Chapter 4
Self-reliance and Situational Influences

In some situations it is easier to stay alert and do the right thing than in others. Anyone who has to be attentive and make mental exertions for hours on end will have problems concentrating and make mistakes at some point. Anyone who has to continuously control themselves—staying calm, not making a noise, not drinking alcohol, not lighting a cigarette, sticking to a diet—will sooner or later have a moment of weakness and do precisely what they did not intend to do. If someone is experiencing stress, it is often more difficult to keep thinking clearly and not to respond to every stimulus. Even the calmest of souls will start performing badly if the pressure is cranked up enough.

This is very important for this study. It means that the extent to which someone is capable of self-reliance also depends on their current situation and living conditions. First, this affects moral judgement. For example, to what extent is it somebody’s ‘own fault’ if they take bad decisions because their capacity for self-control has been affected by stressful conditions such as with acute and problematic debts\textsuperscript{1, 2}? Second, it opens up—at least in theory—new perspectives for policy. If it is true that living conditions have an influence on self-reliance, the government could try to promote conditions that will help improve self-reliance (or at least will not undermine it).

We therefore discuss these situational influences in more detail in this chapter. We will deal with the following subjects in succession:

- the influence of acute stress. A little stress is usually good for you, but too much stress leads to reduced mental performance. Under stressful conditions it is more difficult to think clearly and act in a thoughtful manner;
- mental fatigue. Anyone who has to undertake demanding mental activity for prolonged periods will eventually become tired and start making mistakes. We also focus on ego depletion, the phenomenon whereby the capacity for self-control can be temporarily drained;
- the psychological effects of poverty. The previous two mechanisms appear to be combined in this one.
Focus on self-control

In this chapter we discuss the capacity for self-control in greater depth. Why are we highlighting this characteristic? As stated in the previous chapter, the capacity for self-control is associated with all kinds of outcomes. First, self-control means that people are better able to resist counter-productive tendencies and impulses. People with a great capacity for self-control will tend to tackle problems that they would instinctively rather avoid, or conversely, will not immediately rush into a new situation if it would be better to stand back.

Second, self-control is probably also linked to life outcomes because it provides protection from a less favourable score in the other non-cognitive characteristics that we identified in Chap. 3. Self-control can potentially provide protection from the risks of pessimistic beliefs or lack of belief in one’s own abilities. People with a great capacity for self-control will tend to be able to force themselves to have experiences which, if successful, could result in a greater belief in their own abilities. In short, life is sometimes a swamp but people who have great capacities for self-control will be better able to pull themselves out of that swamp through their own efforts.

Self-regulation, executive control or executive functions are often discussed in the literature, as well as self-control. These are concepts that overlap with self-control, but are a little broader. Self-regulation is defined as “the process of purposefully directing one’s actions, thoughts, and feelings toward a goal”. The term ‘executive functions’ refers to a family of “top-down mental processes needed when you have to concentrate and pay attention, when going on automatic or relying on instinct or intuition would be ill-advised, insufficient, or impossible”. Three ‘core executive functions’ are often identified, namely working memory, cognitive flexibility and cognitive inhibition. The third function is very similar to self-control. Various studies have been conducted to ascertain the influence of situational conditions on ‘self-regulation’, ‘executive control’ or ‘executive functions’. We will discuss a number of these studies below. Because, even though these studies use different terms, they do provide a clear insight into the way situational factors influence the capacity for self-control.

As is already evident from this introduction, the scientific findings in this chapter are less robust than in the previous chapter. That had a very broad empirical basis, often meta-analyses of dozens, if not hundreds of studies. However, quite a few of the insights in this chapter could be described more as ‘work in progress’. The research is often recent, the results are not always clear-cut and many questions remain unanswered.

4.1 The Influence of Acute Stress

According to Contrada, a key element of many definitions of stress is “the idea of an imbalance between environmental demands and adaptive capacity”. There is a mismatch between what a person is capable of and what the situation demands. Quite a lot is known about the physical processes of acute stress. The body produces substances to make it ready for immediate action, including cortisol, also known as the stress hormone. An elevated cortisol level is an indicator of stress.
Box 4.1 Affected brain regions (based on Arnsten\textsuperscript{7})

A lot of research into the effects of stress goes into great detail about the brain regions and neurotransmitters affected by the phenomena being studied.

The prefrontal cortex (PFC) is particularly relevant to the subject of this study. “The basic function of the prefrontal cortex is the representation and execution of new forms or organized goal-directed action,” according to Fuster\textsuperscript{8} in his standard work on the prefrontal cortex. The PFC is therefore the headquarters for self-regulation. It is closely connected to other cortical and subcortical brain regions, to be specific:

- the dorsolateral PFC (DLPFC) has many connections to the sensory and motor cortices, and plays a key part in regulating attention, thought and action;
- the right inferior PFC (RIPFC) appears to specialise in inhibiting inappropriate responses and behaviour;
- the ventromedial PFC (VMPFC) has many connections with subcortical structures which are responsible for emotions and habitual behaviour (e.g. the amygdala);
- the dorsomedial PFC (DMPFC) is involved in monitoring errors and ‘reality testing’.

