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THE LEARNING FACTORY

AN EFFECTIVE SYSTEM FOR ACQUIRING KNOWLEDGE AND SKILLS

SECOND EDITION

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Introduction

Within these pages, you'll find the results of nearly six years worth of research and experimentation. I've gone through the proverbial ringer in order to discover the most efficient and effective methods for learning, and now you can reap the benefits of my long, hard slog. In other words: *my pain will be your gain*.

Everything you'll find here is based on well-documented, studied phenomena from cognitive science, neuroscience and psychology. We've come a long way in the last couple of decades when it comes to our understanding of learning, and now, with this short book, you can get clear instructions on how to integrate the best parts of all that science into your daily life.

What you're reading is the result of my constant frustration with books related to learning, memory and the various psychological mechanisms involved with forming positive habits. On the one hand, you have books which contain genuinely useful information, but is presented in such a way that you're left wondering how it can possibly be applied to your day-to-day life. This is particularly true for books written by academics, which are great in many ways, but the average person doesn't have the time or inclination to sort through them and filter out the most useful information. Finding the best way to incorporate these concepts also requires experimentation, which most people just can’t swing for a variety of reasons.

On the other end of the spectrum, there are books written in a purposefully vague, self-help fashion. The authors of these books are usually people that have marketing backgrounds, and they tend to prefer feel-good euphemisms and debunked folk wisdom to support their material. Many of these books do come with some instructions, but since their underlying methodology is not scientifically sound, it’s rarely useful.

The most famous of these types is the “memory champion.” These are people who have mastered specific mnemonic techniques that allow them to do things like memorize a stack of playing cards or recite long poems by heart. Although these skills do have their uses (I use mnemonics all the time), possessing them does *not* make one an expert in memory. On the contrary, they are simply experts in mnemonics. Successful learning is not about pure memorization, and getting the most from your memory is not simply a matter of picking up a mnemonic system.

My goal here is to bridge the gap between academic books that have useful, evidence-based information but aren’t written in a user-friendly manner, and the more “self-help”-style books that are easily understood by large swathes of people but rarely beneficial. As such, I do not go into much detail about the scientific work done behind the principles themselves. However, if you’re interested in getting an in-depth look at the “sciency” details, I do cite relevant studies throughout the book, and I also provide a reading list with books that provide much deeper lists of studies.

I’ve made the book purposefully short. You should be able to read this in its entirety within a few days, and my hope is that you’ll get some tips and information you can start using on your first day of reading. This book was not written for the benefit of professional psychologists, cognitive scientists or neuroscientists; it exists for the average person who is not aware of the concepts presented here, and who is, even worse, often exposed to incorrect (and sometimes counterproductive) ideas about how the memory and learning work.

Schools certainly aren’t teaching students how to be better at learning, and even though there are countless content providers, very few (if any) are providing tools for effectively absorbing that content. Many people make it through difficult academic environments without picking up the skills they need to successfully learn out in the real world. The demands of these environments is better at producing people who excel at rote memorization and passing exams than people who can leverage information to come up with creative solutions.

For example, there are a seemingly endless number of programming courses and books to choose from. Each one promises to sharpen your skills in one way or the other, but none of them offer any techniques for actually *remembering* the material. Once you're finished with the book or course, you'll forget most of what you picked up. You'll wonder where your time and energy went, and then proceed to recreate this frustrating cycle hoping to get better.

In other words, there's a ton of *what to learn material out there, but a shocking lack ofhow to learnmaterial.*

This is not the case when you use a Learning Factory. This is because all the tools and techniques I'm about to describe are focused on making sure you form long-lasting memories. What this translates to is spending far less time going back to old learning materials to refresh your memory, and more time putting your learning into action.

If you're pressed for time, or are perhaps not as interested in the underlying mechanisms as I am, you can quickly go through this book and put Learning Factory methods to use immediately. The only pieces of equipment you'll need to get started are a computer and a smart phone.

It would also be a good idea to pick up an e-reader of some kind. I personally use a Kobo, but an Amazon Kindle or any other reader will work just as well. Many people prefer regular books - and there's nothing wrong with that - but the benefits of being able to keep your entire library in a single device are substantial. It also means that you can backup your books, so even if you lose that device you don’t lose your library. Utilizing snippets from books (you’ll understand what that means later on) is also much more difficult when you use physical books.

A word of warning: if you’re looking for a lazy solution to your lack of knowledge, you’re reading the wrong book. This isn’t *The Secret* - you will have to do more than just imagine yourself learning more efficiently. Without a modicum of discipline you won’t be able to use *any* learning system effectively.

The Learning Factory described in this book should be viewed as “barebones.” It gives you a strong foundation, and from that you will build something highly personalized. Although I’m going to give you examples to work with and plenty of actionable information, I don’t have any insight into key variables in your life, like your work or school schedule, or your ability to get a good night’s sleep. Don’t develop a slavish devotion to the basic Learning Factory - shape it into something that works for you.

Changes are being made to my own Learning Factory as I’m writing this book, and (I hope) it will continue to evolve for as long as I’m physically capable of adding to it. Likewise, I expect you to also constantly craft and mold your Factory as you go. There are step-by-step instructions throughout the book, as well as worksheets at the very end that will help you out at during the early stages of your learning.

Building a Learning Factory, much like building a physical factory, has an incredibly high return on investment. Your up front time and energy expenditures will pay for themselves a thousand times over by saving you countless hours later on in life. And, once you’ve done it for a while (and I’m talking about months here, not years), taking in and retaining new information will be nearly automatic. You also won’t need to re-read another book ever again, and that alone is priceless.

