

CHAPTER 20

Attention

The Buddha said, 'The systematic four-stage training in attention is the only way to Enlightenment.' My students quickly realise that the main skill that I want them to learn is attention, and that relaxation and mental calm are just spin-off benefits that arise from focusing on the body.

Attention is an underrated, neglected and misunderstood function, except perhaps in the field of education, where the effects of its deficiency are painfully obvious. We assume that we can always pay attention when we want to, or that we could always focus better if we tried. Psychologists often disparage attention as being irrelevant to mindfulness. Meditators see it as a chore and few people develop it as a skill unless they have to. If you are similarly disinterested in attention, please feel free to skip this chapter. It is fairly technical.

To understand attention better, let's start at the cellular level. The purpose of the Nervous System is to initiate movement in response to stimuli. This is why animals have a nervous system and plants don't. Plants are fixed in place, but animals constantly have to move towards reward and away from danger.

Evolution tends to conserve primitive functions, so the brain still does the same task as much simpler nerve circuitry: it initiates action. The great pioneer of the brain, Joaquin Fuster, categorically states that: "The purpose of the Prefrontal Cortex is goal-directed activity."¹ We evolved

¹ Fuster. 2008. p 2. "The entirety of the frontal cortex is... devoted to action of one kind or another, whether skeletal movement, ocular movement, the expression of emotion, speech or visceral control; it can even be the kind of internal, mental, action that we call reasoning. The frontal cortex is 'doer' cortex, much as the posterior cortex is 'sensor' cortex."

rational minds to make decisions in situations which are too complex for instinct and habit to deal with.

The Nervous System operates according to 'the perception-action cycle.' Nerve cells divide into 'afferent' sensory neurons that take in information, and 'efferent' motor neurons that initiate action on the basis of that information. However that is not the whole story. Between the input and output comes the evaluation. Although the input may be simple and the output is usually a single action, the evaluative process in between is phenomenally complex.

The act of perception doesn't copy an external object like a camera does. Every sense perception is shredded into hundreds of tiny components in specially designated regions of the cortex. This information is then reassembled in parallel with other sensory, emotive and memory data in the so-called 'association areas'. This is how the brain recognises an object and attributes value to it prior to a response.

For each sensory neuron, there can be *thousands* of 'interneurons' doing this evaluative work. That's how important it is. Making good perception-response decisions determines happiness or misery for most humans, and life or death for animals.

The cycle of perception + evaluation + action (or inaction) goes like this. You touch a hot stove (perception). You evaluate it (bad). You pull back (action). We also met this dynamic in the chapter on emotion: perception + valence + action tendency.

Simple information is processed quickly. The perception-action cycle will happen in a nanosecond within a cell. This is the speed at which enzymes switch on and off. The process is much slower when consciousness is involved. It might take 5 seconds to decide which breakfast food to buy. It might take 30 seconds to choose the best route to drive across town.

The perception-action cycle at every level of the biological hierarchy is self-regulating and continuous. Each action instantly changes the local situation which leads to new evaluations and so on. This results in a nonstop negative feedback loop which balances out the activity for optimal results. These loops maintain homeostatic balance throughout the body, and the same is true within the brain. The constant backchat between thought, emotion, memory and the body optimises our behaviour. It is the pre-conscious foundation of our intelligence.

Automatic and conscious thinking

Do you assume that thinking is always conscious and always reliant on language? Many scientists now believe that a lot of *high quality* thought occurs just below consciousness, and that it doesn't need language. This Dual-Processing Theory argues that cognition ('mental processing' or 'thinking') has two operational modes.

These are 'Automatic' and 'Conscious', or intuitive and rational. Scientists usually prefer more neutral terms: System One and System Two. In other words, we have both an Automatic System for perceiving, evaluating and responding to inputs, and a Conscious System.

The Automatic System is primary. It operates continuously and on parallel tracks day and night. We make most decisions without reflecting on what we do. Our brains make literally thousands of evaluations and choices each day. Shall I put on the left sock before the right sock? Cross the road now or wait? Continue doing this or switch to that? This 'see-evaluate-do' nervous system processing is based on a colossal repertoire of learnt behaviours called 'action schemas' that no longer require much conscious thought.

We can get dressed, drive, eat, work, shop, talk to colleagues and family, answer the phone, all on automatic pilot. It takes years to learn how to do all this. A successful life largely depends on developing ever more sophisticated action schemas, routines, habits, flow-on sequences, protocols, algorithms and see-do responses. What we do on automatic pilot can be very clever indeed. It should never be dispraged.