- In non-stressful conditions, these prefrontal brain regions regulate thought, emotion and behaviour (see Fig. 4.1).
So what happens when stress arises? A number of changes occur (see Fig. 4.2). The amygdala activates stress responses in the hypothalamus and the brain stem, which in turn triggers the release of noradrenaline (NA) and dopamine (DA). This reduces regulation by the PFC and boosts the influence of the amygdala. The main result is that our attention is guided less by the thoughtful top-down control from the PFC and more by the perceived stimuli in our environment. The behaviour is guided more from the bottom up. “During stress, orchestration of the brain’s response patterns switches from slow, thoughtful PFC regulation to the reflexive and rapid emotional responses of the amygdala and related subcortical structures.”

**Fig. 4.2 Stressful conditions**

*The Effect of Acute Stress*

Below we discuss studies on the influence of acute stress on executive functions. This type of study is usually organised as follows. First, an experimental group is subjected to acute stress, e.g. by asking them to address a group of critical listeners almost completely unprepared, or by administering cortisol to them. Both the experimental group and the control group are then given a specific task to do, after which they are tested to see whether there is any difference in performance.

What does this type of experiment teach us about the effects of stress on mental performance? Some studies have recently been conducted to ascertain the effects of stress on the working memory, one of the core executive functions. One example is Schoofs et al.10 They first subjected the experimental group to stress. They then measured the performance of the subjects in three tasks, two of which made great demands
4.1 The Influence of Acute Stress

on their working memory and one of which made significantly fewer demands. In one of the difficult tasks, for example, they had to do sums for 12 min while remembering words at the same time. The results showed that the experimental group performed less well than the control group in the two difficult tasks. There was no difference with the easy task. It was also found that there was a correlation between performance and cortisol level in the two difficult tasks, but not in the easy task. Schoofs et al. concluded that “stress impairs performance in demanding [working memory] tasks requiring maintenance and executive processing of information”.

Even less research has been done into the effects of stress on the two other core executive functions. Plessow et al. studied the effect on cognitive flexibility. The subjects were first subjected to stress and then had to perform two different, randomly alternating tasks. The experimental group was found to perform less well than a control group after an alternation. The stress had therefore impaired their cognitive flexibility. Schwabe and Wolf studied the effect of acute stress on inhibition. Their study focused on the difference between goal-directed behaviour and habitual behaviour. The first type of behaviour is directed by and adapted to the extent to which the desired goal is achieved, but not the second type, which is merely an automatic response to certain stimuli. They found that it took subjects with acute stress longer to unlearn a no longer productive habit than the control group. “Overall, our findings provide strong evidence that stress favours habit performance, at the expense of goal-directed performance”. 

Indirect evidence that stress can have a negative influence on executive functions is provided by Starcke and Brand. They carried out a review of seventeen studies on the impact of acute stress on decision-making. Several experiments showed that people subjected to stress tended to take a decision even before considering all the alternatives properly. Other experiments have shown that stress causes certain groups to prefer the option with the highest immediate reward value (e.g. snacks) when given a choice of food. All in all, Starcke and Brand’s study points in the same direction, namely that stress has an adverse effect on the executive functions. As a result, choices
are guided more strongly by automatic responses and habits and less by “controlled
cognitive processes”\textsuperscript{18}.

\textbf{Risk Aversion and Immediate Reward}

As stated, little research has been conducted into the effects of acute stress on the
core executive functions. It is therefore a good idea to cast the net somewhat wider
and also include research into the effects of stress or certain other forms of negative
affect on two important variables in the economy, namely risk aversion and time
discounting.\textsuperscript{19} Haushofer and Fehr\textsuperscript{20} set out in detail what is currently known about
this.

First, on the basis of thirteen studies, they concluded that people subjected to
anxiety or stress become more risk-averse. One example is an experiment conducted
by Cohn et al.\textsuperscript{21}. They subjected their subjects to anxiety and stress by connecting
their left hand to an electrode and announcing that they could receive a powerful
electric shock at random moments throughout the experiment. It was then ascertained
how much of a budget allocated to them they invested in a series of risky choices
of which it was not certain in advance whether they would make a profit or suffer a
loss. They were found to invest a smaller proportion of their budget than the control
group.\textsuperscript{22}

Second, on the basis of eleven studies, Haushofer and Fehr concluded that people
under the influence of negative feelings tended to choose an immediate reward.\textsuperscript{20} One
example is Lerner et al.\textsuperscript{23} They found that if subjects had watched a sad film clip
first, they chose an immediate reward for participating in the experiment rather than a
significantly greater reward later. “Sadness makes one myopic,” was the conclusion.
Cornelisse et al.\textsuperscript{24} administered cortisol to subjects and found that if they were
presented with time-discounting tasks quarter of an hour afterwards they were more
likely to opt for the immediate reward than people who had received a placebo.

All in all, there are sufficient research results to show that stress or elevated cortisol
levels have an adverse effect on executive functions. To be specific: they have an
adverse effect on the working memory and can reduce cognitive flexibility, increase
habitual behaviour and heighten sensitivity towards direct stimuli and short-term
reward. The quality of decision-making declines and people’s behaviour becomes
regulated less by top-down control and more by bottom-up reactivity.\textsuperscript{25} Within the
scope of the conceptualisation of this study, we can therefore conclude that acute
stress can have an adverse effect on the capacity for self-control and therefore on
self-reliance.

