'A definitive guide on how to survive the world's most extreme environments.'

BEAR GRYLLS

EXTREME

why some people thrive at the limits

EMMA BARRETT | PAUL MARTIN

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CONTENTS

Abbreviations ix

1. Life at the Edge 1
2. Bravery 14
3. Hardship 26
4. Bad Sleep 43
5. Monotony 57
6. Alone 73
7. Other People 86
8. Teamwork 104
9. Know-how 126
10. Focus 149
11. Resilience 165
12. Choosing Extremes 183
13. Staying and Leaving 200

Appendix: Studying the Psychology of Extreme Environments 213
Notes 219
References 241
Index 273

ABBREVIATIONS

BPS	Boredom Proneness Scale
CBS	Charles Bonnet Syndrome
DORA	dual orexin receptor antagonists
fMRI	functional magnetic resonance imaging
HP	harmonious passion
HPA	hypothalamus-pituitary-adrenal
NDM	naturalistic decision making
OIC	officer in charge
OP	obsessive passion
PSS	Preference for Solitude Scale
PTSD	post-traumatic stress disorder
REM	rapid eye movement
REST	Restricted Environmental Stimulation Technique
RPDM	Recognition Primed Decision Model
SAS	Special Air Service
SSS	Sensation Seeking Scale
STAI	State-Trait Anxiety Inventory
WNSS	Weinstein Noise Sensitivity Scale

1

Life at the Edge

> Out on the edge you see all kinds of things you can't see from the center. Big, undreamed-of things—the people on the edge see them first.
>
> Kurt Vonnegut Jr, *Player Piano* (1952)

Throughout human history, some people have chosen to put themselves into extreme environments. On land and sea, at the poles, in the air, and in space, they place their lives at risk in order to work and play in environments that expose them to the most intense physical and mental demands.

This book examines extraordinary human endeavour and the psychological qualities that underpin it. Drawing on real-life cases, including those of explorers, mountaineers, deep-sea divers, and astronauts, we explore their personal characteristics and complex motivations, and analyse the psychological attributes that lead to success (or failure) for individuals and teams.

We draw on scientific research to understand what happens, both mentally and physically, to people at the limits of human experience. What psychological and emotional qualities does a person need to survive and thrive in such hard places? How do they prepare for situations that are beyond the limits of normal experience? What are the long-term effects on them and their families? And why on earth do they choose to do it in the first place?

We also consider the practical lessons we can all learn from understanding how people cope in hard places. Being brave, making good decisions, planning and preparing, dealing with social conflict, working in small groups, learning to focus attention, coping with boredom, sleeping well, and building psychological resilience are valuable skills in everyday life, just as they are in extreme environments.

We begin by taking a look at some of the hardest of hard places, and the people who choose them.

Hard places

Apsley Cherry-Garrard described polar exploration as 'the cleanest and most isolated way of having a bad time which has been devised'.[1] Some 8,000 men applied to join the 1910–1913 British Antarctic expedition led by Captain Robert Falcon Scott. The handful who made it through the selection, including Cherry-Garrard, willingly subjected themselves to danger, snow blindness, frostbite, exhaustion, dysentery, hunger, and of course extreme cold. Many did not survive.

The winter before Scott's ill-fated walk to the South Pole, Cherry-Garrard and two other members of Scott's team embarked on a journey to collect Emperor penguin eggs.[2] During the black depths of the Antarctic winter, the three men hauled two sledges weighing a third of a ton across the frozen wilderness in complete darkness and temperatures of minus 60 degrees Celsius. Their rations consisted only of pemmican (a paste of meat and fat), biscuits, butter, and tea, and they had no means of communicating with anyone else.

