5.

Multitasking

Anyone who can drive safely while kissing is simply not giving the kiss the attention it deserves.

— Anonymous

Let's start this chapter with a little game. For this, you'll need something to write with, something to write on, and a timer.

Round 1

During this round, your goal is to try to complete two different tasks in under 10 seconds.

1. Divide your page into two vertical columns.
2. Set your timer to 10 seconds.
3. As soon as the timer begins, begin writing out the first twelve letters of the alphabet (A to L) vertically in the left column. Do this as quickly as you can.
4. Once finished with the letters, begin writing out the first twelve numbers vertically in the right column. Again, do this as quickly as you can.

See if you can write out all 24 letters and numbers within the 10-second window.

Ready … set … begin!

I'm guessing you either completely finished or got fairly far along that process before time ran out. Now let's play this game again, except this time let's change one small thing …

Round 2

During this round, your goal is to complete the same two tasks as above — except this time you will quickly alternate between each.

1. Divide your paper into two vertical columns.
2. Set your timer to 10 seconds.
3. As soon as the timer begins, write out the first letter in the left column (A), then the first number in the right (1), then the second letter in the left (B), then the second number in the right (2), etc.

Again, see if you can write out all 24 letters and numbers within the 10-second window.

Ready … set … begin!

If you're like most people, this time you probably only made it about two-thirds of the way through each list. More importantly, even though the tasks weren't particularly difficult, you might have found yourself getting flustered and making a few mistakes, perhaps repeating a number or needing to mentally run through the alphabet to remember the next letter.

So what happened? Why was the second round so much trickier than the first?

Attention filters

The world is a chaotic place.

As I write these words, I am sitting in a crowded coffee shop with dozens of customers streaming by my table, an espresso machine hissing in my ear and two girls boisterously debating the extracurricular activities of some guy named Chad. With all this stimulation it's an absolute wonder anyone can get anything done at all — yet, somehow, we can cut through the chaos and home in on those sights, sounds, tastes, smells and feelings that are meaningful to us in the moment.

This is the power of attention.

Perhaps the easiest way to understand how attention works is to think of a filter. Much like those 3D glasses we used to wear as kids that only allowed certain wavelengths of light to hit our eyes, attention allows only *relevant* information to pass into conscious awareness while blocking out *irrelevant* information. As we learnt in the last chapter, information deemed irrelevant still enters our memories (context and state dependency), but it's simply not *consciously* processed.

This leads to an important question: what determines if a piece of information is relevant? The answer changes depending upon the specific task we are engaged with. Just like a board game, every task we undertake — be it writing an email, tallying up bills or simply taking the dog for a walk — comes with its own unique set of rules that dictate what actions are required in order to 'succeed'. For instance, to successfully read these words right now, your reading ruleset dictates that you must move your eyes left to right over each line, hold each word in memory until you reach the end of a sentence, use your fingers to flip between pages, etc.

Whenever we engage with a task, the relevant rules must be loaded into a small area of the brain called the *lateral prefrontal cortex* (we'll call it the LatPFC). Whichever specific ruleset is loaded into the LatPFC will determine what information is deemed relevant or irrelevant. For instance, seeing as your reading ruleset is currently loaded into your LatPFC, this has tweaked your attention filter to allow these black squiggles into conscious awareness while blocking out the texture of these pages against your fingers, the chapter title at the bottom of this page, any noises going on around you, etc.

I often liken this entire process to those old video game systems from the 1980s. In this instance, each video game (task) has its own unique set of characters, controls and objectives (ruleset). Any time you wish to play a particular game, you must pop the relevant cartridge into the game system (LatPFC). Once a game is loaded in, the pixels on the television screen will display that game's heroes, villains, weapons, etc. (attention filter).

Who's in charge here?

Sticking with the video game analogy, who *selects* which game to play at any one moment?

The primary selector is you. Via a specific brain system called the *dorsal attention network*, your personal goals, desires and intentions are used to select relevant rulesets. Right now, seeing as you have personally chosen to read these words, your dorsal network has accessed your reading ruleset, loaded it into your LatPFC and set your attention filter accordingly.