\section*{4.2 Mental Fatigue}

Another question is how long people can maintain effective self-control, self-
regulation or executive control, leaving aside any stress effects. For an unlimited
length of time or do they get tired at a certain point? The latter is true. People who
have to make a mental effort or control their impulses for a prolonged period will
notice fatigue taking hold sooner or later. Performance deteriorates and it becomes harder to maintain executive control or self-control. But why? What is the mechanism behind this?

Now we are coming to a complicated subject and current research in this area is generating fierce controversy. It is impossible to avoid discussing it in depth and going into the scientific details. This is because, from the perspective of self-reliance, there is a lot at stake. In essence, the question is: if people cease to maintain effective self-regulation at a certain point, is it because they are no longer able to or because they no longer want to? This potentially matters a lot in terms of moral judgement.

It is just like the question of intelligence and academic performance. If students do their very best but are not good learners because they are of limited intelligence, they are hardly to blame. That is a question of inability. Such students deserve help and support. On the other hand, if students are smart but don’t make an effort and prefer to hang around in the pub, many people would say that it was their own fault if they didn’t get a degree. That is just a question of unwillingness. Such students are more deserving of a kick in the pants.

There is therefore quite a lot at stake. To create some order in all the research, we will distinguish between two types of mental fatigue:

- **Objective fatigue.** This is where someone’s performance actually declines as a result of continuous mental labour;
- **Subjective fatigue.** This is where someone starts to feel tired as a result of continuous mental labour.

Both the findings in the area of objective mental fatigue and the explanation for subjective mental fatigue are currently the subject of controversy.

**Objective Fatigue and Executive Control**

What is known about the effect of mental effort sustained for long periods on performance? The scientific importance of this issue grew with the advent of the industrial revolution. After all, it was important that factory workers should be able to keep doing their work for as long as possible without making mistakes. Scientists therefore started to investigate what happened if people had to keep performing a demanding cognitive task, e.g. doing complicated sums, for hours or sometimes even days on end. However, it was soon found that, contrary to prior expectations, there was no clear correlation between ‘time on task’ and performance. “Under fatiguing conditions, performance sometimes declines, sometimes remains unchanged, or sometimes even increases as time on task increases”, is how Ackerman summarised it. Moreover, it was often found difficult to replicate the research results.

A couple of things are clear, however. Vigilance and attentiveness already start to decline within half an hour. This is important for certain occupations, such as soldiers and control staff. Declining performance is more likely with rapid, repetitive and uninterrupted work and with tasks requiring continuous executive control. The latter has been found in a handful of studies conducted in the Netherlands. For example, Van der Linden et al. found that, after performing a complicated cognitive tasks
for 2 h, subjects performed less well in a test that measures cognitive flexibility, and also less well in a test that measures the extent to which people make a plan before taking action.\textsuperscript{29} In other studies, it has been found that sustained mental effort causes problems with focusing attention\textsuperscript{30}, that sustained mental effort causes subjects to work in a less systematic way and to change strategy less quickly in the event of adverse outcomes.\textsuperscript{28} Boksem et al.\textsuperscript{31} also found that subjects who had to keep performing a task requiring a sustained focus for 3 h gradually started to make more mistakes. They were also more likely to be distracted by irrelevant stimuli and less able to confine their attention to the stimuli relevant to the task. In an exercise lasting 2 h, Boksem et al.\textsuperscript{32} noted that the subjects not only made more mistakes after a period of time, they were also less likely to realise that they had made a mistake and less likely to use the correction option. In short, what all these studies show is that executive control is adversely affected if people have to continue exerting mental effort for a number of hours.

\textit{Self-control and Ego Depletion}

In recent years, a phenomenon known as ‘ego depletion’ has been the subject of much attention. This term refers to the fact that people cannot maintain self-control indefinitely. Sooner or later, their self-control declines and people start to give into the impulses that they were trying to control. According to Baumeister et al.\textsuperscript{33}, this decline in willpower occurs because the mental resources required for self-control are gradually depleted. It is like a muscle that becomes steadily weaker the longer it has to bear a load. This is the ‘strength’ or ‘resource’ model of self-control.

Many dozens of experiments have now been conducted in which the ego depletion effect has been found. The standard methodology for this is known as dual task design. In this design, the experimental group has to perform two tasks in succession that require self-control. In the first task, they must, for example, suppress their emotions while watching a heart-rending tear-jerker such as \textit{The fault in our stars}. They next have to perform a second task also requiring self-control, e.g. pressing a handle or keeping away from treats such as chocolate biscuits for as long as possible. Their performance is then compared with that of a control group which has performed the second task but not the first. If it is now found that the experimental group did less well in the second task than the control group, this is indeed ego depletion.