During their five-week mission, Cherry-Garrard and his two companions often came close to death. In the pitch-blackness, each of them frequently fell into deep crevasses from which they had to be hauled by the others. With perhaps just a hint of understatement, Cherry-Garrard noted that: 'Crevasses in the dark *do* put your nerves on edge'.[3] The cold was so intense that their teeth split and they became frostbitten even when inside their sleeping bags. The suppurating blisters on his fingers made even the stoical Cherry-Garrard howl with pain. Against all odds, though, they reached their destination and returned with their prize of three penguin eggs.

A decade later, Cherry-Garrard observed that the Winter Journey, as it came to be known, 'had beggared our language: no words could express its horror'. His suffering had been so great that he had hoped only to die

without much pain. It was, as he put it, 'the weirdest bird's-nesting expedition that has ever been or ever will be'.[4]

Climbing mountains is another extreme activity in which people expose themselves to intense hardship and risk. Errors of judgement and bad luck can end a climber's life in many different ways, including by falling, avalanche, rock fall, altitude sickness, or freezing. Europe's highest mountain, Mont Blanc, has alone claimed more than a thousand lives.[5]

In 1936, four German and Austrian mountaineers attempted to be the first to climb the fierce North Face of the Eiger. Reaching the summit requires a technically demanding piece of climbing across an apparently impassable slab of sheer, icy rock. During the ascent, Andreas Hinterstoisser was the first to cross the 'Hinterstoisser Traverse', as it was later named in his honour. His companions followed, using the rope he had set up, retrieved the rope, and continued their ascent.

All went well until falling rocks injured Willy Angerer, forcing the group to abandon their summit attempt and descend to the Hinterstoisser Traverse. Only then did they realize that it could not be crossed in reverse without fixed ropes. With the Traverse impassable, they were forced down a much more perilous route. As they descended, an avalanche struck them. Hinterstoisser fell to his death, Angerer was propelled into the mountainside with fatal force, and Edi Rainer was asphyxiated in his ropes. The remaining climber, Toni Kurz, was left dangling at the end of his rope, within sight, but not reach, of a rescue party that had struggled for hours to reach him. He died within a few arms-lengths of rescue. A cascade of bad luck had created a situation that was beyond the climbers to overcome.[6]

Equally daunting hazards, including drowning, asphyxiation, ruptured lungs, and decompression injuries (the 'bends'), face those who dive deep under water. To avoid the bends, divers must pause for long periods during their return to the surface, a process that can take many hours on the deepest dives.[7] During these decompression stops, the diver must cope with cold, dehydration, and sheer tedium. And the stops do not always go smoothly: one cave diver almost died when a gas bubble formed in his inner ear during an ascent from 250 metres, destroying his sense of balance and making him

uncontrollably nauseous. He was completely disorientated, vomiting repeatedly, and barely able to hold on to his guideline. Nonetheless, he still had to complete more than 10 hours of decompression before reaching the surface.[8]

Cave diving is a particularly dangerous form of diving. It has been likened to swimming down a flooded lift shaft in a ten-storey office block in complete darkness. The cave diver can easily become lost or trapped, and merely touching the floor can stir up a cloud of silt that cuts visibility to zero, making it impossible to distinguish up from down.

When death does come in a cave diving accident, it does not always come quickly. In one case, a diver became lost while exploring a labyrinth of flooded caves in South Africa. Rescuers found his body six weeks later on a dry rock shelf. He had climbed out of the water and survived for three weeks before eventually dying alone in absolute darkness.[9]

The pursuit of extreme activities has taken people to great heights. Twelve men risked everything to stand on the surface of the Moon. Hundreds more have braved the vacuum of space. Scott Carpenter, who became the fourth American in outer space when he orbited the Earth in 1962, said: 'I volunteered for a number of reasons. One of these, quite frankly, was that I thought this was a chance for immortality. Pioneering in space was something I would willingly give my life for'.[10] Although Carpenter eventually succumbed to old age, eighteen people have died during space missions, including three cosmonauts who asphyxiated when their air supply leaked into space as they undocked from a space station.[11] Sending people into space—and returning them safely—is one of the ultimate tests of technology and teamwork.