As you’re going through this book, think about what you could learn that would give you an advantage at work, or, if you’re currently looking for a job, what skill might make you more attractive to potential employers. I recommend you use these skills as your first project, as nothing will illustrate the power of your Learning Factory more dramatically than getting a new job. You could also use your new-found abilities to create a company if you’re less risk-averse.

I have a challenge for you: before you start diving into any other books, take the time to read this guide and then put the next book you read through your own Learning Factory. Then compare how much you remember about that book with a book you’ve read prior to using the Factory. The results will speak for themselves

Counter-Productive Learning Techniques

Ultimately, this book is about saving you time and energy while learning new subjects. While there are countless volumes available that can provide you with content, very few actually lay out how you can improve your process of absorbing said content. What's worse is the fact that many of them have counter-productive tips, which only increases the visibility of bad learning techniques in the public's mind.

Regardless of whether you end up reading the full length of this book or not, I hope that you will at least read through this section and, if you're practicing any of these habits, drop them immediately. You don't have to use what I teach you later on, but I implore you: save yourself some time and stop doing these things.

All of these also provide an illusion of competence and/or accomplishment. It's easy for someone to pad their ego when they look at all the highlights they've put into a massive textbook or talk about how they've read a sophisticated book ten times. But these are really nothing to brag about. In reality, people should see those "accomplishments" for what they are: time wasted that you will never get back.

Don't be one of those people. Remember, we want to work smarter *and*harder.

The methods that *are*worth your time are explained in great detail later on in the book. For now, just read this list, and if you’re doing any of these things, stop doing them immediately.

The offenders are as follows:

1. Speed reading
2. Rereading
3. Cramming
4. Highlighting*
5. Passive note taking*
6. Brain games

**These techniques can be transformed into useful tools with some modification, but on their own they don’t facilitate any meaningful memory creation.*

Speed Reading

Who *doesn't* want to be able to absorb a book's worth of information in a single sitting? It's considered a sort of learning superpower, and many people subscribe to the belief that it exists. This makes the subject of speed reading fairly controversial, with ardent believers clashing with skeptics on a regular basis. Unfortunately for its supporters, not much has surfaced aside from "I can tell you it works from experience" when it comes to evidence supporting speed reading's effectiveness.

There are multitudes of popular courses online that will purport to give you the ability to read upwards of 1,000 words per minute with near-perfect comprehension and only a small amount of instruction. Many of these courses are defended viciously by their adherents and authors alike, and it's easy to find people propping up the validity of speed reading.

Although it is possible to physically read many words per minute, the most important piece of the puzzle - comprehension - is lost when speed reading is used. In 2000, NASA did a study of a speed reading product, PhotoReading, that claimed to grant readers a 25,000 word per minute reading rate [1]. I'll let the results of the study speak for themselves (emphasis is mine):

*“These results clearly indicate that **there is no benefit** to using the PhotoReading technique. The extremely rapid reading rates claimed by PhotoReaders were not observed; indeed the reading rates were generally comparable to those for normal reading. Moreover, the PhotoReading expert showed an increase in reading time with the PhotoReading technique in comparison to normal reading. **This increase in reading time was accompanied by a decrease in text comprehension.** These results were found for two standardized tests of text comprehension and for three matched sets of expository texts.”*

Another study from 1992 tested speed readers and put the comprehension of its participants at lower than 50% [2].That’s simply an unacceptable rate for anyone looking to actually learn a subject beyond its most superficial concepts.

Even the World Championship Speed Reading Competition views a comprehension rate of around 50% acceptable as long as the reading rate floats around 1,000 words per minute. The fact that such terrible comprehension rates are considered passable should be a big enough red flag regarding how little value there is in speed reading.

An ardent speed reading advocate may be telling the truth when he says that he’s read an 800-page book in a single sitting. Unfortunately, he would be lying if he said that he remembered anything more than surface details about said book. If your goal is to learn, speed reading ends up being not only practically useless, but a dangerous deception that can trick you into believing that you’re absorbing more than you truly are.

It’s been shown that the human brain has a limit on the amount of information it can take in and adequately process at once. While we don’t know exactly how fixed this capacity is, it isn’t nearly as flexible as people who sell speed reading courses would have you believe. In fact, the most effective method of taking in information is in small, bite-sized chunks. These digestible bits are built up over time and eventually create a high-level understanding.

When you try to force glacier-sized globs of information into your skull all at once, you exceed your information-processing limits very quickly. The end result is that a very small amount of information makes it through, while the rest gets ignored. In the military, they have a useful analogy for this process: “It’s like drinking from a firehose.” Yes, a little bit of water will get into your mouth, but most of it just splashes outward.

Even if you could take on large amounts of information at once, speed reading still does not address the problem of retention. Forming memories takes time and repetition (a process we will dive into later on), and speed reading does not allow for either. Sucking in tons of information all at once without ever attempting any kind of meaningful recall later on will never be a recipe for forming long-lasting memories.

There has only been one documented case of a genuine speedreader: Kim Peek, the inspiration for Dustin Hoffman’s character in the movie *Rainman.*He was an autistic savant with abilities almost beyond imagination. Every time he picked up a book, he read two pages at once, absorbed thousands of words per minute, and had near-perfect retention.

Peek’s gifts have been linked to physical abnormalities within his brain, and he was severely mentally disabled in nearly every way except his incredible information-related abilities (he could not care for himself and even simple conversations were a challenge for him). His IQ was found to be 87 [3], a below-average number that reflected his level of impairment in other areas. The average person is not capable of developing reading skills at this level, and, considering the side effects you’d have to endure, you wouldn’t want to anyway.