Despite the many studies in which the effect has been found, doubt has arisen in recent years as to whether the ego depletion effect really exists. This doubt is further amplified by the replication crisis in social psychology. We therefore discuss this issue in detail in the box. For those who do not wish to read our conclusion in advance at this moment: the ego depletion effect is probably less pronounced than was originally thought, but it would be going too far to conclude that it does not exist at all.
Box 4.2 Does ego depletion actually exist?
On many a street corner you can now learn that ‘will power is like a muscle that can become exhausted’. In the last few years, this scientific finding has found its way to the general public via various popular science publications.34

Recently, however, serious doubts have arisen among scientists as to whether the ego depletion phenomenon really exists. Initial doubts were prompted following a meta-analysis by Hagger et al.35 This analysis of almost two hundred experiments conducted according to the dual task design found “a significant effect of ego depletion on self-control task performance”. However, according to Carter and McCullough36,37, the positive results of Hagger et al. were distorted by publication bias. Studies in which the depletion effect was not found, are usually not published, and were therefore not included in the review either. Carter and McCullough analysed the data from Hagger et al. again, using three different techniques to correct for possible publication bias. As could be expected, the remaining effect was significantly less pronounced. One of the three techniques did not even leave any significant effect at all.

Then, in 2014, it was decided to undertake a worldwide series of replications of the ego depletion research using a dual-task design, under the direction of Hagger as mentioned above. In order to gain a proper understanding of this replication, it is necessary to consider the design in detail. This was based on Sripada et al.38 and is as follows:

- The first task for the experimental group consists of an ‘effortful regulation’ task lasting 7.5 min. In this task, participants are presented with words on a computer screen and have to press a button if the word contains an ‘e’, unless it is next to or one letter away from another vowel. The control group only has to press a button if they see a word containing the letter ‘e’.
- The second task lasts 10 min. In this task, the participants are shown a row of three figures between zero and three on a computer screen, two of which are always identical and one is unique. They then have to press the button showing the number of the unique figure. This figure sometimes appears in a position in the row that corresponds to the value of the figure (i.e. the figure three in the extreme right-hand position), sometimes in a position that does not correspond to its value (e.g. the figure one in the middle position).

The dependent variable is the response time to the figure task.

In early 2016 the results of the series of replications was published, and what was found? Fail! Most of the 23 participating research groups found no significant difference in performance between the experimental group and the control group.
So what now?

Goodbye ego depletion? Are we once again faced with a psychological phenomenon which, as a matter of fact, does not actually exist? That remains to be seen. It is still too early to be certain of all the implications of this series of replications, but we do want to highlight a few points.

Let’s start with what this failed series of replications has actually established. What are the facts? It has not been established that people can never have problems with self-control. Neither has it been established that people can maintain self-control indefinitely. So, what has been established? Strictly speaking, all that has been established is that people who have completed the first task to cross out the ‘e’ do not become so fatigued that they have significantly longer response times afterwards on the second figure task. This means that it is not ‘the’ ego depletion task that has been replicated, but only one specific experiment from the literature concerned, namely the experiment by Sripada et al.\(^{38}\) The fact that there were 23 participating laboratories is impressive, but as each lab followed exactly the same procedure, there is in fact only one replication experiment, albeit involving a large number of subjects spread over several continents.

They key question is then the extent to which Sripada’s experiment is ‘crucial’ to the ego depletion phenomenon as a whole. Has the essential element by which the entire effect stands or falls now been measured? We may have our doubts in this regard. Baumeister and Vohs\(^{39}\) call the choice of this specific procedure ‘foolish’. Although the ‘letter e’ task results in cognitive fatigue, it does not require self-control because there is no impulse or habit that has to be inhibited. This would only have been the case if an automatic tendency had been created in the subjects to score out all the letters ‘e’ in a text. Moreover, it is not clear to Baumeister and Vohs why the dependent variable—namely response time—was supposed to be an indicator of self-control. With hindsight, they clearly regret that they did not object more strongly when they were presented with the proposal for a replication of this design at the time. Now they have little choice but to start their own replication and they have taken the first steps in this direction. Inzlicht (an outspoken opponent of Baumeister and Vohs when it comes to the cause of ego depletion) is also highly critical of this replication. “Was this a perfect study? Not even close. Can we do better? Absolutely”\(^{40}\)

But say the first task, contrary to what Baumeister and Vohs claim, does require self-control, the methodology can still be criticised. Perhaps 7.5 min is too short a time to bring about a depletion effect. As Hagger et al.\(^{41}\) also note themselves, it cannot be ruled out that most people can cope for such a short time, but their mental capacities do become weaker if they have to maintain self-control for hours, days or even weeks on end and are not allowed to give into the temptation to smoke, drink alcohol, make impulse buys, etc. For this reason, we also devote quite a lot of attention to the Dutch fatigue studies in
the main text. The periods of mental effort were much longer in these studies, often at least a couple of hours. In many cases, that was found to have a definite effect.

**Lab versus real life**

A final point: to what extent should we generalise results from laboratory research? Psychologists are sometimes accused of being too quick to extrapolate the results of laboratory research to real life. While this practice is indeed open to dispute, the reverse is also true. We should not generalise the lack of significant results to real life on a one-to-one basis either. It is therefore also important to conduct research into possible ego depletion in real life settings. As far as we know, this has only been done systematically in two studies to date.