However, imagine if an angry, snarling bear suddenly came running towards you. Technically, seeing as this bear is irrelevant to your chosen

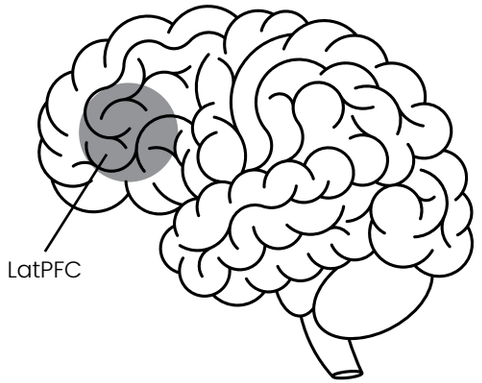

ILLUSTRATION 30. THE LATERAL PREFRONTAL CORTEX (LATPFC)

RULESETS

LatPFC

ATTENTION FILTER

ILLUSTRATION 31. YOU CAN ONLY LOAD ONE RULESET AT A TIME

goal of reading, your filter should block it out and you should never be consciously aware of it. Clearly this isn't the case. If a bear suddenly appeared, I imagine you'd be out the door before this book hit the floor. This means there must be a *secondary* selector somewhere within the brain.

Indeed, there is.

Churning away in the background is a system called the *ventral attention network* which continuously (and subconsciously) monitors all the information your attention filter deems irrelevant and blocks out. If something shocking or unexpected occurs — such as a bear running towards you — this secondary system will *automatically* take over, load up a new set of rules ('escape from a bear' ruleset) and change your attention filter accordingly.

An easy way to conceptualize how these two different networks operate is to consider one of those driving instructor's cars that has two different steering wheels. Most of the time, the car is being controlled by the student driver (the dorsal network), who is consciously focused on moving and turning in a specific manner. However, sitting quietly by is the ever-vigilant instructor (the ventral network), constantly aware of the surrounding world and able to take control should anything dangerous arise.

It's not multitasking — it's task-switching

Think back to the first chapter where we learnt that attempting to simultaneously read while listen to someone speak leads to a processing bottleneck. It turns out we have the same issue here. Much like a video game console, *the LatPFC can only hold onto one ruleset at a time*.

Put another way: we cannot multitask.

Wait a second — you've surfed the internet while writing an email; texted while attending a meeting; updated your Facebook status while reading. Isn't this multitasking?