Reading speed for the average person can be increased, but the upper limit of comprehension is in the hundreds of words per minute. And, even less exciting, the only way to reach that level is to do it the hard way: by reading many, many books [4]. Like nearly every other skill under the sun, you can improve it with enough focused practice.

Interestingly enough, there’s also evidence that reading too slowly ends up killing comprehension as well [5]. So while you shouldn’t be blazing through text at a speed reading pace, don’t snail through it either.

So please, don’t believe the hype of speed reading. All you’ll end up doing is wasting time and providing yourself with the illusion of competence. In all actuality, “speed” reading ends up being incredibly inefficient time-wise. This is because if you ever actually need to remember something from the material, you’ll need to read it again - which probably won’t do much for you anyway, owing to your biologically-enforced information processing limits. You’re much better off using a technique that will provide you with effective retention the first time through, even if it is slower.

Rereading

This is another insidious beast of a technique, although it has a far more legitimate place in the public's mind. People often talk about how they reread certain books every now and then, and several historical figures have prided themselves on the practice. Frederick the Great, for example, is said to have never gone into battle without his copy of *Enchidiron*, Epictetus's classic Stoic manual (an excellent and highly recommended book). Another example is Robert Greene, famous for his books about strategy, who has said that he rereads the works of Florentine politician Niccolo Machiavelli every year.

The thinking behind rereading seems simple enough: people want to be reminded of the wisdom within the pages of their favorite books. While there is evidence that passively reading a text more than once can have a reliably greater effect on comprehension [6], it's an incredibly inefficient route to take. It also has limited impact on retention, as you're not doing anything out of the ordinary to ensure that you will remember what you're reading. As with speed reading, you may understand the material, but you're probably going to forget it sooner rather than later.

Rereading is a brute force method of learning, and you should avoid such techniques whenever possible.

Learning is largely predicated on effective encoding and retrieval techniques, and passively reading something multiple times doesn't fall into either category.

It's also worth noting that it is very easy for someone to form an illusion of competence if they've read a text more than once. In the mind of the reader, they've gone over the material enough times to justify his or her belief that they now truly understand it. Without explicit feedback, they can fall into the trap of thinking, "I've read this a bunch of times, I *must* be an expert."

Unfortunately, reading does not automatically mean you comprehend the material at hand. Don't think that plowing through anything means much - completion is only admirable if you can prove that you've gained new insight. There are ways to do that, and we'll talk about how later on in the book.

Rather than reading a book multiple times, wouldn't you rather be reading something new and interesting that you can glean fresh insights from? Aside from that, reading is very expensive in terms of both time and mental energy. If you really want to learn what a book has to offer you, you should adopt a more efficient system of learning items so that you get what you want on the first go.

You should think of rereading as being very similar to working 18 hour days or sleeping 3 hours per night (which often go together). Some people pride themselves on these practices, but really they're both marks of poor planning and poor work practices. You shouldn’t need 18 hours to get your work done, and sleeping for 3 hours per night is one of the worst things you can do for your long-term mental and physical health.

Instead of rereading a book to glean its finest points, spend some time looking for a way to capture what you need and want from it the first time. There are tools and techniques out there that can help you do just that, so there’s truly no point in ignoring them if they’re available to you. Besides, life’s just too short to read the same material over and over again.

I will say this: I understand that some people reread books for the pleasure of experiencing them again, and that’s perfectly fine. For example, I know someone who rereads Frank Herbert’s *Dune* series annually purely because it’s something they enjoy doing. That’s perfectly acceptable, as rereading a fictional book is very similar to watching a favorite movie more than once. But if your goal is to learn and retain useful information in a time-sensitive manner, rereading is not a good choice.

Cramming

Whether it’s because of procrastination, laziness, unforeseen circumstances or just a naive belief in its effectiveness, cramming is something nearly everyone is guilty of doing at least once (myself included). The concept is, like many bits of folk wisdom, easy to see value in: if you stuff all that content into your memory right before you need it, you’ll remember it more easily.

Unfortunately, that’s just not how memory works. Your mind needs time to process new information, and you need to practice reviewing the material several times over a period of time before it is effectively transferred to your long-term memory. You should be spending time studying and focusing on material, but extended study sessions have proven to be a waste of time [7].

Cramming essentially gives you a highly superficial, temporary boost that may in fact help you with your imminent exam, but you won’t be forming meaningful, long-term memories. Your mind simply won’t have time to facilitate the transfer of information into your long-term memory, and most of what you’ll learn in a cramming session will be lost rapidly.

To put it simply, **cramming gives you a big boost now in exchange for forgetting nearly everything later.** If all you’re interested in doing is passing exams then this is an OK model, but it is not an acceptable option for those of us who want to retain what we learn.

Highlighting

Highlighting is a technique that seems to get an abundance of recommendations from academic institutions. I know I’ve had teachers in the past that instructed students on it, and I’m guilty of filling books with highlights thinking that I’ve made progress. Once again, this practice is a dreadful time killer that provides little to no comprehension benefit when it is done without any follow up.

Similar to rereading, highlighting is something that appears at first blush to be a real help. As you’re reading through a textbook, for example, you see a passage that really solidifies a concept and you decide to highlight. The first thing you’ll think is, “Yes, now I’ll remember that nugget of knowledge!” Make no mistake, you will not remember it if you don’t do anything else with that highlight.

