

# Viewing training and performance through the lens of stress, adaptation and overload

In modern sports, athletes are surrounded by a large support staff with each support member having his or her own area of expertise. The higher you go up the hierarchy, the more you should encounter generalists. Those are staff members that have a broad knowledge base about all the different factors influencing performance, but don't have as much in-depth knowledge per subject as the people who are hired to assist them. The simple reason for why this should be the case is that the more you focus on one subject, the less you can focus on others.

Whether you call someone a generalist or specialist depends purely on the scale you are focusing on. When you look at the dynamics of governing a sports team (in a high-performance setting) you would typically have a Head of Performance, with underneath him maybe a Head of Strength and Conditioning, Head of Sport Science and so on. Zooming in to strength, a strength coach can develop expertise in different areas, as strength and conditioning is composed out of parts of other disciplines such as general and specific strength, power, speed, agility and conditioning, while all of these can be further and further compartmentalized. The question is then: *up to which point is it relevant to keep going further down the rabbit hole of details?*

In this article I am going to discuss how I view training and performance through the lens of stress, overload and adaptation and why I believe that a good strength and conditioning coach (especially in team field sports) should be a generalist and not a powerlifting or sprint specialist. To paint a clear picture, we need to cover a couple of concepts first.

Let's start by talking about stress. Most people who are serious about training have heard of the General Adaptation Syndrome (GAS) by Selye. GAS is a theoretical concept stating that when you apply a certain stressor through training it leads to an acute decrease in performance through fatigue and after a period of recovery this leads to increased performance through 'supercompensation'. For this to occur the stressor must be potent enough, but not too excessive. That is the beauty of the human body, *a little bit of something bad makes you stronger in the long run.*

## Specific Stress

The principle of GAS can also be applied across different scales, and I like to think in terms of general stress and specific stress. With specific stress I refer to stress that is directly caused by a certain activity or event. Different activities cause different types of stress, strength training causes a different type of stress than sprinting or jumping and different types of strength exercises also cause different types of stress from each other. For example, a Back Squat might cause more fatigue to the muscles that stabilize the trunk than split squats, while both cause fatigue to the leg muscles. Stress does not only occur from training, studying for an exam might cause mental fatigue which is also a specific outcome of the activity.

## General Stress

With general stress I refer to overall stress level, which is made up out of all the specific stressors combined. Each activity not only contributes to specific stress, but also to total stress that can be handled. To illustrate, everyone reading this probably knows the feeling of general fatigue that can come from having to focus on too much at the same time: work, training, studying, decorating the house, helping your parents clean their garage, keeping your social life afloat and whatever else comes

to mind. While you can handle all those separately without a problem, combining them can have a big effect on your fatigue levels.

## Capacity

The total system has a maximal amount of stress it can handle and all the subsystems also have a maximal amount of specific stress they can handle themselves. Crossing that line might result in injury or overtraining. We can refer to maximal tolerable stress as capacity, which can also be divided into specific and general capacity. Crossing the line of specific capacity might result in an injury, because the tissue cannot handle the amount of stress you are applying (muscle tear or tendinopathy for example). Crossing the line of general stress can lead to functional overreaching (which is fine if you plan a recovery period), but it can also lead to overtraining or loss of performance if done for too long. To make things a bit more complicated, general stress can also influence specific capacity. This is probably mostly caused due to a lower ability to recover when general stress is high, which can result in incomplete recovery between sessions. To illustrate, say you have a sprint session on Monday and another one on Thursday. If you don't have a lot of other stressors you probably won't have a problem with being fully recovered for the Thursday session. If your general stress level is high due to exams or additional training, you might have trouble getting a good night's sleep or eating enough to fully recover before Thursday, which would result in a lower capacity to handle the session compared to you being fully rested. Repeat that a couple of times and you might be in trouble.

## Adaptive Capacity

We have established that there is a maximal amount of general and specific stress that you can handle and that different stressors can influence each other. We have also stated that there is a minimal amount of stress that you need to apply to improve (GAS). These two go hand in hand. The more trained you are, the higher the amount of stress you can handle (both general and specific). However, the more trained you are, the more stress you need to apply to improve. The CrossFit 'throw a grenade and do everything at the same time'-style training works fine if you have a very low training age but is not sustainable in the long run. Sooner or later, you will reach a point where you can't improve on everything at the same time because it becomes gradually more difficult to apply enough specific stress to all the subsystems without crossing the line of maximal general stress capacity. *Jack of all trades, master of none*. As with most training related concepts, the Soviets figured that out a long time ago.