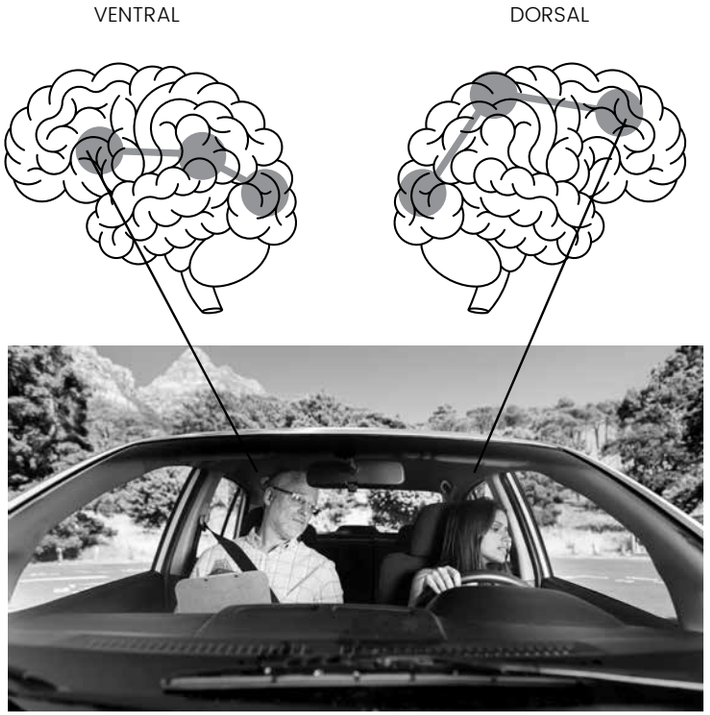

ILLUSTRATION 32. THE DORSAL & VENTRAL ATTENTION NETWORKS

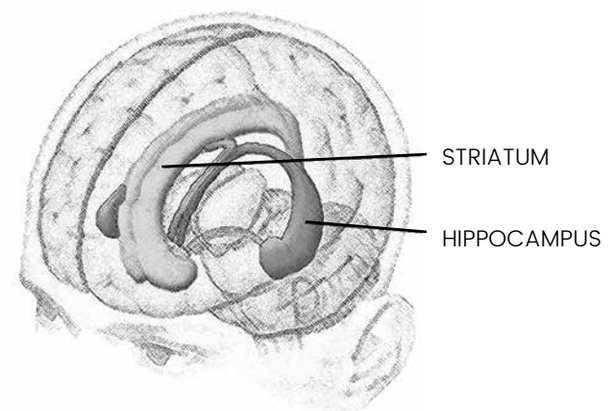

ILLUSTRATION 33. THE STRIATUM

Surprisingly, no it isn't.

Although we often *think* we're multitasking, never do we actually undertake multiple tasks simultaneously. Rather, we really quickly *jump back and forth* between tasks, swapping out rulesets within the LatPFC each time we do. Researchers call this *task-switching*, and it's a lot like trying to watch two different shows on a single television: sure, you can quickly flip back and forth between stations but you're only ever watching one show at a time.

Why does this matter? It turns out that jumping between tasks has three major consequences.

COST NO. 1: TIME

Task-switching is not an instantaneous process. As we jump from one task to another there is a brief period when our attention turns 'off' as the filter is updated. Researchers call this period the *attentional blink* and it is essentially a sensory dead zone: all external information stops being consciously processed.

Although a single attentional blink is relatively short (0.1 to 0.2 seconds), this occurs *every time* we switch between tasks. Accordingly, as the number of task-switches increases, so too does the amount of time we spend in this sensory dead zone. Thinking back to the game at the start of this chapter, this is why you could finish more during round 1 (uni-tasking) than you could during round 2 (multitasking).

COST NO. 2: ACCURACY

Task-switching is not a seamless process. As we jump from one task to another there is a brief period when the two rulesets blend. Researchers call this the *psychological refractory period* and during this time general performance suffers.

Have you ever tried to write an email while having a conversation and accidentally typed out the words you meant to speak aloud? Have you ever been rushing to prepare for work in the morning and

accidentally poured coffee in your cereal bowl? Have you ever had to jump back and forth between writing letters and numbers (say, at the start of this chapter) and accidentally scribbled down the digits in the wrong order? This is the psychological refractory period in action.

COST NO. 3: MEMORY

At this point in the book, whenever you hear the term 'memory' there should be one brain region that immediately comes to mind: the hippocampus. Interestingly, during task-switching, activity within the hippocampus decreases. This means that attempting to multitask impairs memory formation.

To make matters worse, during task-switching, activity within the *striatum* increases; this is an area of the brain that subconsciously processes reflexive and repetitive skills (such as walking). This means that information learnt during multitasking is often stored as a habitual routine, making it incredibly difficult to consciously access and manipulate in the future (try describing the exact muscle movements you undertake in order to walk).

Task-switching in the real world

Imagine you're driving when suddenly a deer jumps in front of your car. How long do you think it would take you to react? If you were focused only on driving, it would take about one second to recognize the deer and slam on the brakes.

Interestingly, if you were drunk, this reaction time would slow to about 1.15 seconds. Seeing as alcohol dampens sensory processing and slows the speed with which people recognize and respond to the world, this leads to an estimated 275,000 motor accidents in the US every year: that's about one accident every two minutes.

Here's the scary part. If you were *reading* or *writing* a text message while driving, it would take you around 1.3 seconds to slam on the brakes. Every time you jump between your phone and the road, you must update your relevant ruleset. This process takes *twice as long* as the reflex lag caused by alcohol and leads to an estimated 1.6 million motor accidents in the US every year: that's about one accident *every 20 seconds*.

It's bad … and getting worse

On the scale of 0 (horrible) to 10 (incredible), how good would you say you are at multitasking?

Believe it or not, the better you rated your ability to multitask, the worse a multitasker you likely are. Researchers consistently find that people who consider themselves strong multitaskers are notoriously bad at recognizing just how poorly they perform when jumping between tasks.

Furthermore, the adage 'practice makes perfect' has little bearing on multitasking. In fact, people who frequently multitask almost always perform worse during task-switching than people who rarely multitask. To make matters worse, frequent multitasking strengthens people's confidence in their ability to task-switch … which leads to more multitasking … which leads to even higher confidence … and so on.

