat starts to be seen on your forehead, your lips may start shaking. Furthermore your eyebrows will be pulled upwards, and wrinkles will occur on your forehead. Your eyes will widen, and your pupils will dilate in order to receive more information. Your mouth will open, and at the same time your lips will tighten and pull back. Changes can also occur in your skin, you may become pale, as the blood is drawn away from your face towards internal organs in order to protect them. These facial changes can increase other reactions of fear in your body. The palms start getting clammy. In addition to these external changes, several changes occur within the body. When you perceive that there exists a potential threat, the resources of your body are quickly mobilized. The brain sends signals to release the hormonal substance adrenaline into the bloodstream. The adrenalin flows through the body, and reaches the heart, the lungs, and the muscles. The different parts of the body then starts creating the changes necessary in order to react to the perceived threat. The muscles need more oxygen to either fight or flee. A result of this is that your muscles will tighten. The breathing becomes faster and deeper in order to be able to receive the extra oxygen. The blood vessels dilate to carry more blood around faster. The heart will then beat faster because it wants to pump the

blood through the body. In those areas of the body where the oxygen is not needed, the blood vessels will restrict themselves. The extra resources that have been mobilized will make it possible for you to throw yourself away from an oncoming car, or to start defending yourself either by running away from the danger or by fighting your adversary. When you perform some kind of action that is correct according to the situation you are in, you use the chemical changes that your body has produced to deal with the situation. Your body will then try to return to a normal state again.

The emotional elements

In addition to these bodily changes, fear is also closely related to the following strong emotional elements: dread, terror, horror, nausea, fits of shivering, creeping sensations in the body, as well as the feeling of having a lump in the stomach. Most of us have some time experienced some of these emotions. Often we use these words to describe how we felt when we were in a dangerous situation and were afraid.

Behavioural elements

Finally we have the opportunity to either run away from the threatening situation, or stay and defend ourselves. These patterns of behaviour are known as the fight-or flight response to a perceived threat. The whole sequence, from the moment you become surprised when you saw the three youths standing in front of you, to your feeling of uncertainty, further to worry and finally to the feelings of fear and the mobilization of the resources in your body in order to fight or flee, usually takes about a second. If you are a trained fighter and you quickly recognize the threat, your reaction time, or more correctly, your response time can be as little as 0.25 sec. On the other hand, if you are not a trained fighter and do not recognize what the threat is, either through disbelief or denial of your predicament, your response time can be up to 4-5 seconds or until they land the first punch!

About the authors

Ole Boe has a Ph.D. in psychology, and he is an Expert level military and civilian instructor in Krav Maga. He is also qualified as a close combat instructor through the Swedish army combat school. He lives and teaches in Norway.

Jon Hegan is an Expert level instructor from the UK teaching in Essex.