Others who explore the skies include test pilots such as Bill Waterton, who in 1952 took off in a prototype jet aeroplane minutes after witnessing a fellow pilot die in a horrific crash. Waterton, who still had burn marks from a crash he had survived nine days earlier, was forced to taxi along one edge of the runway to avoid the smouldering wreckage of his friend's plane.[12] The ability to overcome fear and manage anxiety is a prerequisite for coping with extremes.

Despite the high mortality rate and meagre pay, the life of a test pilot in the decade following World War II offered extreme sensations that few humans ever experience. One pilot rhapsodized about taking a new type of jet fighter up to 40,000 feet and pointing it vertically downwards on full throttle: 'Soon you are going straight down at the earth at supersonic speed. You can see the earth rushing up towards you. It's a wonderful thrill'.[13] (He later fractured his spine after a crash-landing.) Extreme environments clearly offer the prospect of rewards that are unavailable in everyday life.

Some people travel to extreme altitudes in order to plummet back to Earth. The record for the highest parachute jump is currently held by Felix Baumgartner, who in 2012 stepped from a balloon 24 miles above the Earth. At such altitudes a human body would suffer catastrophic damage unless heavily protected. Without a pressure suit, bubbles would form inside the body, blocking arteries and causing extreme pain. The lungs would haemorrhage because of the pressure difference. Even with a pressure suit, a high-altitude parachutist faces tremendous hazards. A free fall can potentially reach the speed of sound, and there is the danger of succumbing to an uncontrollable 'flat spin' of up to 200 revolutions a minute.[14] Managing such extraordinary risks requires meticulous preparation and extensive practice.

Then there are those who brave the oceans. Even a circuit of the British Isles can be lethal, as competitors in the 1979 Fastnet Race discovered. Two days into the race more than 300 yachts were hit by a huge storm and fifteen sailors died. Two more sailors were left for dead on their sinking yacht, one with severe injuries. Anxiety, dehydration, pain, and exhaustion impaired their ability to think clearly about how to deal with their situation. They were rescued in the nick of time. More than 4,000 people took part in the Fastnet rescue, one of the largest in sailing history, and three rescuers died.[15] Pursuing extreme activities can put other people's lives at risk as well.

Stories like these underline the physical and psychological demands that characterize extreme environments, and the sorts of qualities people must possess if they are to survive in them. An early Antarctic explorer captured several common themes when he wrote of 'the strain of the whole thing, the

exhaustion and pain, the cold, the want of food and sleep, the monotony, and the anxiety as to what is to happen at the end'.[16]

What all extreme environments have in common, according to one established definition, is making 'extraordinary physical, psychological, and interpersonal demands that require significant human adaptation for survival and performance'.[17] As this definition makes clear, the demands are not just physical. An individual's psychological response is often the most important factor. The ability to cope with stressful situations depends at least as much on the mind as it does on the body.

Stress and stressors

Extreme environments are undoubtedly stressful. But what does that mean? Stress occurs when an individual is subject to demands that exceed, or threaten to exceed, their capacity to cope.[18] As such, stress depends on both the environment and the individual. The extreme environments described in this book have features that make them objectively demanding by any standards. But the extent to which they are stressful will depend on the individual's ability to cope with those demands, which in turn depends on factors such as their skills, experience, and physical and mental state at the time.[19]

A couple of definitions may be helpful. The unpleasant and potentially harmful stimuli that are capable of causing stress are often referred to as stressors, while the psychological and physiological reactions they elicit are known as the stress response. As we shall see, stressors may be physical, psychological, or social.

Stressors vary in their impact according to factors such as their severity, duration, predictability, and controllability. Other things being equal, a stressor will have a bigger impact, both psychologically and physiologically, if it is persistent and uncontrollable—in other words, if it lasts a long time and there is little you can do to avoid it.[20] Stressors encountered in extreme environments often have both characteristics.