To be fair, if you spend time explicitly practising multitasking with two specific tasks (say, writing emails and sending texts), you will likely improve your switching speed between these. Unfortunately, this does not mean you will boost some general 'multitasking ability' which will help you jump between any and every task. In fact, as we saw above, any improved ability to jump between email and text will almost certainly be due to the striatum forming a habitual routine — meaning it will be a subconscious skill difficult to explicitly access and apply across other task-switching scenarios.

Enter the supertaskers

A small warning: it's possible you will read the following section and think to yourself 'That's me!' The truth is, for every 100 people who read this book, only one will fit this bill. To put that into perspective, more of you will have a small hole above your ear that's thought to be a remnant of gills from our ancient fish ancestors (the preauricular sinus); more of you will have two distinct hair whorls going in opposite directions on the back of your head (a double-crown); more of you will be able to bend your thumb backwards far enough to touch your wrist (hypermobility).

Just saying.

In a 2010 multitasking research study, people were asked to memorize word lists and mentally complete maths problems while undertaking a driving simulation. Of the 200 participants, the vast majority performed as expected: horribly. Their reaction time slowed by almost 20 per cent while their memory and maths skills dropped by nearly 30 per cent and 10 per cent, respectively.

Interestingly, five people showed no change whatsoever! These people showed no slowing of their reaction time and had no decline in memorization or mental maths ability. It was as if they weren't multitasking at all.

Further research has revealed there is a small subset of people dubbed 'supertaskers'. Just like normal people, supertaskers cannot actually do two tasks at one time; however, they can swap rulesets incredibly rapidly. This ability shortens their attentional blink and allows them to quickly recognize any ruleset overlap, thereby combating the psychological refractory period.

As I said above, supertaskers are quite rare and I wouldn't get my hopes up about being one. However, if you would like to check your status, you can go online and search for 'supertasker tests'. Even if it turns out you're a mere mortal like the rest of us, these tests will help demonstrate just how truly difficult and detrimental multitasking can be.

Implications for leaders, teachers and coaches

1. Don't invite multitasking

This one is simple: if you're at all interested in reducing effort while boosting efficacy and efficiency, do not invite multitasking. Every time we mention a web address, distribute practice problems or display a complex graph during a learning session, we encourage others to multitask which, ultimately, can impair comprehension, memory, and performance. To avoid this, we must ensure that every learning task has a clear focus, a step-wise trajectory (see Implication 2, below) and a devoted block of time to allow for engagement and completion.

In addition, ask others to turn off emails, put away their smartphones and keep only one internet tab open during sessions. Though this might cause a few grumbles, when people focus on a single task they will finish quicker, perform better and remember more.

BURNING QUESTION 1:

WALKING AND TALKING

‘If it’s impossible to multitask, then why can I walk and chew gum at the same time?’

Touché!

The truth is, we multitask every day. We hold conversations while eating. We sing while showering. We ponder work projects while jogging.

Interestingly, if you look closely at these examples, each includes a *habitual routine* mediated by the *striatum*. Chances are you have mastered the art of eating, showering and jogging — you can perform these skills on autopilot. This means we *can* perform two tasks at the same time, as long as one of those tasks is automatic and can be done with little conscious thought.

With that said, have you ever been so involved with a conversation during a meal that you forgot to eat? Or been so wrapped up in a song that you absentmindedly shampooed twice? Or been so concerned with a project that you accidentally tripped while jogging?

Even when one task is a habitual routine, this does not guarantee effective multitasking. Rulesets, filters and goals can still become mixed up, leading to impaired reaction speed, performance and memory. Furthermore, beyond a certain age, even automatic tasks like walking and talking can begin to interfere with one another (which is why many older people stand still when chatting).

So, walking and chewing gum is certainly possible — but this does not negate the multitasking story.

BURNING QUESTION 2:

BATTLE OF THE SEXES PART 1

‘Women are better than men at multitasking … right?’

Although there is quite a bit of research exploring this issue, the results are all over the shop: sometimes women perform better, sometimes men perform better and sometimes there’s no difference at all.