How does this relate to training and performance? Training for elite sports performance consists of a lot of different qualities that need to be addressed. On one side you have what you would call specific sport qualities, such as tactical and technical execution. On the other side you have the general physical capabilities such as strength, power, speed, conditioning and so on\*. In field sports there are a lot of different qualities that you need to develop to get to the top, but as we have discussed above, you have a limited capacity to handle stress (see illustration 1 and 2). You cannot just throw a CrossFit bomb and hope for the best. To have good long-term success you need to have a good model of what makes up elite performance, apply enough stress to improve while managing the different aspects of training and have a system to keep track and prevent the different stressors from overflowing. *This is why you periodize*.

*\*Yes, these are very broad categories and there is a sort of spectrum from general to specific, but I have chosen to simplify here.*

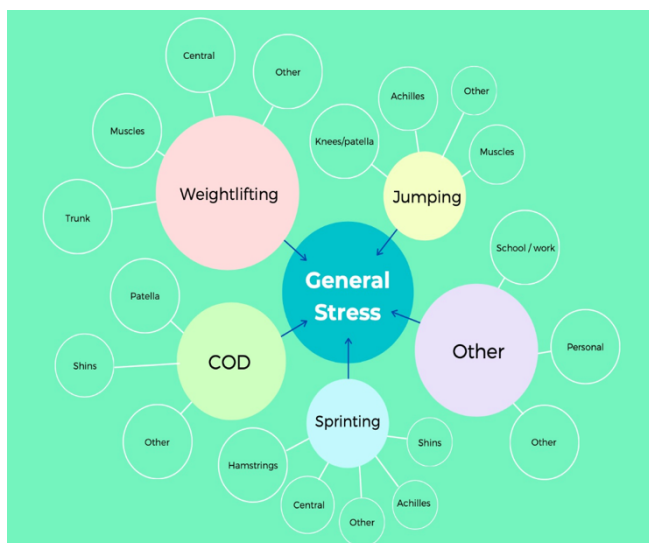


Illustration 1. Very simplified overview of general stress and different specific stressors. This illustration is useful to get an idea of the overall structure, but is by no means a realistic representation of reality.

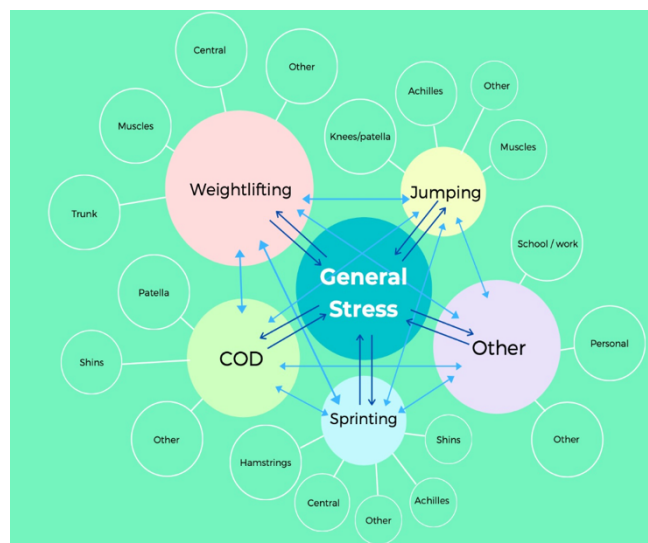


Illustration 2. More realistic, but still simplified overview of stress and how different stressors relate to each other. Everything you do has an effect on everything else you do. This is made even more complicated when you consider that changing one variable can influence the relationship between two other variables, but that's something for a later article.