What does stress do to us? The answer depends on a number of things, including whether the stressor is acute (short-lived) or chronic (prolonged). The immediate response to an acute stressor is sometimes referred to as the fight-or-flight response. It involves rapid adjustments in cognition (thinking) and physiology that prepare us for a challenge which threatens our well-being. Energy reserves are mobilized and attention is sharply focused on the immediate threat. The pupils dilate to let in more light and reaction times speed up. If the threatening event does materialize, the brain stores vivid memories of the experience, enabling the individual to respond faster if confronted with a similar threat in future.[21]

Acute stress is accompanied by changes in brain function, in which complex thinking is reduced in favour of quick reactions. These changes speed up responses but they can also impair the ability to make complex decisions.[22] Stressful situations tend to promote short-term thinking. People under stress often feel pressured to take decisions quickly, even if, in reality, they do not need to. They may ignore relevant information or attend only to information that confirms their expectations. They tend to consider fewer options and fall back on tried and tested responses. Stress can produce a form of mental paralysis, referred to as decision inertia, in which the individual procrastinates, performs important tasks slowly or not at all, and makes excuses for inaction. One of the most powerful defences against poor decision-making under stress is expertise acquired through learning and practice[23] (we explore this theme in Chapter 9).

The physiological processes underlying the acute stress response have been investigated over many decades and are reasonably well understood. Acute stress triggers a complex cascade of neural and hormonal signals, releasing a cocktail of chemical messengers that affect organs throughout the body.

Central to the acute stress response is the release of the hormones adrenaline and noradrenaline into the bloodstream. This prepares the individual for immediate action by triggering rapid rises in blood pressure, pulse rate, and breathing. The heart beats faster and pumps more blood with each beat, while blood vessels supplying the muscles expand to improve the

supply of oxygen. The bronchial tubes dilate to allow more air to pass with each breath. Sweat glands are activated and blood is shunted away from the extremities of the body into the muscles, heart, and brain. The constriction of peripheral blood vessels produces the 'cold feet' (and cold hands) associated with acute stress. Digestive processes slow down, with associated symptoms of dry mouth, loss of appetite, and churning guts (hence 'getting the wind up').[24]

Another core element of the stress response is the hypothalamus-pituitary-adrenal (HPA) axis, comprising the hypothalamus region of the brain, the pituitary gland (at the base of the brain) and the adrenal glands (located next to the kidneys). Under instructions from the brain, the adrenal glands release the hormone cortisol into the bloodstream. One of the main functions of cortisol is to mobilize the body's energy reserves. The HPA axis mediates the longer-term response to stress and is activated by prolonged or repeated stressors, especially those involving social threats or negative emotions.[25]

An acute stress response may be triggered by the *anticipation* of a stressor, possibly long before it actually happens. Some time before a person makes their first ever parachute jump, for example, their adrenaline and noradrenaline levels, blood pressure, and heart rate are likely to rise, and they may experience the characteristic symptoms of dry mouth, cold extremities, and loss of appetite. These responses typically disappear soon after they have landed, when the pre-jump feeling of anxiety is succeeded by one of elation.[26]

The stress response has evolved to help us survive. But too much stress can be detrimental to physical and mental health. Traumatic experiences may leave mental scars in the form of post-traumatic stress disorder (PTSD). Chronic stress can have other insidious effects. One of its harmful consequences is altering the functioning of the immune system, making the individual more susceptible to physical illness. This happens partly because of chronically elevated levels of cortisol, brought about by activation of the HPA axis. Cortisol has a variety of biological actions, one of which is suppressing elements of immune function. Prolonged activation of the

HPA axis is associated with a range of mental and physical health problems, including anxiety disorders, depression, and cardiovascular disease.[27]

Coping with stressors

In this book we will be looking at how people cope (or fail to cope) with the multiple stressors they encounter in extreme environments. Many of these stressors are physical, such as extremes of temperature or pressure, lack of oxygen, or noise. Those who enter extreme environments must also cope with hardships such as squalor, pain, thirst, and bad sleep. As we shall see, all of these stressors have psychological and emotional consequences, including affecting the ability to think and make good decisions.