Highlighting, although slightly more effective than just passively reading, doesn’t have much of an effect on retention [8]. You could create flashcards with those snippets and make something effective out of them, but highlights on their own will fade into the distance very quickly. As with most items on this list, highlighting by itself simply does not have the power to start a meaningful transfer from your working to long-term memory.

Passive Note Taking

Another staple of academia is the practice of passive note taking. By *passive* I mean you're writing things down and not doing anything else with what you've written. Writing notes down is often viewed as a great way to retain information, and it's not difficult to find people who use handwritten or typed notes as a means of remembering things.

What's worse is that people often take very long, detailed notes and don't even attempt to simplify the content of whatever it is they're trying to retain. Complexity makes learning *more* difficult, not less. Whether people do it to feel like they've done a thorough job or they're simply uninformed about how to take effective notes is beyond me, but the result is the same: a near-total lack of retention.

Think for a moment about how you treat notes after you've written them down. What happens when you try to remember what you wrote? Do crystal clear memories pop into your mind, or do you feel you have to pull the notes out and look at them again? With the way that most people take notes, I think it's safe to say that you'd need to go find your notes. This then begs the question: **What's the point of taking notes at all if you**

constantly have to reference them to use the information they contain?

I’m not saying that all note taking is a bad thing. On the contrary, there are ways of taking notes, which I will explain later, that are incredibly useful. But if you’re filling up notebooks with information and then never looking at them again, then you’re really doing yourself a disservice. It’s also equally useless if you need to have that information on hand in order to remember it.

Not too long ago, I came across an ancient note-keeping system called the “commonplace book.” This system originally involved placing notes of interest into a standard notebook, but some are now doing it by buying a large box and filling it with categorized index cards. Each time a user comes across something they find interesting, they create a card and file it in the book. Or, if they’re using a notebook, they simply write it down.

Its adherents include a some famous people, including Ronald Reagan and marketer/writer Ryan Holiday, and those who use them claim their commonplace books are invaluable. Although I can admire the work and organization that goes into them, these aren’t particularly useful. Rather than committing information to memory, people that utilize a commonplace book are using a mental crutch that will not only be useless if they can’t access it (since its value lies in the user’s ability to browse it), but the fact that it is a physical item means it’s very fragile and easy to destroy.

Even though I’m not going to address this point directly, you’ll discover later on that there are a variety of ways that you could convert the information inside of a commonplace book so that it will be infinitely more useful and resilient within your memory. But using a commonplace book on its own isn’t nearly as helpful as many seem to think it is.

Mind maps are also worth grouping into this category, as they’re a commonly referenced method for retaining information. It makes sense on the surface, as you’re creating a visual reference for and grouping information. The problem with mind maps is the same as the problem with regular notes: you’re not actually doing anything to retain that information.

The visual piece is a step in the right direction, but if you’re not taking steps to actively transfer information from your working memory to your long-term memory then you’re wasting time.

Brain Games

There is quite a bit of hype around services that provide games that supposedly enhance your brain's capabilities. A couple of them even have commercials that are widely broadcast, lending an air of credibility to their services. What's worse is that they'll claim they have neuroscience on their side. Although their claims sound reasonable enough, they are almost entirely false [9].

What brain games end up doing is making you good at those specific games. There aren't any benefits that carry over into other areas of your cognitive abilities. So you might end up being really good at rapidly clicking on a spot or arranging items a certain way, but those skills won't translate into making you better at unrelated tasks.

Researchers who study these sorts of things call this *transfer specificity*, and it is an unfortunate fact of human intelligence. We all seem to be searching for that one activity which will make us smarter in general, but our brains refuse to cooperate.

There was hope that an exception to this was found within the *n-back* task, which is a game designed specifically to enhance working memory. Initial studies [10] showed a non-trivial increase in fluid intelligence as a result of using it, and as a result there are still many vocal proponents of its use. These findings even caught the attention of *Wired* magazine, which published a feature-length article about it.

Unfortunately for those that value the n-back, two [11] studies [12] done in 2012 failed to replicate the original's results, and stated that no cognitive boosts were observed as a result of doing n-back tests. However, this does not stop people from fiercely defending the value of n-back, and, much like speed reading, you don't have to travel far on the internet to find those who sing its praises.

If you like playing brain games as a way to have fun and/or relax, then please, by all means, continue using them. I have friends and family that regularly enjoy old fashioned brain games, such as chess and crossword puzzles, and sometimes I indulge in them myself. However, you shouldn't fool yourself into thinking that skill in these games translates into anything meaningful. Doing so only creates an illusion of competence, and any perceived gains in intelligence are almost certainly a delusion (although there's nothing wrong with playing them for fun!).

Educational Myths

Aside from techniques that may act as roadblocks to progress, you should also be aware of some popular ideas about how we think that are not true. As with all folk wisdom, they make sense on the surface, but end up falling flat when it comes to supporting evidence.

Photographic (Eidetic) Memory

It’s worth mentioning that there is exactly zero evidence to suggest that photographic (a.k.a. eidetic) memory exists. Despite what popular media might present, there has never been a proven case of someone possessing a photographic memory. You read that correctly: not a single case.

The reason for this is pretty simple: your eyes are not cameras attached to a hard drive. Rather than taking snapshots of everything around us, our brains *process* information through a variety of different lenses. Our biases, previously held beliefs and neurological processes heavily influence what we see in the world, and this is because information is not placed in perfect form into your memory. This is why things like eyewitness testimony are so unreliable - we don’t have perfect recall, and when we try to remember things we often fudge the details due to our own biases.

