Optimal Human Performance

A beginner's guide to the psychology of human performance

2 PERCEPTION & ATTENTION

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Understanding how our cognitive processes operate and influence performance comes as a distinct advantage. Although largely ignored by behaviourism, 'perception' and 'attention' have, since the 1950s, been ascribed more weight through cognitive theories of human behaviour. In lesson two, we explore perception and attention, and examine how they form a pivotal role in the execution of elite performance.

INTRODUCTION

Have you ever been told by your coach or boss, or even perhaps by yourself, 'hey c'mon, this is important, pay attention. Let's focus now.'How exactly does one achieve that? By the tuning of what structure and upon what exactly are you required to focus? Do you even have control over your ability to focus? Consider a field sports game situation, for example; should you focus on the player you're marking or a particular space on the field? Or should you focus on the current play or is it upon an aspect of your game, a skill perhaps?

The act of *trying* to focus is perhaps impossible. The reality of the matter is that this instruction, even if given by you to yourself, will probably take your mind to what you are doing wrong. Distraction ensues, and the spiral downwards begins.

Sports psychologist John Kremer says in Pure Sport that being told to pay attention lacks meaning. In other words, if you want to be effective, the instructions received (and delivered) must be meaningful and task-specific. These things must be immediate and under our control. Where they are not, less than optimal results are not far away. One way in which we can interpret the instruction is to focus on the components of the skill. But this can be detrimental because it often creates performance anxiety and needless stress – paralysis by analysis. Instead, skill execution must be automatic and free of both internal and external distraction (Kremer & Moran, 2012).

Focus and attention cannot necessarily be called upon easily like flicking a light switch. In many cases the process is automatic, practiced relentlessly under controlled conditions, and in others, process driven thinking is required. In this lesson, we will discuss these systems of thinking and their foundational building blocks; cognition, perception, and attention. We will explore the operative components involved in how performers read, process and react to environmental information. In doing so, you may better understand your reactions, behavioural responses, and performance results.

Later in the lesson, we will also look at the threat of distraction and how you can win that constant fight to stay on point by applying practical techniques for effective concentration. To perform in business, sport, art, or music, the science of psychology understands that all of these constructs at work. Whether you are a professional or novice, developing a personal understanding will most certainly assist you in your own performance.

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TWO THINKING SYSTEMS

Consider the following scenario; you're sitting down for dinner with your family and your spouse elbows their empty glass off the edge of the table. You happen to be looking in their direction and see the glass fall, so you reach out and catch it without as much as a thought. Everyone breaths a sigh of relief. Before you sat down to dinner, you needed to plan, prepare, and cook the meal. That process was structured and methodical, and likely followed a previously established pattern. In these two scenarios there are said to be separate brain systems in operation. Eminent psychologist and Nobel Prize winner Daniel Kahneman calls them System 1, and System 2 (Kahneman, 2011).

According to Kahneman, in his bestseller Thinking Fast & Slow, System 1 is fast and automatic. It functions without conscious effort or voluntary control, and it allowed you to catch the falling glass in the above example. System 2, on the other hand, assigns attention to tasks as required, and it allowed you to reorganise the table for your guest. Conscious choice, agency and effortful concentration are generally associated with System 2. System 1 is fast and complex. System 2 is slow and methodical. System 1 can react to the bounce of a ball on the field of play, System 2 can decide where on the field to run. System 1 can detect from the tone of the customer's voice that it has not yet secured the sale, System 2 meticulously plans the sales strategy.

Speedy System 1 has access to our innate and rehearsed repertoire of skills available in any moment as required. Pedestrian System 2 allows us to think and plan, apply effort and overrule automatic responses. However, in all these attentive responses to environmental conditions, there are limitations. You can't naviagte a busy motorway while reading a book, for example. Performing a 80kg snatch while having a casual conversation is impossible for most of us, and you can't park your car in a tight spot while on the phone.

System 1 and System 2 are a means by which we can conceive the two modes of thinking. The bottom line is that there is a limit to conscious attention and we've got to know where that is for us, otherwise failure will be our constant companion. Kahneman says that as we become skilled in a task, it reduces cognitive energy demands. The brain is wired for efficiency, and the 'law of least effort' applies. In the economy of effort, Kahneman says, effort is a cost, and the acquisition of skill is driven by the balance of effort and cost. A sequence of text printed in legible font, a repeatedly delivered audio message, or an olympic lift sequence performed day in day out, will be fluently processed by the brain.