In addition to physical stressors, people in hard places must cope with psychological and social stressors such as anxiety, fear, and the pressure of living in enforced proximity to a few other individuals for long periods. Social tensions may manifest themselves as conflict between members of a team, between team members and their leaders, or between the team and 'mission control'. Lack of privacy can amplify interpersonal irritations, and poor communication makes matters worse by fostering misunderstanding. Stress can be infectious: transmitting our own anxieties to other people increases the pressure on them. Spending time in hard places also disrupts relationships with family and friends. The damage may become apparent only after the adventurer has returned to normal life.

Despite all of this, plenty of people clearly do cope with the stress of extreme environments and some even thrive on it. How do they do it?

Individuals vary considerably in their coping ability, and therefore the stress they experience under apparently similar conditions. A situation that is highly stressful for one person may be tolerable or even positively stimulating for someone else. Someone who is about to make their first ever parachute jump, for example, is likely to be more stressed than someone who has successfully jumped many times before.

Much depends on the person's assessment of their situation and of what they might do about it. This assessment process, which is known as

cognitive appraisal, is crucial to how individuals deal with stressful situations. The assessment may be conscious and deliberate—as, for example, when pausing to think through the practical implications of worsening weather conditions. It may also be influenced by feelings that are below conscious awareness, as in a sense of foreboding.[28]

The behavioural and psychological responses that people use for dealing with stressors are often referred to as coping strategies. These strategies may be directed either at the stressor itself (problem-focused coping) or at the individual's emotional response to the stressor (emotion-focused coping). Strategies may involve avoiding the stressor, mitigating its effects, or tolerating the resulting stress.[29] For instance, you could respond to extreme heat with problem-focused coping strategies such as using air-conditioning, wearing suitable clothing, staying in the shade, and avoiding physical activity. You could also use emotion-focused coping strategies such as self-medicating with alcohol, distracting yourself by talking or reading, and maintaining an attitude of determined stoicism.

An individual's response to a stressful situation will further depend on factors unique to them, including their skills, experience, personality, beliefs, physical health, and experience of previous stressful events. Contextual factors, such as hunger, sleep deprivation, and social environment, also play a role.[30]

One of the most effective coping strategies is to gain a sense of control over the stressor. Individuals who feel they are in control of a challenging situation tend to be less stressed by it than those who perceive themselves to be passive victims of circumstance.

The importance of control was demonstrated decades ago in experiments in which pairs of rats, mice, or people were repeatedly exposed to identical stressors such as mild electric shocks or loud noises. One individual in each pair could control the stressor by, say, pressing a button to turn it off, while the other subject's button did nothing. Both individuals experienced the same stressor at the same time, differing only in their ability to control it through their own actions. The experiments consistently showed that an uncontrollable stressor generally evokes a bigger stress response than a

controllable (but otherwise identical) stressor.[31] A person whose experience and training equip them to understand a difficult situation is better able to control it and therefore more likely to cope. In extreme environments, planning, preparation, and expertise play crucial roles in coping with stress.

Another important buffer against stress is social support. Individuals who have supportive social relationships tend to be less vulnerable to stress than those who are socially isolated.[32] However, social support is not always available in extreme environments, and personal relationships can also be a powerful source of stress.

Another way in which people cope with stressful situations is by observing how others respond and then copying them. One consequence is that particular coping strategies tend to spread within groups or cultures. Cultural differences in coping strategies have been observed in extreme environments. Psychologist Larry Palinkas and colleagues studied more than 200 men and women from five nations who were based in Antarctic research stations during the polar winter. 'Wintering over' is a potentially stressful experience that involves months of confinement with a small group of people and little possibility of rescue should anything go wrong. People from different nations varied significantly in their responses. For instance, the Poles and Russians sought social support from their colleagues more often than did the Americans.[33]

Bestselling accounts of extreme environments have, unsurprisingly, tended to emphasize suffering, reinforcing a perception that stressful activities are inherently harmful. Stress is not all bad, however. Exposure to mild, acute stressors can be stimulating and enjoyable—as demonstrated by popular forms of entertainment such as bungee jumping and theme park rides.