Whenever a body of research is this chaotic, there is typically a very simple explanation: individual differences. In this instance, it’s highly unlikely that one gender is better at multitasking than another. Far more likely is that some people are better than other people at multitasking — regardless of gender. And, of course, when I say ‘better’, I really mean ‘less worse’. Outside of the rare supertasker, everyone suffers.

BURNING QUESTION 3:

THE MIND WIPE

‘Sometimes I walk into a room only to suddenly forget why. What’s going on there?’

As we learnt earlier, whenever the ventral attention network registers a threat it will automatically drop our current ruleset.

When this occurs, any lingering information that has not been funnelled through the hippocampus will be effectively erased. It's as if every time you turned a page in this book you were to forget the last sentence you read. Researchers call this moment an *event-model purge*: but it's more commonly known as a mind wipe.

This process makes sense when a hungry bear is approaching (who cares what you were just thinking about if your life is suddenly in danger?), but why should it happen when we walk between rooms? It turns out, our ventral network sometimes interprets doorways as threats. Although no one is certain why this happens, it's commonly thought when the door jamb passes quickly in front of our eyes, danger is sensed, our ruleset is reset and whatever information we were just pondering is erased. This is called the *doorway effect*, and it's the same reason why we sometimes open the refrigerator and, as the door quickly passes in front of our eyes, we suddenly forget what food we intended to grab.

Luckily, if we return to the room we were originally in (or close the refrigerator door), we can use spatial-, context- and state-guiding cues to reconstruct our initial train of thought and remember our original intentions.

2. Break complex tasks into small bits

When confronted with a long-term, complex task, many people set their sights squarely on the final product. Unfortunately, when people form a singular goal that exists far in the future (known as a distal goal), this increases their tendency to multitask which, in turn, can delay project completion, decrease performance and diminish an individual's confidence in their own skills and abilities.

When large projects are broken down into small, discrete steps (known as proximal goals), you are more likely to persist with and effectively complete each individual step. Beyond curtailing multitasking, setting smaller goals has been demonstrated to hasten project completion, improve performance, boost confidence and deepen learning.

There is one issue to keep in mind when considering proximal goals: difficulty. If small goals are too demanding or impossible to accomplish (for example, writing 1000 words in one hour), this can make you feel incompetent and drive you to quit. Conversely, if small goals are too easy and require no real effort to accomplish (writing ten words in an hour), this can perpetuate a sense of pointlessness and kill creativity, innovation and performance.

As such, when breaking a large project into small segments, keep in mind the Goldilocks principle: not too difficult, not too easy — a solid mix of challenge and time is paramount.

3. Ensure technology is integral

Many people employ technology with little rhyme or reason. Every student gets a laptop; every session is streamed online; every discussion occurs via digital message-boards. The sentiment seems to be that 'If there's a computer involved, people must be learning'.

Unfortunately, this sentiment simply isn't true. Generally speaking, those who utilize technology more often during learning tend to remember *less* than those who don't.

This is largely because technology breeds multitasking. In fact, it's built into the very fabric of most programs: smartphones run dozens of apps simultaneously; laptops display several windows on a single screen; Twitter cycles multiple conversations concurrently. As such, if you choose to utilize a piece of technology to help others learn, ensure all background programs are switched off so that people can devote their attention completely to the task at hand.

Furthermore, only employ technology if it is *integral* to the learning task. A good rule of thumb: if you can run a session or activity in

person using physical tools and interaction — do it! By ditching unnecessary technology, you can remove the temptation to multitask, keep others focused and boost learning.

However, if *learning* is not your ultimate goal, then much of this discussion is irrelevant. Technology is a great means to boost *engagement* and *enjoyment* — though, as we learnt earlier, engagement and enjoyment are not synonymous with learning (remember the Attenborough Effect?). Simply be clear on *why* you are using technology. If it's to get people involved and excited, then go to town. If it's to help others embody new ideas, then ensure the technology is essential, otherwise ditch it.

BURNING QUESTION 4:

MEDIA MULTITASKING

'Does watching TV while studying impact learning?'

I'm guessing you've already gleaned the answer to this one.

It's been estimated over 60 per cent of people engage with different forms of media while studying. Unfortunately, watching television, surfing the web or texting while learning are all forms of multitasking which require task-switching and can negatively impact on memory.