The first study is by Hoffman et al. They asked 205 subjects—most of them students—via their smartphone whether they had felt a desire within the last half hour at seven different times every day for a week, and if so, for what. They were also asked each time whether they had resisted that desire or (partly or completely) given into it. The results showed that “the more frequently and recently participants had resisted any earlier desire, the less successful they were at resisting any other subsequent desire”.

The second study is by Dai et al. They studied how faithfully nursing staff in hospitals washed their hands between each patient contact. The rule is that they must always wash their hands before they visit the next patient as this prevents many infectious diseases. However, the problem is that people by no means always obey this rule. What is the reason for this? Dai and her colleagues had access to detailed hand-washing data for over 4,000 nurses in 35 different hospitals for a period of almost three years. This amounted to as many as 14 million hand-washing opportunities. The analysis completed by Dai et al. shows that as the hours of someone’s shift went by, their hand-washing discipline declined, especially among those with increased work intensity. At the end of a 12-h shift, the likelihood of someone always washing their hands between patients declined by an average of one third. On the other hand, rest breaks resulted in restoration of discipline and that restoration was stronger, the longer the rest break lasted. The researchers explained their results on the basis of ego depletion.

**Interim conclusion**

What should the conclusion be now? It is a good thing if results of psychological research are verified in replication studies, but the question is whether this is such a great example. To really be able to conclude that ego depletion does not exist, this should have been a crucial all-or-nothing experiment, and it certainly was not. The ego depletion effect is probably less pronounced than was believed a short time ago because it has now become clear that publication
bias was a factor. For the time being, however, it would be going too far to conclude that the effect did not exist at all—even the researchers in this replication effort did not go so far as this. Rather, the conclusion must be that more accurate research is needed into the question as to why the effect sometimes does occur and sometimes does not, and what the mediating factors are.

**Subjective Fatigue**

If people have to keep performing a task requiring their self-regulation for long periods, their performance may gradually decline. However, this does not answer the question as to how long people persist with the task. When do they stop? It is tempting to answer: when their energy has run out. Fatigue means empty batteries. Nevertheless, however plausible this sounds, it can never be the complete answer. Experiments show that if you increase the reward, people are capable of persisting for longer with a cognitively effortful task or with self-control. Obvioulsy, people have a set of spare batteries when it suits them. This is also evident from everyday experience when people who say they have no more energy to continue with a boring task suddenly appear to find reserves of energy when they are allowed to do something they enjoy, such as a favourite hobby.

Many scientists therefore assume the reason people stop is that they have a feeling of fatigue. The moment when this feeling arises does not merely depend on the length of time they have been working on a task (time on task). Other factors are also at play, such as people’s personality traits, how interested they are in the task, how much benefit they derive from it, what kind of mood they are in, when they last ate and—last but not least—the presence of distractions (smartphones!). According to Hockey, it is not a question of how much ‘energy’ people have left but how much effort they want to put into the task concerned. In his opinion, the choice people make is determined by a cost-benefit analysis.

But the big question is: what is on the cost side of the analysis? This is the subject of real controversy. On the one side are scientists, especially Baumeister and Vohs, who believe that there is a physical limit somewhere, a specific bodily substance or reserve that becomes depleted when mental effort has to be maintained for too long. In essence, the explanation is energy-related. In their quest for a source of energy, they have up till now pinned their hopes on glucose—but without much success.

On the other side are scientists such as Hockey, Kurzban et al. and Inzlicht and Berkman who are firmly opposed to this energy-related explanation. They assume that it is entirely a question of motivation. The reason people find it hard to maintain mental effort and self-control is purely because they reach a point where they no longer want to. First, no evidence has been found thus far of a relationship between glucose levels and self-control. Second, as stated above, people seem perfectly capable of maintaining self-control for longer if they are rewarded for doing so. Moreover, people also continue for longer if they believe that there are no limits on the capacity for self-control. In other words, it's all in the mind. "[S]elf-control wanes over time not because people have no energy but
because people experience a shift in motivation away from “have-to” goals, which are carried out through a sense of obligation and duty, and instead come to prefer “want-to” goals, which are fun, personally enjoyable, and meaningful”. 49

Is it really necessary to delve so deeply into this debate in this book? Yes, because as stated above, when translated back into the issue dealt with in this book, the question is whether limitations on self-regulation and self-reliance are a matter of inability or unwillingness. If the first school of thought is correct and lack of self-control is the result of a depleted energy source, people will not be able to do much about the fact that sooner or later they will no longer be capable of taking thoughtful decisions and controlling themselves. Blaming them for this would be just as unreasonable as blaming people for having to sleep sooner or later. If, however, the second school of thought is correct, it is their own choice if they make unthoughtful decisions and give way to temptations. Many people will have little compassion for individuals who get into difficulties because they are repeatedly tempted to make all kinds of ‘stupid’ choices, such as impulse buys of things they don’t need or an unhealthy lifestyle. They should just control themselves better.