More significantly, the experience of coping successfully with stressful situations can have long-term psychological benefits. A growing body of evidence shows that many people who spend time in extreme environments find it a positive experience that enhances their well-being. Coping with moderate stressors can have a psychological toughening effect, making individuals better able to cope with stressful situations in the future. People

who succeed in extreme activities often emerge from their experience energized, confident, and keen to face new challenges.[34]

The sense of mastery and achievement that comes from coping with extreme challenges can bring lasting satisfaction and happiness.[35] Even traumatic experiences can bring long-term psychological benefits—a phenomenon known as post-traumatic growth. At best, extreme experiences can leave a person mentally and physically more resilient, wiser, and more satisfied with their life.

Science in hard places

Throughout this book we refer to scientific evidence about the psychology of surviving and thriving in extreme environments. You might wonder how such evidence is obtained. By their nature, extreme environments are difficult places in which to work, let alone carry out psychological research. Even so, there is a substantial body of empirical evidence.

Scientists who study extreme environments use a range of methods. One source of data is first-hand accounts and contemporary logs from expeditions, which psychologists later analyse. Evidence also comes from observational studies of people in actual and artificial extreme environments. Sometimes psychologists study people who are already engaged in extreme activities, such as those who overwinter on Antarctic stations. Government agencies, notably those involved in manned space exploration, fund scientists to study people in simulated missions. Volunteers are confined to artificial or real extreme environments such as caves, deserts, or underwater habitats. For readers who want to know more about how such research is carried out, we have included further detail in the Appendix.

As well as published scientific research, we have drawn upon anecdotal accounts of extreme experiences. Such accounts contain many of the same themes that feature in the research, such as the stress of being isolated with a small group of people and the debilitating effects of poor sleep. We found other themes in anecdotal accounts that were less prevalent in the scientific literature, including the crucial importance of being able to focus attention, a

general lack of desire to take unnecessary risks, and the positive effects of extreme experiences.

Mainstream psychological research is also relevant. We refer later to research on topics as diverse as disgust, meditation, pain, boredom, teamwork, and expertise, all of which are relevant to understanding how people cope in extremes. We have been struck by how applicable the psychology of extremes is to everyday life. Understanding why people survive and thrive in extreme environments can provide useful lessons for us all, regardless of whether we ever venture into extremes ourselves.

In summary, extreme environments are enormously varied in their physical characteristics, but they share the capacity to produce similar forms of psychological stress. Stress occurs when the demands exceed the individual's actual or perceived capacity to cope. This means there are things we can do to mitigate stress, such as planning and preparing. Our ability to cope in demanding situations depends primarily on factors such as experience, knowledge, attitudes, and personality. Surviving and thriving in extreme environments—as in everyday life—is largely a mind game.

2

Bravery

To hell with it all, let us die cheerfully.
Frank Hurley, Antarctic explorer: private diary, January 1913

Extreme environments can be terrifying. People who venture into dangerous places face the prospect of unpleasant and potentially debilitating fear. To survive and thrive in extreme environments, they must control their fear and, in many cases, display remarkable bravery.