System 1 can take care of these actions. But new material, an unfamiliar task or a familiar one carried out in stressful conditions, requires System 2. Kahneman's method for thinking and talking about the mind is simple, yet it comes from decades of in-depth study of the underlying systems of cognition. In short, System 1 is automatic and unconscious. System 2 is conscious, methodical and measured. Perhaps most important to remember for performers, System 2 can train System 1.

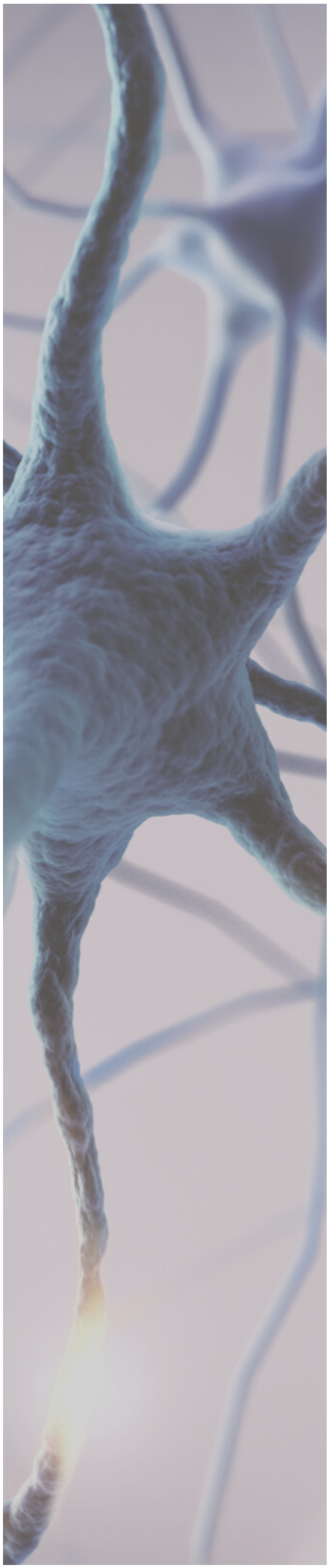
THE BUILDING BLOCKS OF PERFORMANCE

Some performance environments such as the playing field or stage, require high levels of cognitive processing and split second reactions. Other situations such as the poker table or chess board are less physically intense, but are no less demanding cognitively. Regardless of the performance domain, the same fundamental psychological processes have been found at work. In the following section we will examine the cognitive processes of perception and attention, which are common in all domains of human performance.

Cognition

Human beings are pattern recognition organisms. We navigate and manipulate our world through the recognition of patterns of data in our environment, process the information, and produce a series of physiological and psychological responses. The engine room of these responses is the Central Nervous System (CNS) which we discussed in lesson one. Psychologists have termed these responses ‘higher order functions', which consist of attention, perception, emotion, language, learning and memory. Executive functions such as planning, decision-making, goal setting, problem solving and creativity are also features of cognition. These conscious and methodical cognitive processes are associated with the pre-frontal cortex. In demanding performance settings such as the fast-paced workplace or sports field, surgical theatre or military manoeuvres, efficient cognitive performance is critical.

How much do you know about and have control over your own mental processes? Do you think about your thoughts and feelings and direct them towards ends you decide? Psychologists call this phenomenon of thinking about thinking, higher-order cognition or meta-cognition. It consists of a performer's knowledge, control and monitoring abilities. Meta-cognitive knowledge is referred to as your declarative knowledge of how you–the performer, the task at hand, and the strategies you use interact.



Meta-cognitive skills, on the other hand, refer to your procedural knowledge of your learning and problem-solving ability. Although perhaps a little abstract, it is advantageous to form a concept of these underlying processes as you proceed in your work.