The truth probably lies somewhere in between. Undoubtedly, the early theories about mental fatigue and ego depletion were too one-dimensional in their exclusive focus on energy (possibly as a metaphor). Motivation is certainly a factor. But it is going to the opposite extreme to explain everything by motivation and deny completely the possible role of energy (or other mental or physical resources of a limited nature). This would make certain facts difficult to explain. If mental effort really does not cause any energy to be expended, why do people regularly make less effort for a mental task than they could? And why does 3 h doing arithmetic feel more tiring to most people than 3 h sleeping? 52 Moreover, as Baumeister and Vohs 39 note, if self-control did not involve the expenditure of any energy, why would it be adaptive from an evolutionary point of view for the body to transmit fatigue signals at a certain point that stimulate people to change over from ‘have-to’ goals to ‘want-to’ goals? That would simply be counter-productive. It is precisely those who can maintain self-control for long periods who have the evolutionary advantage.

In short, the empirical results are a good deal easier to understand if we postulate that mentally demanding work also has intrinsic costs. The fact that these costs actually exist is also the argument of Kool and her colleagues, whose research shows that people have an innate aversion to demanding mental labour. 53 “In cognitive/leisure decisions, the utility of leisure derives, in important part, from the relief it offers from costly control”. 54

A ‘Central Governor’?
A possible way out of the controversy is provided by research into physical fatigue, as the phenomenology of mental and physical fatigue is very similar. Research into endurance sports shows that, contrary to what was initially thought, feelings of physical exhaustion do not correlate directly with the physical condition of the body. People start to feel physical exhaustion well before all their muscle power has been used up. It has also been found that, just as with mental fatigue, an extra effort is possible if the
reward is increased. The sports physiologist Timothy Noakes therefore surmises that human neurobiology has a ‘central governor’ that regulates the effort exerted by the body. In response to signals from the body, this central governor generates feelings of fatigue long before the body becomes so exhausted that there is actually a risk of physical damage (‘catastrophic breakdown’), such as torn tendons and muscles. In evolutionary terms, this is a particularly sensible physical innovation.

Evans et al. propose that ‘the central governor theory of physical fatigue’ can help to improve our understanding of mental fatigue, and postulate an integrated model inspired by this theory. The real essence of this theory is that there are ‘multiple inputs’ that determine whether mental fatigue is occurring and the activity concerned is continued or discontinued. The relevant elements are “current conditions (workload, available energy, goal value), expected conditions (future workload and available energy), and opportunity costs of not pursuing some other goal”. Previous experience of how much energy the task in question involves is another factor. In short, both energy and motivation are involved.

All in All…
So what should we conclude now? As stated, this is an ongoing debate. The last word has not yet been said on this subject, as even the central governor concept is not undisputed. What is clear at any rate is that, contrary to what was assumed in classic fatigue research, there is no direct correlation between available energy or resources on the one hand and performance levels or self-control on the other. It is not purely a matter of metabolism. However, it is unlikely that there are no limits at all to the amount of mental labour a person can endure without rest or interruption or that self-regulation can therefore be continued indefinitely. Even though it is still unclear what exactly the physiological processes are, it is incorrect to conclude from this that these limits therefore do not exist. Neither does it chime with research which shows that, when confronted with a need for sustained self-control, the body behaves as if its energy is being depleted. Partly for this reason, many scientists definitely do see a role for limited resources—whatever they may be.

On balance, the findings can probably be best summed up in the term ‘buffer’. If people have to exercise their self-regulation, e.g. to perform effortful mental tasks or to maintain their self-control, they do not immediately deploy all their resources for this purpose. They hold a reserve that can act as a buffer. For this reason, it is possible to make a greater effort, should that be unexpectedly necessary or desirable. Sooner or later, however, we reach the limits of what is possible.

4.3 The Psychological Effects of Poverty

The way stress and mental exertion affect self-regulation is clearly shown in research into poverty. Haushofer and Fehr highlight the role played by stress. They believe that poverty leads to stress and—as we have seen above—stress leads to reduced
mental performance. Haushofer and Fehr\textsuperscript{20} found a total of 25 studies on the effect of a fall or rise in poverty on indicators of psychological well-being, such as happiness, reported mental health, depression and cortisol levels. The great majority of these studies showed that a rise in poverty leads to negative feelings and stress, whereas a fall in poverty has the opposite effect.

Ego depletion could be another factor. Spears\textsuperscript{59} reports on three studies which show that if people on a low income have to decide how best to spend their meagre budget, this can result in a temporary reduction of self-control. In one of these studies, he investigated the extent of ‘secondary eating’ while doing the shopping. Secondary eating is eating while doing something else, such as driving or watching TV. It is a form of ‘thoughtless eating’, which is regarded as a sign of lack of control. The analyses found that people on a low income did more secondary eating while grocery shopping than people on a high income. Obviously, they have to expend mental energy in taking financial decisions, which leaves less for self-control.

