WHY CRAMMING FOR TESTS OFTEN FAILS

We've all had to face a tough exam at least once in our lives. Whether it's a school paper, university final or even a test at work, there's one piece of advice we're almost always given: make a study plan. With a plan, we can space out our preparation for the test rather than relying on one or two intense study sessions the night before to see us through. It's good advice. Summed up in three words: cramming doesn't work. Unfortunately, many of us ignore this rule. At least one survey has found that 99% of students admit to cramming.

You might think that's down to nothing more than simple disorganisation: I'll admit it is far easier to leave things to the last minute than start preparing for a test weeks or months ahead. But studies of memory suggest there's something else going on. In 2009, for example, Nate Kornell at the University of California, Los Angeles, found that spacing out learning was more effective than cramming for 90% of the participants who took part in one of his experiments – and yet 72% of the participants thought that cramming had been more beneficial. What is happening in the brain that we trick ourselves this way? It's better to spread out revision before the big exam

Studies of memory suggest that we have a worrying tendency to rely on our familiarity with study items to guide our judgements of whether we know them. The problem is that familiarity is bad at predicting whether we can recall something.

After six hours of looking at study material (and three cups of coffee and five chocolate bars) it's easy to think we have it committed to memory. Every page, every important fact, evokes a comforting feeling of familiarity. The cramming has left a lingering glow of activity in our sensory and memory systems, a glow that allows our brain to swiftly tag our study notes as "something that I've seen before". But being able to recognise something isn't the same as being able to recall it.

Different parts of the brain support different kinds of memory. Recognition is strongly affected by the ease with which information passes through the sensory areas of our brain, such as the visual cortex if you are looking at notes. Recall is supported by a network of different areas of the brain, including the frontal cortex and the temporal lobe, which coordinate to recreate a memory from the clues you give it. Just because your visual cortex is fluently processing your notes after five consecutive hours of you looking at them, doesn't mean the rest of your brain is going to be able to reconstruct the memory of them when you really need it to.

This ability to make judgements about our own minds is called metacognition. Studying it has identified other misconceptions too. For instance, many of us think that actively thinking about trying to learn something will help us remember it. Studies suggest this is not the case. Far more important is reorganising the information so that it has a structure more likely to be retained in your memory. In other words, rewrite the content of what you want to learn in a way that makes most sense to you.

Knowing about common metacognitive errors means you can help yourself by assuming that you will make them. You can then try and counteract them. So, the advice to space out our study only makes sense if we assume that people aren't already spacing out their study sessions enough (a safe assumption, given the research findings). We need to be reminded of the benefits of spaced learning because it runs counter to our instinct to relying on a comforting feeling of familiarity when deciding how to study

Put simply, we can sometimes have a surprising amount to gain from going against our normally reliable metacognitive instinct. How much should you space out your practice? Answer: a little bit more than you really want to.

HOW MANY SENSES DO WE HAVE?

Some myths about the brain, such as the idea we only use 10% of our grey matter, are notorious, especially among neuroscientists. One of the generally accepted ides is the idea that the human brain is served by five senses. This belief is so ingrained that even the scientifically literate will treat it as taken-for-granted common knowledge. Perhaps it is due to the idea's noble origins. The principle of five basic human senses is often traced back to Aristotle's De Anima (On the Soul), in which he devotes a separate chapter to vision, hearing, touch, smell and taste. Today, the five senses are considered such an elementary truth that it is sometimes used as a point of consensus before writers embark on more mysterious or contentious topics. "What do we actually mean by reality?" asked the author of a recent article in New Scientist magazine. "A straightforward answer is that it means everything that appears to our five senses."

If only it were that simple. Simply defining what we mean by a "sense" leads you down a slippery slope into philosophy. First consider the senses that relate to the position of our bodies. Close your eyes, and then touch your right forefinger to your left elbow tip. Easy? How did you do it? Somehow you knew where the end of your finger was and you also knew the position of your left elbow. This sense is known as proprioception and it's the awareness we have of where each of our body parts is located in space. Proprioception is possible thanks to receptors in our muscles known as spindles, which tell the brain about the current length and stretch of the muscles. Now imagine you are blindfolded and I tilted you forwards slowly. You'd immediately have a sensation of how your body's position was changing in relation to gravity. This is thanks to the fluid-filled vestibular system in your inner ear, which helps us keep balance. This system also gives us our experience of acceleration through space, and it links up with the eyes, making it possible to cancel out our own motion. If you wiggle your head around while reading, for example, you'll see that it makes little difference to your ability to read and stay focused on the words. There are also numerous senses providing us with information about the inner state of our bodies. The most obvious of these are hunger and thirst, inner body pain, and the need to empty the bladder or bowel. Less obvious and less available to conscious awareness are incoming signals about blood pressure, the pH level of the cerebrospinal fluid, plus many more. Alongside temperature-sensitive receptors, packed in our skin we also have receptors dedicated to mechanical pressure, pain (known as nociceptors) and itch (pruritic receptors). Using the same logic, however, taste can be divided into sweet, sour, salty and bitter and potentially "umami", which is activated by monosodium glutamate and is associated with a "meaty" flavour.