Conquering fear can be a rewarding experience. As one eighteenth-century climber commented, after observing the perilous lives of chamois hunters in the Alps: 'it is these very dangers, this alternation of hope and fear, the continual agitation kept alive by these sensations in his heart, which excite the huntsman, just as they animate the gambler, the warrior, the sailor'.[1] A contemporary BASE jumper made a similar observation: 'You can't even begin to try to make somebody who hasn't done it understand how frightening, how exciting, how peaceful, and beautiful that sensation is'.[2]

The men of Scott's Antarctic expedition of 1910–1913 had to draw on deep reserves of courage every day. One of the many hazards they faced was the unpredictable plunge into a crevasse, as the ice suddenly gave way beneath their feet and a seemingly bottomless pit opened beneath them. 'I had the misfortune to drop clean through, but was stopped with a jerk when at the end of my harness', wrote a member of Scott's team. 'It was not of course a very nice sensation, especially on Christmas Day and being my birthday as well. While spinning around in space like I was it took me a few seconds to gather my thoughts and see what kind of a place I was in'.[3] Another team

member fell into crevasses eight times in the space of 25 minutes. 'Little wonder he looked a bit dazed', commented one of his companions.[4]

People who choose to engage in risky activities may be regarded as brave, heroic, or even reckless. The philosopher Charles Carroll Everett described the relationship between bravery and recklessness in these terms: 'As the coward sees danger where there is, practically speaking, none, the reckless man does not see it where it actually exists . . . The really brave man does not overlook the danger. He does not let his mind dwell upon it; but if it exists he knows just what it is'.[5] In this chapter we look at the emotions of fear and anxiety, and at the qualities of bravery, heroism, and recklessness. We start with what it feels like to be in the grip of fear.

Being fearful

Fear and anxiety have similar psychological and physical symptoms, and the terms are sometimes used interchangeably. However, psychologists often draw a distinction between the two.[6] Fear may be regarded as a state of apprehension and physiological arousal that is triggered by the presence of a specific and imminent threat to well-being. The state of fear helps us to prepare for danger, by focusing attention on the threat and boosting physical readiness to respond. Fear is an adaptive response that starts rapidly when the threat appears and ends when the threat goes away.

Anxiety, on the other hand, is a more diffuse state. It may be triggered by less specific or less tangible threats, including a general apprehension about possible future events or personal concerns. Encountering a knife-wielding mugger on a dark street would normally trigger fear, whereas a person might feel anxious about the possibility of there being muggers in the vicinity. Unlike fear, anxiety can be long lasting. Some unfortunate people suffer from an anxiety disorder: a sense of persistent, overwhelming, and distressing anxiety that can generalize to many areas of their life.[7]

Fear has three dimensions. The first dimension is physiological arousal: the fight-or-flight response to an acute stressor, which includes a racing pulse, clammy hands, and rapid breathing. The second dimension is the

cognitive response, which includes appraising the situation and considering its possible outcomes. The final dimension is the behavioural response, such as avoiding or escaping whatever is inducing the fear.

The three dimensions of fear can become disconnected: for instance, you might experience a physiological reaction, such as a racing pulse, without necessarily feeling fearful or running away. However, they are usually closely linked. A cognitive response, such as assessing a situation as threatening, triggers physiological arousal. Conversely, physiological arousal can trigger a cognitive response: having a racing pulse can make us feel apprehensive even if there is no apparent external threat.[8]

Because the cognitive and physiological dimensions are so closely linked, people can control fear by concentrating on one of the components. For instance, controlling your cognitive response by remaining focused in dangerous situations can help control your physiological response, just as concentrating on reducing your breathing rate can help you to calm racing and fearful thoughts.

Fear is a response to basic threats to survival. A vivid example is what happens when someone is deprived of oxygen, as can happen at high altitude or underwater. A standard experimental method for inducing fear and acute stress is to breathe air containing a high proportion of carbon dioxide (CO_2). Inhaling just a few deep breaths of air containing 35 per cent CO_2 can induce an acute stress response accompanied by unpleasant sensations of acute anxiety, breathlessness, and feeling trapped. It also triggers a physiological response involving rapid changes in blood pressure, breathing, and heart rate, together with the release of stress hormones. The response is intense but short-lived. In a minority of people the experience provokes a full-blown panic reaction.[9]