But money problems can have yet another psychological effect: a narrowing of perspective. Mani et al.\textsuperscript{60} studied the psychological impact of financial scarcity by presenting passers-by in a US shopping mall with some imaginary financial choices. They had to imagine, for example, that their car suddenly developed a fault. Would they have it repaired and, if so, how would they fund the repair? Two alternative questions were asked, i.e. a cheap alternative and an expensive one. In the cheap alternative, the repair cost 150 dollars, an amount that most people could pay without much difficulty. In the expensive alternative, the repair cost 1,500 dollars. This amount would not be a problem either for people on a good income but would be for people on a low income. It could trigger their feelings relating to monetary concerns. The subjects were then told that they could think about the question and do two short tests in the meantime, namely one measuring fluid intelligence and one measuring cognitive control of impulses.\textsuperscript{61} Finally, they were asked what they had decided about the financial dilemma. What was important to the researchers now was not the answer to the dilemmas but the scores for the two tests. They showed that in the cheap alternative (150 dollars) people on low or high incomes performed equally well in the two tests. However, in the expensive alternative (1,500 dollars) people on low incomes performed significantly worse. Their money worries had obviously been triggered, with an adverse effect on intelligence and control. Converted into IQ, the effect was equivalent to a drop in IQ of about 13 points. “These sizeable magnitudes suggest the cognitive impact of poverty could have large real consequences”.\textsuperscript{60}

4.4 Conclusion: Stress and Mental Exertion Have an Adverse Impact on Self-reliance

What effect does mental exertion and stress have on self-control, i.e. executive control, executive functions or self-regulation? That was the key question in this chapter. What is striking is how little we actually know. “I have no expectation that the laws
of mental fatigue will be formulated in the immediate future”, remarked Dodge a century ago. Since then, only modest progress has been made. Even ego depletion, a phenomenon that was undisputed until recently is again being questioned.

The following conclusions can, however, be drawn. The capacity for self-regulation can be impaired by:

- **Acute stress or elevated cortisol levels.** Acute stress and cortisol have an adverse impact on the working memory. They can also lead to reduced cognitive flexibility, increased habitual behaviour, increased sensitivity to direct stimuli and—if the stress is associated with negative feelings—a short-term orientation. The quality of decision-making declines and behaviour is regulated less by top-down control and more by bottom-up reactivity;

- **Mental exertion**, e.g. demanding cognitive tasks or prolonged periods of self-control. The effects do not necessarily occur immediately. Anyone who wants to can tap into their reserves to maintain the desired performance level for longer but this may be at the expense of other physical or mental functions, and the reserves are not unlimited. Sooner or later, their performance will decline. Moreover, it does seem at present that self-control cannot be maintained indefinitely;

- **Feelings of scarcity and poverty.** Various psychological mechanisms can be triggered in people with serious financial worries that can impair executive functions. This can involve stress or depletion effects but it could also be ‘attentional capture’, where people are so preoccupied with money worries that they have less attention left for other things.

In short, situational factors can affect the degree to which someone is capable of setting goals for the future, focusing on them and working towards them in a planned way, persisting and not getting distracted. These are capacities which are always useful, but especially when life is difficult, e.g. losing a job, getting divorced or dealing with problematic debts. It is at those times when it is essential to keep one’s head. Unfortunately, these are precisely situations which could be associated with stress and therefore have an adverse effect on self-regulation. Just when self-reliance is most important, people run the greatest risk that the capacities they need will be impaired.

**Endnotes**

1. Mullainathan, S., & Shaffir, E. (2013).
2. Tiemeijer, W. (2016).
3. Carver, C. S., & Scheier, M. F. (2011).
4. Diamond, A. (2013, see also p. 135).
5. Contrada, R. J. (2011, see also p. 1).
6. Besides acute stress, the literature also refers to chronic stress. This pertains when the body does not get enough rest after acute stress to return to the ‘normal’ situation, resulting in a position where there is a constant heightened level of stress hormones.
7. Arnsten, A. F. T. (2013, see also p. 4).
8. Fuster, J. (2015, see also p. 1; italics in original).
9. Quite a lot of research has been done into the effects of stress on the long-term memory and recall (see Schwabe et al. 2010), but significantly less into the effects on working memory.
10. Schoofs, D., Wolf, O. T., & Smeets, T. (2009, see also p. 1073).
11. Comparable results were found by Oei et al. (2006), Schoofs et al. (2008), Qin et al. (2009) and Olver et al. (2015). As stated, it is also possible to raise the cortisol level artificially. A meta-analysis of eighteen studies showed that the administration of cortisol did indeed impair the performance of the working memory in the short term (Shields et al. 2015).
12. Plessow, F., Fischer, R., Kirschbaum, C., & Goschke, T. (2011).
13. Plessow, F., Kiesel, A., & Kirschbaum, C. (2012).
14. Schwabe, L., & Wolf, O. T. (2009, see also p. 7915).
15. Schwabe, L., & Wolf, O. T. (2011).
16. In some ways contrary to the above, however, Shields et al. (2015) appear to have found in a meta-analysis of 24 studies on the effects of administering hydrocortisone that this actually improved inhibition in the short term.
17. Starcke, K., & Brand, M. (2012, see also p. 1241).
18. Yet more results: McCormick et al. (2007) found that women with raised cortisol levels made more mistakes in the Wisconsin Card Sorting Test, which is supposed to measure set-shifting an cognitive flexibility (one of the executive functions), than women with reduced cortisol levels, but the reverse was true for men. Scholz et al. (2009) found in men completing TSST that first resulted in elevated cortisol levels, that they scored less well in a go-no go task a moment later. Maier et al. (2015) found that subjects subjected to SECPT stress had less self-control in a hypothetical choice of food.
19. It is a matter of dispute whether risk aversion does have a negative impact on effective self-regulation. Moderate risk aversion could actually contribute to effective self-regulation but strong risk aversion is probably detrimental because it can help avoid problems that require action.
20. Haushofer, J., & Fehr, E. (2014, see also p. 866).
21. Cohn, A., Engelmann, J., Fehr, E., & Maréchal, M. A. (2015).
22. In another experiment (Kandasamy et al. 2014), cortisol was administered to subjects for a week. On the first, third, fifth and seventh day of the experiment, they also had to perform a computer task in which they had to make a series of choices between different ‘lotteries’ (i.e. sets of chances of winning a prize). It was found that, although they did not choose less risky lotteries than a control group immediately on day one, they did so later in the week.
23. Lerner, J. S., Li, Y., & Weber, E. U. (2013, see also p. 76).
24. Cornelisse, S., van Ast, V., Haushofer, J., Seinstra, M., & Joels, M. (2013).
25. However, the foregoing concerns only acute stress. Yet more academic literature is devoted to chronic and toxic stress. The latter means stress sufficient to have
lasting consequences. It has now become clear that long-term stress during early childhood can result in lasting mental and physical effects, including permanent elevated stress sensitivity (see, for example, Schonkoff et al. 2012). It is therefore a form of gene-environment interaction which affects the mental capital that people take with them into adulthood. This is an important subject, but lack of space prevents us from discussing it here.