## Applying the above to sports performance and training

The fact that there is a maximal recovery threshold means that you have to choose how much of your adaptive energy you are willing to assign to all the different aspects of training. This will largely depend on the sport, the individual athlete and the time of year among other things. Everything that you do that is not the sport itself is always complementary, it is never the goal itself. For this reason, getting better at the sport should always be the number one priority. Always. Therefore, *the most adaptive energy should be geared towards practicing the sport.*

What is the role of the strength and conditioning coach in all of this? As Daniel Kadlec would say: ‘to make athletes resilient enough to handle the greatest quality and quantity of deliberate practice.’ How? Manage the relevant stressors while increasing capacity through more general training means. Working in high level sports is much more about managing stress and preparing for the demands of the game than it is about marginal improvements in some random technical skill, which is something most Insta-trainers don't seem to understand. Sure, a lot of times this goes hand in hand and there is a time and a place for chasing jump height numbers but making sure the athlete is robust enough to handle a high quality and quantity of sport practice should always be the number one goal. For this reason, the strength and conditioning coach needs to understand all the components that cause stress and influence performance to some degree. To do this successfully you have to be a generalist. You cannot be very good at weightlifting and suck in agility or be great at getting someone stronger but know nothing about the sport. You need knowledge of strength training, speed, agility, sport science, nutrition, the dynamics of the sport itself, motor learning, managing a group, improvising when the unexpected happens, rehab, planning, testing and we can go on for a while.

Most importantly, you need to understand stress and complexity (it depends). It is easy to improve the vertical jump of a low-level athlete in the off-season. Trying to improve the vertical jump of a more developed athlete (for example in basketball) while he or she has two sessions a day is a lost cause and will probably lead to overuse injuries due to a high volume of jumping in the sport itself. It is crucial for everyone who works with athletes to realize that there is always a cost to what you are doing.

Every piece of adaptive energy you spend cannot be spent elsewhere. Every time you make the decision to do one thing, you are at the same time making the decision to not do something else. This is something that can truly piss me off from time to time when people go on about supposedly sport-specific training means in the gym. Sure, there might be benefits. But again, by doing that you actively choosing to not practice your sport, so be very critical when deciding if it is worth spending the adaptive energy there. Even worse, there is this magical place on the specificity spectrum where you offer none of the performance benefits while hitting the jackpot on placing the same specific stress that is encountered during the sport. Excessive load to the achilles tendon and increased general fatigue leading to a lower quality of the subsequent sports training. Good job Instagram footspeed guy.

## **The choices I make with my handball athletes**

When deciding what to do with my handball athletes I try to always consider the factors I mentioned above. The most important thing is that the players get as much high-quality exposure to the sport as possible. This provides a certain amount of specific stress and a certain amount of general stress to the athletes. In most cases, when we maximize specific stress we will not have maximized general or total stress. This means there might be room for other training means that don't stress tissue in the same way. Heavy slow resistance strength training offers a different stimulus than what is done on the field, while providing benefits in terms of resiliency. The main reason I tend to choose for a lot of heavy slow resistance is that it has huge benefits for the general capacity to handle load (higher levels of specific stress). If the general capacity to handle loading goes up, the athletes are able to handle more intense sport training sessions, which gives them more opportunities to get better in what really matters. This does not mean that we never do more 'specific' training, it just means that you should be careful in how much of it you do, and you should ask yourself if it's worth the added stress. Sometimes it is, sometimes it is not. During the off-season you can do more, during the in-season everything should revolve around the sport itself, which also means you should not train like you are preparing for a powerlifting meet.

*Because of what I have described above, I prefer the name physical preparation coach above strength and conditioning coach and will use that in the remaining part of the article. I think those two are not the same, but when we talk about the role of the strength and conditioning coach in team field sports it is much more about physical preparation than anything else.*

Going back to the question from the beginning, as a physical preparation coach it is more important to understand general principles of all the disciplines rather than understand some very well while not having a clue about the others. This is something that a weightlifting or powerlifting coach, personal trainer or anyone else who wants to work with team sport athletes needs to understand as well. In the grand scheme of things, you need to understand the small parts, for example strength training, well enough to apply it in a safe, efficient and effective manner. However, it is only one of many aspects of development that need to be covered and small details that might make a difference for powerlifters can be completely irrelevant to team sport athletes. The job of the physical preparation coach is to understand and manage the different stressors as well as possible to try and prevent any capacity bucket from overflowing. Being biased towards one can lead you to neglect others, which can leave your athletes unprepared for the demands of the game. There is only so much adaptive energy to be spent, so think hard when deciding where to spend it. Every time you add, you are also subtracting at the same time.

***Above all, never forget that the sport itself always comes first.***