To make matters worse, when people use devices to media multitask while in a group setting, this not only impairs *their* learning but also the learning of *everyone within that person's immediate vicinity*. In other words, media multitasking has a detrimental radius and anyone caught up within it suffers.

As an interesting aside: think of all the television shows that actively encourage viewers to tweet or email during episodes. Though this might boost engagement, it will ultimately kill viewer memory which, in turn, might decrease willingness to watch future episodes.

4. One message at a time

As this mirrors the graphs and tables discussion from Chapter 2, I'll keep it short. When giving a presentation, you will only ever be able to verbally discuss one idea at time. Unfortunately, if your accompanying slide or handout contains multiple ideas, your audience will likely attempt to jump between them all and lose key information from each. This is simply to say make sure you and your slides impart *one* message at a time. If this isn't possible, employ signalling (see p. 69 in Chapter 3) to guide attention and curb multitasking.

5. Avoid unfinished problems and premature questions

Human beings hate (or love) unsolved puzzles. This is thought to spring from the fact that our brains are prediction machines and an incomplete puzzle represents a failed prediction that must be corrected.

Sometimes during a presentation, we will unwittingly leave concepts or ideas half-finished. Maybe we'll begin a story, only to run off on a tangent and never return. Or perhaps we'll begin drawing a diagram, only to get side-tracked and shift to a different topic. When information is incomplete, many people will feel compelled to complete it while still trying to listen to you — multitasking in

action. Accordingly, try to remain cognizant of the flow of ideas and avoid leaving things unfinished (I know, easier said than done).

Similarly, if you supply handouts with practice problems or reflection questions meant to be addressed at a later time, guess what will happen? Drawn to unsolved puzzles, many people will begin immediately filling them in. This could cause them to miss key information and impair learning. As such, hold onto any questions or problems until they fit into the material you are presenting.

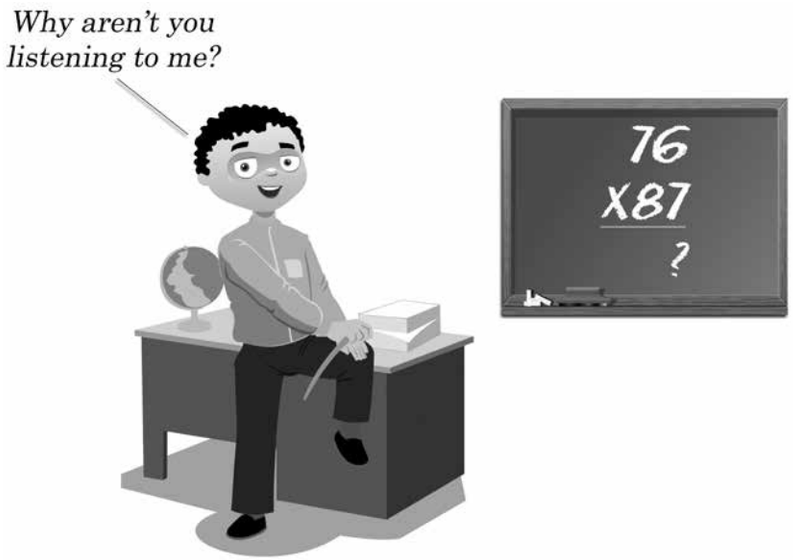

ILLUSTRATION 34. DON'T INVITE MULTITASKING!

AT A GLANCE

Human beings *cannot* multitask. Trying to do so impairs learning and memory.

- We can hold onto one ruleset at a time. This ruleset determines what information our attention filter allows in.
- Typically, *we* select which ruleset is active, but any threatening or surprising situation can automatically activate a different ruleset.
- We don't multitask — we quickly jump between tasks. This takes time, kills accuracy and pushes memory into 'subconscious' networks.
- Although some people can jump between tasks faster than others, nobody can truly multitask.

APPLICATIONS

1. Don't invite multitasking.
   - People *can* perform two tasks simultaneously as long as one is habitual and automatic.
   - Women are not better than men at multitasking.
   - When a threat is sensed, people undergo a sudden mind wipe.
2. Break complex tasks into small bits.
3. Ensure technology is integral.
   - Watching TV, surfing the net or texting while studying can impair learning/memory.
4. Focus on one message at a time.
5. Avoid unfinished problems and premature questions.