Brilliant as it is, the Automatic System has limits. It relies totally on pattern recognition and learnt skills. It can manage 'yes-no' options but not 'either-or.' It can't make side-by-side comparisons. It is hopeless at maths. It is oriented to instant gratification and has no sense of future planning. Above all it can't manage novel situations.

Fortunately, the Automatic System does know its limitations. It includes a radar function designed to detect errors, internal conflicts and shortcomings. The command centre seems to be in the Anterior Cingulate Cortex in the forebrain, where signals from consciousness, emotion and the body all meet. This self-monitoring is a paradoxical kind of *automatic* metacognition. When it realises it can't cope, the Automatic System bumps the problem upstairs. It calls on the Conscious System to get involved. This is when we start to *deliberately* pay attention. This is when we become mindful.

The Conscious System sees consequences and options that the Automatic System can't imagine. It is more cool, rational and far-sighted, but at the price of being considerably slower. It makes its more informed decisions long after the Automatic System has initiated the first response, so it has to play catch-up. It will typically overrule or modify the 'quick and dirty' rule-of-thumb evaluations of the Automatic System. Once everything is back on track, it lets the Automatic System take over again.

We invariably regard attention as a fully conscious function but this neglects its automatic dimensions. It is better to think of attention as the way we distribute our cognitive and metabolic resources across the whole spectrum of mental activity. Attention is like a paymaster handing out money (i.e. glucose and oxygen) for work to be done. It does this by activating particular neural networks at the expense of others (selection) according to what seems most salient at the time (evaluation).

However the paymaster is nothing like a CEO making top-down decisions. The many competing demands from the organism, thousands every second, are processed according to feedback mechanisms. This activity is too complex and chaotic for consciousness to handle. It is collective, local-level decision-making on an unimaginably vast scale. This is why it is so hard to 'control' our attention. The boss can't make every decision in the factory.

'Paying' attention is just like spending money. We first have to pay for food, rent and clothing, and with luck we have some left over for discretionary spending. Similarly, most of our attention and cognitive resources go to keeping us alive, safe and well. Only the remainder is available for conscious attention. Fortunately, automatic processes are fast and economical, and they do most of the work.

Conscious attention is slower and more expensive. It activates the specific network of brain cells that supports the mental representation of an object, and massively increases their energy consumption. This takes effort and so comes with a high price tag. Conscious attention operates serially rather than in parallel. It is more precise than the Automatic System but can only do one thing at a time. It also tends to be a 'Stop, look and evaluate' mechanism that can interrupt our natural flow.

Over time, this is even *physically* exhausting. Anders Ericsson, who researched the kind of intense training necessary for exceptional musical ability, argues that even the best of us can only manage 5-6 hours a day. Whenever possible we will save energy, avoid hard thought and operate on automatic pilot instead.

Bottom-up and top-down attention

In 1890 William James said: “Attention is the taking possession in clear and vivid form of one of several simultaneously possible objects or trains of thought.” In other words, attention is always ‘selective’. We select one thought at the expense of competing thoughts. It means saying ‘yes’ to this and ‘no’ to everything else. This involves ‘taking possession’ or ‘holding something in mind’ (i.e. mindfulness). Furthermore, we do so because it makes that object ‘clear and vivid.’ Paying attention massively enhances detail and recruits the emotional tone of related memories to help evaluate it.

Yet we do seem to pay attention all day long to what we are doing without much effort. It’s not hard to watch TV, have a conversation and then engage in some task. Even when doing nothing, we naturally focus on whatever thought or sensation ‘catches our attention.’ This is what psychologists call ‘bottom-up’ or ‘reactive’ attention. It is our natural, involuntary instinct to respond to what is in front of us. If this is mostly worthwhile – work, people, knowledge – then ‘bottom-up,’ reactive attention can guide us through a very good life indeed. But we shouldn’t count on it.

In complex situations we need to switch to ‘top-down,’ goal-directed, ‘selective’ attention instead. This enables us to make calculated choices, defer gratification, resist distractions and plan a few steps ahead, even when we really don’t feel like it. Top-down attention fine-tunes the way we move towards goals that are not immediately present. This is much harder to maintain than bottom-up attention.

We can usually focus well against competing alternatives only when the issue is important (meet the deadline, feed the child), or if the matter contains some inherent satisfaction or intermediate reward (sweating at the gym, posting the letter). But how do we stay focused on a remote but important matter when the option of watching TV and eating junk food beckons? Research now indicates that willpower, like muscle strength, is a limited resource that is readily depleted. When we are suffering ‘decision-fatigue’, we need a more subtle strategy than ‘trying harder.’