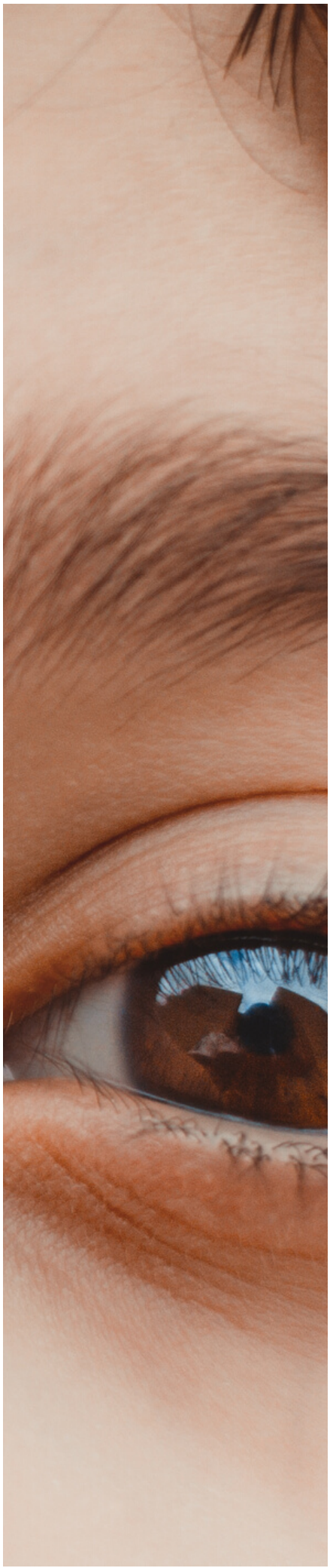
Cognitive theories of performance number in their hundreds and many have not been applied to performance settings (Raab, 2017). Indeed, those theories that have been successfully applied to performance, differ in terms of relevance depending on the applied domain. The building blocks of performance as laid out here, and in more detail within the texts referenced throughout, vary in terms of their weight depending on specific situations, tasks, and performer attributes. Without doubt, however, to perform in business, sport, art, or music, all of these constructs matter. We will now explore two of these; perception and attention.

Perception

Perception is part of the human organism's information-processing system. It is a complex phenomenon that, via sensory inputs, provides the for higher-order brain processes such as action selection and decision making (Raab, 2016). Perception and resultant cognitive responses, according to Magill in Motor Learning & Control (2010), is a complex process involving internal physiological states and memory, underpinning intentional movements that serve a specific goal.

The ecological view of perception suggests, perhaps too simplistically, that it is the organism's direct receiving of a given environmental stimulus. The gestalt perspective suggests that perception is something more than the sum of its sensory input parts. Traditionally, the science of psychology has drawn a clear line between bottom-up sensory inputs and top-down cognitive actions. Regardless of the frame of reference, in performance it is obvious that perception is a critical aspect, and our senses are important inputs. They work in parallel, we can say, although this is perhaps not completely accurate either.

Consider the flight of a tennis ball, for example, as you play it to your opponent. Their visual and auditory senses work together to map the flight of the ball, then coordinate the arm and hand movement to return the ball. The more complex and faster the flight of the ball, the more adept the receiver must be to anticipate its arrival. Hitting a tennis ball with a racket appears simple. It's something a child can learn, and after a while they can become proficient. However, describing how this happens and recreating these apparently simple process (for humans) is not easy. Robots, for example, have problems performing these tasks.



The Occlusion Paradigm

Returning to our tennis example, how does our visual system guide and coordinate movements so that we can return the tennis ball? If a ball is moving at speed toward you, you perceive the size of the ball increasing and its position in space changing. Your perceptual system will predict when the ball will arrive using what has been termed the 'time-to-contact variable' (Lee, 1980). If the ball is far away and flying in a curve, as when a tennis ball is struck with top-spin, your perceptual system needs to calculate where you need to be to return the ball.

Facing down a one hundred mile an hour tennis serve by right should be practically impossible, yet professional tennis players do it regularly. The difference between professional and amateur tennis players comes down to what have been termed, 'perceptual cues' (Bilalic, 2017). The Occlusion Paradigm is an experimental measure that explores an athletes capability to perceive and anticipate conditions. In occlusion based studies of expert tennis players compared to novices, Abernerthy and Russell (1987) found that although both experts and novices take perceptual cues from the opponent's racket position, experts also take cues from their opponent's body–novices do not.

Expert performers are preparing their motor sequence even before their opponents strikes the ball.Expert performers can perceive conditions beyond normal people and literally predict the future. Research by McDowell (2011) showed that Cristiano Ronaldo, perhaps the greatest soccer player in the world, can hit the target even in the dark. In the study, the ball was released to Ronaldo then the lights switched off. Infrared cameras recorded him make perfect strikes even though he couldn't see the ball. The first few seconds were enough for him to perceive and ready himself for contact with the ball. Such is the highly tuned nature of his perceptive abilities.