Your brain is also, as far as we can tell, not capable of absorbing every detail that you come across in your day-to-day life. If you could, you’d be remembering all sorts of unneeded details, and your memory (which has a large, but finite capacity) would become overburdened. Photographic memory is one of those concepts that might sound great at first, but would quickly become maddening.

There is such a thing as superior autobiographical memory (a.k.a. Hyperthymesia, which involves being able to remember vividly every day of your life), but it is exceedingly rare and has substantial cognitive side effects. But even this is still up in the air, with controversy swirling around the mechanisms that enable it. Who knows - by the time you read this it might have already been disproven.

I will never tell you that building a Learning Factory will grant you anything near photographic memory. It will help you learn more in a shorter time frame, but you’ll still forget things from time to time - I certainly do. However, when it comes to subjects you really care about, key concepts will, with enough time and effort, become second-nature.

Learning Styles

Take a moment to consider what type of learner you are. Do you prefer to be more hands-on, or do you respond better to visual cues? Perhaps you don’t fit either of these profiles, and instead prefer to absorb information through sound,such as audio books. Well, I hate to be *that guy*, but the truth is that you aren’t any of those things.

Learning styles are a sort of Holy Grail in the world of education, and the topic has been researched meticulously for decades. Unfortunately, no evidence has been found to support the idea that people have distinct styles of learning [13]. The concept of learning styles originated in the world of 1970s psychology, which was before the birth of what could be considered modern neuroscience.

Initial research led to many schools around the world adopting the idea that students have individual styles of learning, and the accompanying idea that teachers should cater to those styles for each student. Even now, many prominent figures in the world of education still believe that learning styles should be viewed as an important foundation in any effective classroom.

Fortunately, modern neuro and cognitive scientists have been able to empirically test these claims and have yet to be convinced that such styles exist. So what does this mean for you, the layman that just wants to learn efficiently?

It’s simple: stop using thoughts like “but I’m a visual learner!” as a crutch. There are universally effective methods for learning that are supported by empirical evidence, and none of them allow for such ideas. If you find yourself struggling with learning, you’re probably just experiencing a bit of discomfort because it’s all new to you [14]. As you go through this book, you’ll not only learn about how to use the best methods available, but you’ll also be given tips about discipline that will assist you if you’re having a hard time sticking to the material.

Right-Brain/Left-Brain

Closely related to the concept of learning styles is the idea that people are “left-brain” or “right brain” thinkers, depending on which hemisphere of their brain is more dominant. Right-brain/left-brain thinking is particularly attractive to the layman because it appears to give a concrete explanation of creativity and logical thinking.

Left-brain thinkers focus on logic and reasoning, which would explain why certain dispassionate-seeming people are excellent for fields such as science or accounting. Right-brainers are the creative, passionate types that flourish in professions such as art, music or creative writing. But, like most neatly-packaged explanations of complex social phenomena, it simply isn’t true [15].

For some reason, this hypothesis has been widely propagated, and there have even been best-selling books written about it. It’s also become a go-to for some self-help and education gurus that want to provide their followers with a flowery, easy-to-understand concept.

There are certainly aspects of brain function that are focused more on one side or the other. However, those fall into the domain of biology and have nothing to do with a bias towards rational or emotional thought [16]. It’s an excellent example of a real idea being diluted by folk wisdom and turned into something it isn’t.

If you’re using this as a base for how you evaluate your own learning style, do yourself a favor and stop. Just like learning styles, when you begin to self-identify as a “left-brainer” or a “right-brainer,” all you’re essentially doing is providing an easy, widely believed excuse for why you can’t do something. It’s especially tempting to use this when learning a logic-heavy subject, such as math. “I can’t learn that kind of stuff, I’m *way* too much of right-brain thinker.” Nonsense.

Part One: Foundations

This section of the book is dedicated to creating a solid base for you to build your Learning Factory. You'll learn to create a baseline process which, later on, will be combined with other learning tools. So for now, focus on building with these techniques - more specific instructions about how to use the information gathered with them will be given later on.

Memory, Thinking & The Brain

As I mentioned earlier, my intention here is to keep technical details light and allow the experts on each subject to speak for themselves via the reading list at the end and occasional references to studies. However, memory is the central piece of the learning system, and it deserves at least some space in here.

The Purpose of the Brain

It's a common misconception that the brain is designed purely for thinking. On the contrary, the brain is designed, in many ways, to *avoid* the process of thinking. This is because thinking is incredibly energy-intensive, and, like many other processes within your body, your brain will do everything it can to conserve energy.

Before moving on: *I just want to make clear that when I use the word "energy" in this book I don't mean it in the same way that New Age adherents do. I'm not using that word to describe some nebulous force of mystery or "chakras" or "auras" or anything like that. What I'm talking about is the textbook definition of energy: the ability to do* *work. Everything you do on a daily basis requires energy to be expended by some natural process within your body - and your brain happens to be an insanely energy-hungry part of your body.*

To give you an idea of just how much energy is used by everyday brain function, think about this: your brain represents roughly two percent of your body weight, but it consumes ***twenty*** percent of your calories! [17] This is a number that remains nearly constant, even with the wide variety of activity levels you may experience in a day.

The brain’s desire to not think is easy to observe in your everyday life. Assuming that you didn’t just move into the place where you’re currently living, nearly everything you do within it is done on a sort of autopilot. This is because the relatively small number of things you do within your home are done so often that they no longer require detailed thought to execute. With this is mind, the concept of a non-thinking brain makes more sense.