Sustained, top-down attention is a skill that can be strengthened just as muscles can. It takes many repetitions (‘reps’), corrective feedback, good habits and sufficient motivation. Fortunately the act of focusing has one excellent ally: dopamine.

If we *feel* what we are doing is worthwhile, the reward circuitry of the brain steps in to support our efforts. The neurotransmitter dopamine drip-feeds us regular small doses of enthusiasm to keep us focused. We can magnify this effect if we consciously notice our satisfaction, be it physical or mental, in what we are doing. We need dopamine as a cheerleader for demanding tasks.

But if that gut feeling of value is lacking, then focusing becomes a real chore. People often give up on meditating because it doesn't *feel* worth the time it takes. The rewards seem too small. Nor are people encouraged to be mindful of the physical benefits and pleasures. Being inactive, sitting still and 'just watching' don't seem to be strong enough reasons to continue.

It takes time to focus

Researchers have discovered that we can't focus instantly on any new object. It takes time, and they propose that there are three stages. We disconnect from our previous thoughts; we orient towards the new object and we finally 'lock on' to it.

To focus means activating the neural networks relating to a new object, while simultaneously cutting off supply to the old ones. No matter how resolutely we try to abandon a previous thought, it will still take a few seconds to vacate the mental stage and fade into the wings. Until that disturbance goes, we can't focus well on anything new. As a rule-of-thumb, the shift of energy supply from the old object to the new takes about 10-20 seconds.

At a certain point, we manage to 'lock on to' the new object. We make contact with it and we know it. We hold it firmly in our grasp. We establish it as the *prima donna* on the mental stage. It is now in the foreground, in the spotlight. We zoom in on it. These are all metaphors that Cognitive Psychology uses to illustrate this state of good focus.

The act of focusing commonly has a binocular, 'staring-straight-ahead' feeling that comes from the region above the eyes (the orbitofrontal cortex). Focusing induces the calm, singleminded, subject-object gaze of a predator. We 'grasp' the object or 'take possession of' it, as William James said, in a way that is distinctly physical. As the Buddha put it, we 'hold the breath in front of us.' We don't want the object to escape because we get distracted.

Even when we do ‘make contact’ with an object, we can still readily lose it. The next stage is to ‘sustain contact’ over time. This is why meditators commonly count their breaths. They can tell when they are getting lost because they lose the count. Or they scan through the body, using it like a roadmap to resist going off on sidetracks.

Deep sustained focus results in an acute perception of detail. We feel each ripple of the out-breath, and the space before the new in-breath starts seems to last forever. If we listen to music, we catch the exact beginning and end of a phrase, and feel each nuance of the orchestral colour. If we examine an idea, we feel its full resonance within our bodies and minds.

If we are paying attention to an *action*, we move with the optimal levels of muscle tone, arousal and coordination. Athletes call this a state of ‘dynamic balance.’ They typically report that everything moves in slow motion when they are ‘in the zone.’ Sustained attention takes time to establish, but it can exponentially improve the quality of anything we do.

Switching and splitting attention

At any moment in our brains, dozens of thoughts will be competing for their time under the spotlight. This has been called ‘neural Darwinism.’ This competition is particularly true with our normal, undisciplined, bottom-up style of attention. Philosophers from the time of Ecclesiastes onwards have lamented that there is no end to the weariness of thought. So many actors! Such a small stage!

Maintaining focus on any one of them is hard enough, but being able to let go of an object and switch to something else – ‘dis-focusing and re-focusing’ – is just as important. We rarely find this easy to do. It can be most unpleasant to get interrupted when we’re fully engaged in something, and our resistance to switching can be visceral.

Being able to smoothly switch our attention as required is a critical cognitive skill. If we can’t do it, we get caught in the painful habit of useless, exhausting overthinking. Most of us suffer from this at least occasionally, and some have their lives devastated by it.

Even more subtle than switching attention is ‘splitting’ attention. In general when we focus, we try to give all our free attention to just one thing. This is so hard to do that we are pleased when we seem to achieve it. In reality, our attention is always split whether we realise it or not. Attention always involves both ‘focusing’ and ‘monitoring.’ Our cognitive resources are always divided between what is on stage and what is in the

wings; between the object in the foreground and the peripheral mental activity in the background; between conscious thought and automatic thought.

Researchers have shown that even with strong focus there is still some processing of what they call the 'unattended data.' This is how it should be. Complete tunnel vision would be disastrous. If we were meditating well for example, we wouldn't notice the house burning down around us.