26. Hockey, R. (2013).
27. Ackerman, P. L. (2011, see also p. 3).
28. van der Linden, D., Frese, M., & Sonnentag, S. (2003).
29. The Wisconsin Card Sorting test and the Tower of London test respectively.
30. van der Linden, D., & Eling, P. (2006).
31. Boksem, M. A., Meijman, T. F., & Lorist, M. M. (2005).
32. Boksem, M. A., Meijman, T. F., & Lorist, M. M. (2006).
33. Baumeister, R. F., Vohs, K. D., & Tice, D. M. (2007).
34. The WRR has also written about this, namely in Tiemeijer et al. (2009), Tiemeijer (2010) and WRR (2014a).
35. Hagger, M. S., Wood, C., Stiff, C., & Chatzisarantis, N. L. (2010, see also p. 495).
36. Carter, E. C., & McCullough, M. E. (2013).
37. Carter, E. C., & McCullough, M. E. (2014).
38. Sripada, C., Kessler, D., & Jonides, J. (2014).
39. Baumeister, R. F., & Vohs, K. D. (2016).
40. See http://soccco.uni-koeln.de/sites/sozialpsychologie1/Events/CologneMeetings/CSCM-2016/CSCM-2016_Baumeister_Inzlicht.pdf.
41. Hagger, M. S., Chatzisarantis, N. L., Alberts, H., Anggono, C. O., Batailler, C., Birt, A., et al. (2015).
42. Hofmann, W., Baumeister, R. F., Förster, G., & Vohs, K. D. (2012, see also p. 587).
43. Dai, H., et al. (2015).
44. These were obtained electronically by means of RIFD signals.
45. Muraven, M., & Slessareva, E. (2003).
46. van der Linden, D. (2011).
47. Boksem and Tops argue along the same lines. If the costs of “task performance come to exceed the motivation to obtain reward or avoid punishment, the present activities may be abandoned” (2008: 134–135). Kurzban et al. (2013) are even more specific. They contend that this is a calculation of opportunity costs. People stop performing a task when the perceived utility of alternative activities increases to the point where it is greater than the utility of the task in hand.
48. Kurzban, R., Duckworth, A., Kable, J. W., & Myers, J. (2013).
49. Inzlicht, M., & Berkman, E. (2015, see also p. 520).
50. Inzlicht, M., Schmeichel, B. J., & Macrae, C. N. (2014).
51. Job, V., Dweck, C. S., & Walton, G. M. (2010).
52. After all, the opportunity costs of both, the only relevant criterion according to Kurzban et al. (2013), are the same.

53. Kool, W., McGuire, J. T., Rosen, Z. B., & Botvinick, M. M. (2010).

54. Kool, W., & Botvinick, M. (2014, see also p. 138).

55. Noakes, T. D., Gibson, A. S. C., & Lambert, E. V. (2005).

56. Evans, D. R., Boggero, I. A., & Segerstrom, S. C. (2015, see also p. 9).

57. Inzlicht, M., & Marcora, S. (2016).

58. We are focusing attention on the effects of poverty because this has a direct bearing on the part played by non-cognitive capacities in the self-reliance of the public and more specifically on what they have to be able to do in order to keep their personal finances in order. But poverty is not the only possible factor. Research shows that executive functions are also negatively impacted by grief, loneliness and physical problems (see, for example, Diamond 2013 and Cacioppo and Hawkley 2009).

59. Spears, D. (2011).

60. Mani, A., Mullainathan, S., Shafir, E., & Zhao, J. (2013, see also p. 980).

61. The so-called Raven’s test and a spatial compatibility task.

62. Dodge, R. (1917, see also p. 89).