Splitting the senses in this way doesn't feel like the most intuitive way of dealing with the question, however, and it becomes even more absurd if we turn to smell: humans have over 1,000 distinct olfactory receptors tuned to different odorous molecules. Should each one be counted as a different sense? A great example is the human capacity for echo-location. Human echo-location works by a person emitting a clicking sound with the tongue and listening for how it rebounds off the immediate environment.

As you can see, there is no single, logical way to define the senses. In some ways, it might make little sense to draw divisions between them at all – considering that they often seem to blend together; the colour of food – and even the sounds of a restaurant – can influence taste, for instance. Understanding these relationships is important when studying conditions like synaesthesia and could even shed light on consciousness itself. But whichever way you look at it, five is a pretty arbitrary and meaningless number – a glaring "myth" of the brain that needs further recognition.

Does CPR usually bring people around?

How many times do films or TV dramas feature someone kneeling over their collapsed friend, desperately pumping up and down on their chest, breathing into their mouth and begging them to wake up? After a few tense moments, there's some coughing and spluttering from the person on the ground, they open their eyes and their life has been saved. We can all rest easy.

But is it like that in the real world? Cardiopulmonary resuscitation, or CPR, is designed to help someone who's had an unexpected cardiac arrest – in other words their heart has stopped beating strongly enough to pump blood around the body, depriving the brain of blood flow. The idea of CPR is not to start the heart beating again, but to get oxygen into a person's lungs to prevent brain damage. To restart the heart would usually require an electric shock.

This is why it's essential not to give up on CPR before medical help arrives. It buys you time, but it needs to be done hard and fast, which soon tires you out, so you need to get yourself into a position where you can continue for a long time, or ideally take turns with someone else. If someone without a pulse appears to recover and regain a pulse through CPR then the chances are that their heart was still beating faintly all along.

So don't be surprised if someone doesn't immediately come back to life. It doesn't mean you're doing it wrong; it's rare for CPR to rouse someone from unconsciousness straight away.

You wouldn't get that impression from fiction, though. In studies of medical dramas, resuscitation was shown to be successful 75% of the time on US television, whereas there was a more realistic 25% success rate in British dramas. Even that 25% rate is higher than many places actually achieve. The success of CPR depends a lot on where you live and how fast you can get medical help. A review of studies across many countries found a survival rate of just 5.35% in New York compared with 37% in the German city of Heidelberg.

Over the years there's been a lot of debate over the best way of doing CPR. For a long time most guidelines recommended 15 compressions on the chest, followed by two breaths into the person's mouth, followed by 15 compressions again, repeating this sequence until medical help arrives. In 2005, many organisations including the American Heart Association, changed their recommendations to 30 compressions followed by two breaths. But now there's research suggesting the breaths might not even be needed at all, a finding which might well encourage more people to come to the aid of a stranger in the street. At the University of Arizona, Professor Gordon A Ewy and his team demonstrated in laboratory studies using animals that compressions alone were just as effective as compressions with breaths.

But what would happen with people in real-life emergencies? It's not easy studying this – since you don't know who's going to collapse and where, it's impossible to randomise passers-by to do CPR with or without breathing into the person's mouth. However, in 2004 Arizona began a public information campaign explaining that people didn't have to give breaths in order to attempt CPR with a video showing you how to do it (see below). The result was a dramatic increase in the number of bystanders prepared to have a go, leading to an increase in survival rates from 18-34%, Not only did just as many people survive even with no breaths, but giving compressions without interruption in this study protected against damage to the brain.

This is still a matter of debate, especially in Europe. The American Heart Association recommends that in the event of an unexpected cardiac arrest untrained people should use what's known as "Hands Only" CPR, though its latest consensus statement says there's still not enough evidence to discourage those who've had training from giving breathing. These results only apply to adults. In children under the age of 12 it's still recommended breathing into their mouths as well.

Perfect beat

Then there's the question of speed. The 2010 US guidelines suggest a rate of at least a hundred compressions a minute. Humming a tune can help you to get the right pace: the Bee Gees 1977 hit Stayin' Alive, or perhaps Half a Pound of Tuppenny Rice, if you happen to know it. Research from 2012 that sought to find the ideal speed for survival found that it wasn't a case of the faster the better; there were decreasing returns once they reached a speed of 125 compressions a minute.