Merim Bilalic, in his book The Neuroscience of Expertise (2017), says that expert performers differ from novices in that they have fine-tuned perceptual and attentional systems that collect the most important information from the environment. These are known as perceptual-cognitive skills, and those of novices are not sufficiently trained. They cannot differentiate sufficiently to compete. Bilalic says that the interplay between perceptual and attentional systems is the result of heightened levels of acquired domain-specific knowledge stored in long-term memory (LTM).

As highlighted above in the study involving Ronaldo, the visual system of highly trained performers seems to be capable of predicting future events and fill in the gaps in sensory data.

This process may be moderated by the performer's experience, knowledge and expectations (Cotterill, 2017). In other words, as you perfect your skills through purposeful and deliberate practice, you train your perceptual systems to work on the blind. You quite literally become one with the process.

Attention

Attention in both psychological and everyday terms, is a construct that helps us understand how effort is focused. Margaret Matlin (2002) suggested that attention is a "concentration of mental effort", and it is an imperative component in elite human performance. For the well-practiced performer in high paced, high stakes situations, attention works on autopilot. And they know, if they try to focus their lens of attention on more than one effortful task at once, then they can fail. Daniel Kahneman says we can carry out several tasks at the same time only if they are easy (Kahneman, 2011). Attention appears to be finite, but once it has been applied sufficiently to a given task over a given period, then that task can be programmed into long term memory and replayed without the same degree of effort.

Consider the recent neurological study of Brazilian footballer Neymar Jr. by Naito & Hirose (2014). In the study, Neymar's brain activity was monitored during the performance of simple attention based tasks and compared with that of other professional footballers, amateur footballers, and swimmers. The study found that the area of the brain associated with movement of the right foot was less active in Neymar than the other participants. This indicated that his level of skill acquisition was so much more advanced for this simple movement to to the degree of automation he had achieved in his sport. The more automated the skill, the less mental effort and attention is required for its execution.

Perhaps one of the most famous illustration of the selective and limited nature of attention is that of Christopher Chabris and Daniel J. Simons and their invisible gorilla experiment. In the experiment, participants are asked to watch a short video where six people (three in white t-shirts and three in black t-shirts) pass basketballs to one another. While watching they must keep a silent count of the number of passes made by the people in white t-shirts. At some point in the video, a man in a gorilla costume strolls into the middle of the action, faces the camera and thumps its chest, and then leaves. Altogether the gorilla spending nine seconds on screen. The researchers found that half of the participants missed the gorilla.

It is generally accepted that attention is comprised of four major dimensions. **Concentration** is the individual's ability to demonstrate mental effort on tasks that are most important at any given time. **Selective perception** is a mental skill that allows us to discriminate, or, 'zoom in' on information that is relevant only to the task at hand, and ignore distractions. **Mental time-sharing** is the ability acquired by expert performers, to afford adequate attention to two or more tasks and perform them equally well. Finally, **Vigilance** is a performer's ability direct attention and respond as necessary to random stimuli over a given period.

Load Theory of Attention

Researchers of perception and attention recognise that our environment contains too much information for us to possibly register it all, or indeed more than is humanly possible. We simply would not be able to cope. Therefore, it is accepted that attention is focused and selective, as we have seen above. Research also recognises the links between attention and memory, processing, and capacity. A classic study in psychology found that performing a secondary task during the encoding of the primary task in memory, impairs memory. There is what has been termed a 'dual task cost' (Baddeley, 1996). Coding into memory, or, learning a new task, is resource heavy whereas once encoded successfully, retrieval may be automatic.

Load Theory of attention is a means by which we may understand the human capacity for attention and memory (we'll have a closer look at the role of memory in performance later in lesson four). From a performance perspective, it refers to the way you learn and store both simple and complex skills and abilities in work and sport. Cognitive Load Theory suggests that a limited working memory is available to process selective information and a larger, long-term memory is used to store knowledge acquired earlier (Sweller, 2011). It consists of everything from learned facts to complex performance related concepts and procedures.

The primary assumption of load theory is that your perceptual processing systems can only become 'selective', that is to say, they discriminate between valuable and non-valuable information, when you reach the limits of your attentive and perceptive capacities. If you are attending to a demanding task in the white heat of performance, then you'll ignore irrelevant information. You will literally become blind to non-specific information, as we observed in the gorilla experiment earlier, and become primed for early identification of performance cues. Contrastingly, if the task has low demand on your attentive and perceptive capacity, the your remaining capacity may be directed irrelevant information. In other words, distraction may set in.