Breathing CO_2 appears to trigger a defence mechanism that evolved to make us respond rapidly to suffocation. But responding to actual or perceived suffocation can sometimes make a situation more dangerous. One study of scuba divers found that more than half had experienced at least one episode of sudden panic in their diving career. These episodes often start with thoughts about suffocation, which may trigger a physiological response

that makes someone feel as if they are actually suffocating. The behavioural response can be to ascend rapidly, sometimes causing fatal decompression injuries.[10]

People preparing for extreme situations often experience a mixture of anxiety and excitement as they consider not only the rewards of what they are about to do, but also the dangers. The mountaineer Joe Simpson, for example, wrote of the 'hollow, hungry gap' that he felt in his stomach while waiting to start the ascent of a previously unclimbed mountain.[11]

Anticipatory anxiety may disrupt sleep, leading to poorer performance. Brendan Hall, skipper of a yacht that won the gruelling Clipper Round the World Race in 2009–2010, attributed his success in part to meticulous planning. But thinking about all the potential dangers gave him sleepless nights before the start of every leg of the race.[12] Bad sleep, which is common in extreme environments, can seriously impair people's ability to function (a theme to which we return in Chapter 4).

Once someone has started the extreme activity, anxiety often dissipates. Many divers have described feeling anxious until they are in the water, at which point they start to feel more relaxed. One wreck diver put it like this: 'The strange thing about diving, at least for me, is that the most anxious moments are in the preparation. Once in the water the weight of the gear and the worries disappear'.[13] Similarly, researchers who studied the emotions of climbers during a Himalayan expedition found that anxiety was rare, even during the most difficult phases.[14] But anxiety or fear may return quickly if circumstances alter. A change in conditions, such as deteriorating weather or an equipment problem, can trigger anxiety or fear in the most confident expert.

Feelings of anxiety or fear may persist after an extreme activity has finished. Many people feel satisfaction, perhaps tinged with relief, after they have left a dangerous environment. But those who have had a close call, or witnessed traumatic incidents such as the death or injury of a companion, may experience retrospective anxiety and fear as they realize how close they came to death. They may suffer flashbacks, during which

they feel emotionally as though they were living through the experience again. In its more severe forms this can develop into PTSD.[15]

How people respond in difficult situations is partly a function of their personality. As we noted in Chapter 1, individuals vary in their reactivity to stressors. One aspect of this is the personality characteristic of trait anxiety, which is a measure of an individual's general level of anxiety. People who are high in trait anxiety are more inclined to feel anxious: they are the ones who always seem to be worried about something. Conversely, those who are low in trait anxiety are the ones who rarely seem to fret about anything.

Neither extreme of trait anxiety is particularly desirable. Anxiety and fear, in common with other negative emotions, are biological defence mechanisms that evolved to help our ancestors survive in a dangerous and uncertain world. If you are excessively anxious you will see danger everywhere and have a miserable time. But if you are not anxious enough you may fail to respond to real dangers, with potentially disastrous consequences.

Another relevant aspect of personality is known as self-efficacy. This is a measure of belief in your ability to achieve goals, and depends on your perception of your ability to control and cope with difficult situations.[16] The perceived controllability of a situation is a major factor in determining how fearful someone feels, as well as how much stress they experience. Researchers who interviewed BASE jumpers noted that: 'the decision to jump is made by balancing the natural state of fear with knowledge based on personal capabilities and technical expertise'.[17]

Experts tend to be high in self-efficacy. When psychiatrists assessed the men who became the first US astronauts in the 1960s, they found them to be neither fearless nor emotionless. The astronauts were, however, confident that they had the skills and knowledge to overcome realistic threats, and were 'not given to dwelling on unrealistic ones'.[18] It was only when the astronauts felt helpless in a dangerous situation that they felt fearful: 'When you can't do anything, that's the worst time', said one.[19]

Trait anxiety and self-efficacy affect people's responses to threatening situations—in particular, whether they tend to confront or avoid threats. Research has shown that it is generally better to confront a stressful