It is usually best to do one thing at a time as much as possible. It allows for a detailed, unobstructed representation in the mind, leading to a clear evaluation and response. However, to hold two things simultaneously in the mind is occasionally better than a strong single focus.

For example, we usually make either/or choices sequentially. We do a virtual simulation of option 1. Then we stop and do a virtual simulation of option 2. We then toggle between them until one option finally claims us. This approach has its shortcomings. If at all possible, it is sometimes better to hold two options side-by-side on the mental stage, and *feel* the tension between their respective values.

Sharp focus and soft focus

Our attention can vary enormously from second to second, day to day, and most markedly from activity to activity. It can be deep or shallow, sustained or intermittent, clear or dull, strained or effortless. It often fluctuates according to events within our bodies and the environment that we can be quite unaware of. Even when we focus well, our attention still tends to fluctuate on a bright-dim continuum. I suspect this is due to the subtle oscillation in energy supply between the focusing and monitoring functions. I'm sure that scientists will eventually be able to measure this.

Whenever we meditate, we could be more or less alert, or more or less relaxed. We may notice the object in detail and know exactly what is happening in the moment: this is sharp focus. Or we may be gliding along with minimal effort: this is soft focus. So long as we remain on track, doing what we intended to do, both extremes are perfectly fine and each has its own benefits.

Alertness give us sharp focus and often a sense of mental pleasure and control. The longer we focus, the more resources and memories we bring to that object, and the more the peripheral interference fades. We often feel a dopamine-rich sense of engagement and intimacy with it. At that time, everything else is temporarily 'de-selected.'

Strong sustained focus is like a telephoto or zoom lens. It can be as sharp as a diamond, as penetrating as a microscope. It can split time into leisurely, radiant nanoseconds. Its emotional tone is one of reward-driven enthusiasm. Strong focus is essential for the states of bliss that meditators occasionally experience. It is also perfect for listening to music or enjoying any sensory pleasure.

Of course strong focus is not always good. It can easily get too close to the action and lose the bigger picture, resulting in obsession. Strong focus is a hallmark of compulsive, repetitive behaviour and addictions, and a singleminded fixation on the bad is typical of depression. Even strong focus on what is good can destabilise other aspects of our minds and lives.

Soft focus, on the other hand, usually means that we are staying focused on the body or the breath but only just. This sleepy, dark, inward-looking and almost unconscious state is very restful if we can remain in control. It allows the homeostatic processes of the body to restore balance in much the same way that sleep does. The theta brainwaves and fragmentary dream images that occur in Stage One Sleep are often present in this threshold state.

Soft focus is more like a wide-angle lens. It is more broadly inclusive than sharp focus but definition is fuzzy. It can be good at peripheral monitoring, 'watching with detachment,' and indeed it may do little else. Its emotional tone is one of relaxation and contentment. Mindfulness as 'nonjudgmental acceptance' is squarely in the soft focus camp.

It is a different matter if our focus gets even looser. This often results in a state of mind that is drowsy, rambling, uncontrolled, vulnerable to any troublesome thought, and somewhat depressed. We may still be relaxed, but if we're not tired enough to fall asleep, it is a kind of pointless, low level chaos. It lacks the sense of direction and value that is essential for a good mood.

We can't entirely control our level of alertness, but we can turn it up or down to some degree. The Buddha used the metaphor of tuning a lyre. The music sounds best when the strings are neither too tight nor too loose. This means that we should recognise when our attention is too brittle and edgy and deliberately soften it. More commonly, we should recognise when we are becoming too vague and dreamy, and wake ourselves up.

Throughout this chapter, my descriptions betray the prejudices of the English language. It is very hard to avoid the assumption that conscious is better than automatic; that 'selective attention' implies a free, autonomous

choice; that focusing is intellectually noble; that strong focus is better than soft focus; and that the peripheral data is bad, nothing but a source of distractions and temptations.

In fact the brain is not designed to work in full sunlight alone. The mental processes that happen in the shadows are equally important. The fully conscious mind is a pinnacle of evolution, but it still relies on our rich substrata of automatic and unconscious behaviours to function well.

Many researchers recognise that the benefits of mindfulness are largely due to attentional training. It is unfortunate that few people who actually teach meditation take it seriously. Relaxation always seems a more important and immediate goal than mental control. Even when paying attention is encouraged, the emphasis on being 'nonjudgmental' at the same time undercuts its evaluative and regulatory function. 'Paying attention' is often reduced to little more than the instructions: 'When your mind wanders, return to the breath.' This is quite inadequate if we want to actually *train* our attention, as the Buddha recommended.