Sometimes people are nervous about whether or not CPR is needed. It's not dangerous to do it to someone who turns out to be conscious after all. If they open their eyes and start pushing you away then you can stop. The greater risk is that people mistake a person's final gasps for breath as a sign of consciousness and then decide not to do CPR. In fact this so-called agonal respiration can mean they're dying in front of you.

One thing I discovered when I learned CPR in London, trying it out on the mannequin or Resusci Annie as she's better known, was how hard you have to press. Although the ribs and the breastbone flex to an extent, it's not surprising that it can result in a sore chest and even a broken rib or two. It's worth it though. Although you're not bringing someone back to life, you're giving them the chance for someone else to save them. The result can still be the same – you save a life.

Water births risky?

"Women aren't dolphins" is a phrase often use when talking about by those who question why women want to immerse themselves in pools or warm baths during labour and birth. They forget that we're not mountain goats or birds, but that doesn't stop us from rock climbing or hang gliding.

As more scientific evidence emerges about the benefits of water immersion in labour and birth, hospitals and birth centres are increasingly adding large baths to their delivery rooms. The New South Wales department of health has even given a directive that "all maternity services offer access to water immersion in labour (target 100% by 2015)", in an attempt to decrease the rising caesarean section rate.

There are tales of generations of women in the South Pacific giving birth in shallow sea water, but long before this – and possibly throughout the history of humankind – water has been used for pain relief.

The modern use of water immersion for labour and birth began in 1970s Russia when Igor Tjarkovsky, a boat builder, began looking into the therapeutic effects of water. He later installed a glass tank in his home for women to use during childbirth.

Michel Odent, the French obstetrician, went on to popularise water immersion in the 1970s and 80s in Europe, after installing a plastic paddling pool in a French hospital and finding it reduced women's need for painkillers. His first water birth occurred by accident and Odent soon realised the potential benefits of leaving women in the water for the birth.

Water births moved from fad to mainstream maternity care in 1993, with the publication of the United Kingdom's Changing Childbirth report, which recommended pool facilities be an option available to women in all UK maternity units.

The benefits of using water in labour are mainly attributed to buoyancy, hydrostatic pressure and the effect of warmth. Women can move more easily than on land, enabling them to change position with ease. Movement and relaxation help facilitate positive neuro-hormonal interactions that alleviate pain naturally.

There is some evidence that water immersion may be associated with improved blood flow in the uterus, lower blood pressure, less painful contractions, shorter labours and fewer interventions. There are also psychological benefits, with women feeling more in control and that they have their own space, with the bath forming a natural barrier between her and the health providers.

A common concern with water birth is that the baby could try to breathe underwater and drown. But healthy babies have what's called a diving reflex (or bradycardic response), which causes the infant to hold his breath when under water. The reflex is stimulated via the infant's facial skin receptors, which detect the water and inhibits breathing.

There are also concerns about increased tearing of the perineum (the tissue between the vagina and anus) due to the lack of control of the baby's advancing head. But randomised trials to date, and more importantly a systematic review of these trials, has not shown this to be the case.

Last month I published a study in the Journal of Midwifery examining the outcomes of 6,144 Australian women who had normal vaginal births in a birth centre over a 12 year period. I compared outcomes for the mother and baby when women gave birth in water, with those who gave birth in six other birth positions on land: kneeling or all fours, squatting, side lying, semi seated, using a birth stool and standing.

Compared with water birth, the women who gave birth on a birth stool had nearly one-and-a- half times higher rate of major perineal trauma and more than twice the rate of haemorrhage after delivery.

There was no difference in major perineal trauma and haemorrhage after delivery between women who gave birth in water and those who opted for a semi-seated position, the most common birth position in Australia.

Compared with water birth however, babies born in a semi-seated position had a four-and-a-half times higher incidence of five-minute APGAR scores less than seven. APGAR scores rate the newborn's breathing effort, heart rate, muscle tone, reflexes and skin colour. A score of less than seven at five minutes following the birth indicates medical intervention was needed to resuscitate the baby.

We controlled for as many variables as we could, including whether it was a first or subsequent birth, a long period of pushing, a big baby, or a midwife or obstetrician undertaking the delivery. All these women had normal vaginal births so surgical birth was not a variable.

So the idea that babies are more likely to drown if born in water, or that rates of tearing and injury are worse, doesn't hold up.

While women may not be dolphins, they are drawn to water during labour and birth, with little evidence of harm and some evidence of benefit. And once experienced, women usually make the same choice for a subsequent birth and report many benefits to this style of birth.