After all, it would be exhausting to have to think through every detail of mundane household tasks such as washing the dishes or making a sandwich. This autopilot process also ensures that you don’t clog up your memory with unimportant details about your day.

It is for these reasons that seemingly simple tasks can often be tiring if they’re brand new. For example, going through the process of traveling will make all but the most hardened business travelers feel exhausted. This happens even if you’re only taking a two hour flight because, even though you might end up doing a bunch of seemingly simple tasks (such as going to the airport and sitting in a seat on the airplane), you have to consciously process *everything*. Tasks that you normally would handle automatically at home - like eating or using a bathroom - require you to seek out new information and make new choices (each of which require thinking and, as a result, energy).

Another example of this effect can be found when you’re navigating around whatever city or town you currently live in. If you’re brand new, basic errands like grocery shopping can become tiring and frustrating. You have to consider every street, absorb useful landmarks and in general parse through a deluge of new information to get where you need to go. On the other hand, if you’ve been living in a place for an extended period of time, your brain has a solid set of memories to fall back on. The knowledge is probably deep enough that you can combine old and new information in interesting ways. This comes in handy when, for example, you see a traffic jam up ahead and automatically conjure up an alternative route.

Your brain will, in its never ending quest to conserve energy, fight back ferociously against having to think. It will do it as much as it has to, then it tries as hard as it can to switch to automatic mode. So even though you might have to think to find the bathroom at the airport, your brain will switch off into autopilot once you're actually in the stall. That's because the act of using the bathroom is incredibly familiar, and the brain knows it can stop expending energy on new thoughts.

All of this explains why learning a new subject or skill can be so overwhelming at first, especially if it's a skill that requires physical precision. Your mind simply isn't used to processing that information, and is searching for some loophole so it can go back to autopilot. A big piece of the Learning Factory method of learning is fighting back against that autopilot in manageable and realistic ways, such as taking on new information in small chunks. Another key component is getting you to the point that each new skill or area of knowledge you want to be more familiar with is incorporated into that autopilot mode. That is, you are familiar enough with the subject that your brain can utilize information about it without expending excess energy.

A recurring theme throughout this book is the idea of allowing yourself some shortcuts that will cut down on unnecessary thought. Each time you have to thoroughly process information it means there is valuable energy being sapped away, so you need to make sure you that the processing you're doing is worth your time. As such, there will be some tools made available to you that don't require you to think quite as much, and instead will handle otherwise bothersome tasks on your behalf.

If you want to get a head start on optimizing your brain's energy supply, start finding ways to take thinking out of things you do every day. For example, I used to forget my keys constantly and found myself looking for them on a daily basis. At best, this was annoying. I'd get irritated because the keys were missing again, and I'd inevitably find them in a couch cushion or under some piece of furniture. At worst, I'd be late getting somewhere important because I'd need to spend 15 minutes or more looking for them.

The solution? I placed a small plastic container next to the door where I now drop everything I'd need before going out: keys, wallet, sunglasses, etc. As soon as I come back, I put them back in the box. I no longer have to think about where my keys are, and the energy I had to expend on before can be used for more important tasks [18].

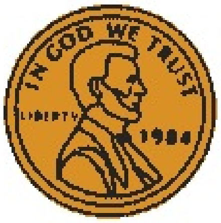
Another side effect of needlessly wasting energy is that your discipline will decrease as well. This is especially true at the beginning stages of your learning, when your brain will be fighting against your new routines with serious gusto. You'll need energy to both fight back against any bad habits you have now and consistently establish new, more positive habits.

What's slightly paradoxical (and, in my opinion, incredibly interesting), is that thinking is the primary determinant in how well you remember something [19]. In other words, the things you think about the most are going to be the things most firmly planted into your long-term memory

[20]. If you’ve ever considered why you remember trivial details such as plot lines from movies you didn’t like, or the hairstyle of a stranger you walked past months ago, this is why. You interacted with that information and then thought about it vigorously. The timeframe for that thinking may have been limited, but you obviously put enough mental “juice” into those things for them to stick around [21].

This simple idea overrides the popular notion that emotional triggers or repetition are what set memories in place. Highly emotional memories (the major ones, like remembering where you were on 9/11), are sometimes referred to as *flashbulb memories* and are often inaccurate due to the various filters your mind places on such thoughts. Emotion has been shown to be a powerful memory enhancer [22], but emotion is not a prerequisite for forming new memories.

Pure repetition also doesn’t seem to matter too much. Take, for example, the following chart [23], which asks you to determine which American penny design is correct:



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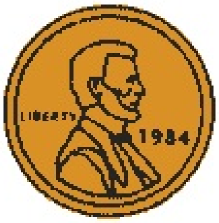

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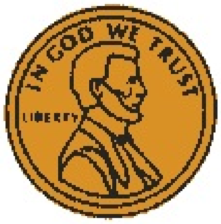

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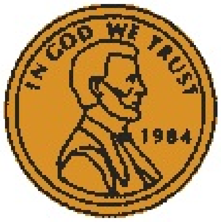

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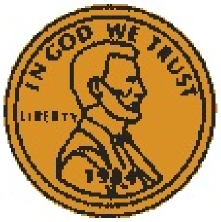

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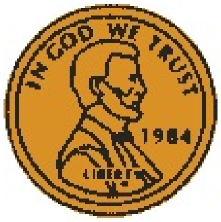

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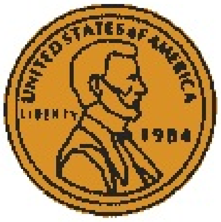