DEVELOPING EFFECTIVE CONCENTRATION

Distraction is the enemy of optimal performance, therefore, developing effective attention, focus, and concentration is of primary concern. According to the requirements of the task, executive functions (top-down) and non-executive functions (bottom-up), become involved, and these functions may not be one hundred percent under our control.

According to Antonio Damasio in his book Descartes Error, human beings are not machines, and we experience emotional states that influence our cognitive performance, both positively and negatively (Damasio, 1996). Theories such as Attentional Control Theory (Eysenck, Derakshan, Santos, & Calvo, 2007), and The Theory of Reinvestment (Masters & Maxwell, 2008), attempt an account of why performance can break down and suggest self-focus or distraction is responsible.

Hyper-accessibility accounts for the phenomenon whereby thoughts we wish to suppress come to mind more easily than thoughts upon which we want to focus. It is especially likely under conditions of cognitive load because conscious attention and focus requires mental energy. When we are tired, feeling the pressure, or anxious, we experience reduced capacity to control our thoughts. Under stress, the autonomic nervous system kicks in and we may lose our ability to direct our attention.

We all have experienced breakdown in performance at some point in our careers. Most of the time we're unsure how it happened–we were so well prepared. Well, perhaps not. In the midst of sub-optimal performance, or afterwards as we contemplate it, the most important thing to do is take personal responsibility.

This does not mean we should self-criticise and beat ourselves up. Instead, we must teach ourselves to deal with the disappointment in an unattached way. We must learn to be kind to ourselves, but we must not let ourselves off the hook, blame conditions or others involved.

The 5 Principles of Effective Concentration

Dr Eddie O'Connor in his course The Psychology of Performance, says there are five principles of effective concentration on which you must consistently work so that you may prepare for the demands of high stakes performance.

1. You must apply conscious effort. You cannot rely on focus and concentration to arrive by chance because it takes a degree of effort and energy. Attaching it to a specific routine will help.
2. When practicing, deal with a single task at a time. Multi-tasking is dead, and quite frankly, counter productive. As we discussed earlier, conscious attention is a finite component of cognition and spreading ourselves too thin produces sub-optimal results. Only when we have perfected the task, can it be executed without conscious attention.
3. Think and talk about what you want to experience in the performance, not what you don't want. This premise comes from studies on Flow states. When what we think and what we do are in unison, then there can be little room for distraction.
4. Pay attention to only those elements of the performance that are under your control. You can influence them, but can't control them, or other people. Attempting to do so causes you distraction and takes attention off your game.
5. Attending an important sales meeting, a job interview, or a championship final is bound to cause nerves. When you feel nervous, focus your attention outward–on the game at hand. When our heart beats hard and our palms become sweaty, it natural to turn attention inward and become self-conscious. We become hyper-vigilant and fearful. So instead, focus on the specifics of the task and execute.

Conclusion

Cognition and its constituent constructs are important factors in optimal human performance. Understanding them and how they play together can help you refine your learning process, produce improved results and achieve your performance goals. In the lesson, we have outlined the process whereby you perceive information from the performance environment, and focus your attention to that which is relevant. In the forthcoming lessons we will explore additional aspects of cognition such as creativity, problem solving, memory and decision making, and learn how that information produces action.

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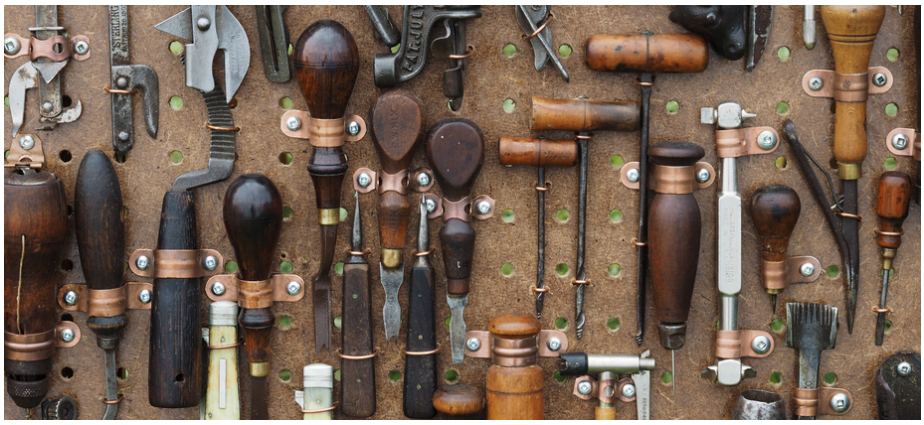

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