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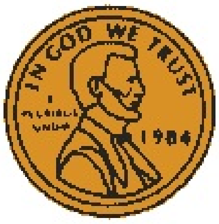

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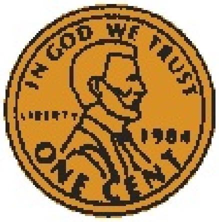

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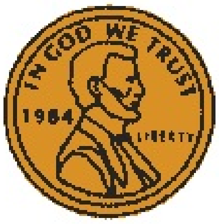

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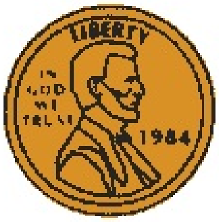

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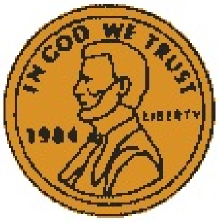

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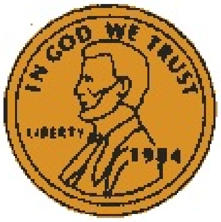

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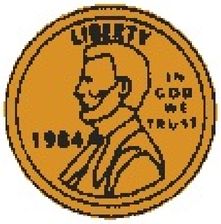

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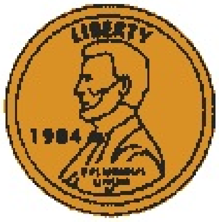


O

Unless you are a collector of pennies (which means you've *thought* about and examined pennies quite a bit), you may very well have chosen the wrong diagram [24]. Think about how many times you've seen pennies or used them in your own life. The number of exposures to the correct design likely goes into the thousands, yet most people don't have a 100 percent accurate picture of what pennies actually look like. We just use them and don't consciously store the information they contain.

We certainly understand that pennies are worth one cent, are made of copper and have Abe Lincoln's face on them but that's about as far as we go. The same could be said for paper money as well: we understand what it's worth tous, but not the finer details. If I were to present a diagram of dollar designs instead of penny designs, I think it's safe to say that you'd probably struggle with that one as well (I know I would).

Hopefully this has driven home an important point: if you want to remember something, you must *think* about it. Truly focus and pay attention to what you're studying so that factual and contextual information can build up in your memory. If you find yourself either flying through or nodding off during a study session, you aren't dedicating adequate brain power to remembering a subject and you're probably wasting your own time.

For those of you who are wondering, the correct answer for the penny diagram is...wait for it...A.

A Framework for Practice

Practice is, unfortunately, a key part of getting good at anything. As far as researchers can tell, it's impossible to gain expertise in anything without copious amounts of practicing. When you practice, a transfer from working memory to a specific type of long-term memory called *procedural memory* is taking place. Procedural memory is memory that is called up whenever you need to engage in an action that you've done a million times before. This happens at a level just below consciousness, and is essentially automatic.

You know how the phrase “It’s just like riding a bike” is used to describe something you can do without thinking? Well, that’s an example of procedural memory. If you grew up riding bikes like I did, the various bits of balancing and pedaling are done without any mental effort. Even though I haven’t ridden a bike in years, I’m confident that I could ride one again without any special effort because the memory of riding is so ingrained in my procedural memory. My skill level has definitely gone down as a result of not riding for so long, but I will be able to pick it up again without exerting myself too hard.

In martial arts, there is a distinct split between arts that place an emphasis on sparring with live, resisting opponents, and arts that focus primarily on performing choreographed movements against thin air [25]. While there may very well be benefits to the latter, the former is (not surprisingly) far better at keeping the arts viable. When practitioners are forced to apply their techniques at full speed against other, resisting practitioners then they develop competence by necessity. The art itself also maintains its potency, as only the most effective techniques are kept and used on a regular basis.

With sparring-focused arts such as Brazilian jiu-jitsu, judo, sambo, wrestling, boxing or Muay Thai, the flow of a class usually goes something like this:

1. Spend some time focusing on a technique or set of techniques with minimal resistance, where the goal is getting the movements right and understanding nuances. This can take the form of hitting pads (striking arts) or positional drilling (grappling).

2. Once the instructor is confident everyone in the room has taken at least something away from the lesson, sparring begins. Each student is expected to incorporate what they learned today into whatever they already know and combine the two during the sparring session. The technique taught that day may not be completely in the minds of the students, and they may very well mess it up during sparring. But through practice both that day and later on, they can improve.

3. During sparring, it’s common to have a mix of experience levels working against each other. A beginner may spar with other beginners, or he may face an expert. Through each round of sparring, practitioners get a sense of where they are in the skill continuum and can gather perspective on what they still need to work on.

We can take this framework and take away some important insights about learning and how to apply what we learn.

Brazilian jiu-jitsu in action: Romulo Barral (bottom) trying to lock in a triangle choke. (Image courtesy of Wikipedia)

The most important lesson is that you need to make sure you're actually *applying* what you learn. If you're only reading books, taking courses and taking in information, you're not building a skill. You may very well be increasing your level of knowledge, but the usefulness of that knowledge depends on how well it can be utilized within the context of your actions.

Think of it this way: if you read an in-depth manual about riding bicycles, do you think reading that alone would make you an expert in riding bicycles? On the one hand, you may have a very well-honed knowledge of the physics behind what makes riding bicycles work. On the other, you will almost certainly fall off any bike you attempt to ride because you lack experience in the application of your knowledge.

Part of becoming a skilled learner is figuring out how to balance your time between absorbing information and using it. This is known formally as the *exploration-exploitation dilemma*: the constant battle between looking for new information (exploring) and using what we know to get things done (exploitation). If you explore too much, you never end up making or doing anything significant, and if you exploit too much, you'll get blindsided by changes you didn't see coming (since you were too busy working to learn new things).

There is no exact solution to the exploration-exploitation dilemma, as there are too many factors to consider for each individual's situation. However, it's constructive to keep this in mind: **explore less over time, but never stop exploring.** In other words, it makes sense to do lots of exploring when you're first getting started with something, but as time goes on you should be spending more and more time utilizing your knowledge. Just make sure you don't get so caught up in exploitation that you stop looking exploring for new ideas.

Your brain also doesn't like tasks that are too easy or too hard. Much like the finicky Goldilocks, who needed her porridge to be "just right," your brain likes to deal in tasks that are in the intermediate difficulty range [26]. If you try to tackle a task that is far beyond your current abilities, your brain will fight back, and if you attempt something that's way too easy, the result will also be an internal mental rebellion.

Because of this odd quirk, your most productive work will be tasks that are just above what you currently believe you're capable of. By doing this, you'll keep your brain from rebelling furiously against what you're doing while simultaneously improving your knowledge and skill sets. An excellent way to accomplish this is by using something called *deliberate practice*.

Deliberate practice, which was first described by world-renowned expertise researcher K. Anders Ericsson, entails finding your current weak spots, then focusing on them in your practice sessions until they're no longer weak spots. Ericsson conducted a study in 1993 [27] that examined how expert-level musicians became so skilled. Even though the average music-related time expenditure was roughly the same for all musicians in the study, it was the ones who spent the most time deliberately attacking their weakest areas that ended up being the most skilled.

When you first start out, respecting your brain's desire to do tasks at the boundaries of your capabilities will actually be relatively simple. This is because your experience at the beginning is so limited and even basic concepts will expand your knowledge base. However, as time goes on and skills begin to grow, you'll need to recognize and respect the boundaries of your current understanding. Taking a bird's eye view of your learning will give you a chance to examine areas that you need to work on, and give you a clearer perception of where your limits lie.

Taking an inventory like this on a regular basis also translates to less frustration, as you won’t be dealing with the mental anguish of a brain that is refusing to deal with something that is simply beyond its current capabilities.

To use martial arts as an analogy, it doesn’t make sense to spend all your time sparring against either people who are much worse than you or people who are far superior. The rank beginners will not be enough of a challenge to force skills growth, and the experts will crush you so severely that you don’t have a chance to do anything except survive. Your best rounds (growth-wise) will be against those who are around the same skill level as you, preferably slightly better. These are the rounds where you can make incremental progress, because you’re neither slicing through their defenses with ease or getting dominated.

Long-Term Memory vs. Working Memory

Long-term memory is something you are probably familiar with. As its name implies, it is the part of your memory that stores information in a near-permanent manner. Think of long-term memory as a sort of hard drive in your mind. Just as your computer’s hard drive can be used to bring up data with ease, the long-term memory is where we store information that is most familiar and easy to recall.

Anything that you can easily rattle off from memory is currently stored in your long-term memory. Concepts such as numbers, addition and the names (and faces) of loved ones are all stored here. When you're presented with a question such as "What is 5 + 3?" your long-term memory effortlessly conjures up the values of both 5 and 3, the concept of how to add the two together, and the resulting value of the equation.

You've dealt with these numbers and the concept of adding numbers together enough that there isn't any real effort involved in pulling them up. Recalling the previous section that talked about how the brain thinks, long-term memory is where autopilot information is stored. Anything that is solidly in your long-term memory will be nearly effortless to retrieve, and you can put things there without much trouble if you know how to do it.

What if I asked you to do something you've never done before or done only a few times? You'd need to think about it for at least a moment, and in that moment you'd be utilizing your working memory. Working memory is the place where your thinking is done, and it is very important for you to understand its features and limitations.

To put it simply, working memory is where new information is both stored and combined with old information [28]. This is all thinking really is - combining old information retrieved from your long-term memory with new information. You receive input from outside sources such as sights, sounds and smells, and that input is placed into your working memory. Your long-term memory is then searched to see if anything is similar or identical to this new information.

Once information has been processed in working memory, it is usually discarded. This is a good thing, because your working memory has, as far as researchers can tell, a fixed capacity. A limited number of items can be held within working memory at any given time, and if you didn’t have this natural flushing process, you’d never be able to get any real thinking done. We’ll talk more about how to deal with this capacity limit in a little bit, but for now you should understand that it is of critical importance to work towards using as little of your working memory as possible.

An analogy to this process would be the steps you take to find information on the internet, which is usually done with a search engine. You enter a word or phrase into the engine, it compares its database against that input, then spits out a results page. In this case, the word or phrase represents external inputs, such as sights or sounds. Then your working memory compares these inputs with long-term memory, just like the search engine compares your search terms to its index of web pages. After that’s done, your brain returns a set of results (if they exist), similar to how the search engine gives you a list of pages that contain your search term.

To use another analogy from computing, your working memory is very similar to your computer’s Random Access Memory (RAM). RAM serves as a temporary place for data to be held that is relevant to programs that are currently running. As the programs run, new information is added and changed, but it all gets deleted once the computer is turned off. It also has a fixed capacity, so if you overload it with data, it will stop functioning. Working memory acts the same way: it keeps information that you need in place long enough for you to manipulate it, then it’s discarded. Try filling it beyond capacity and it stops working.

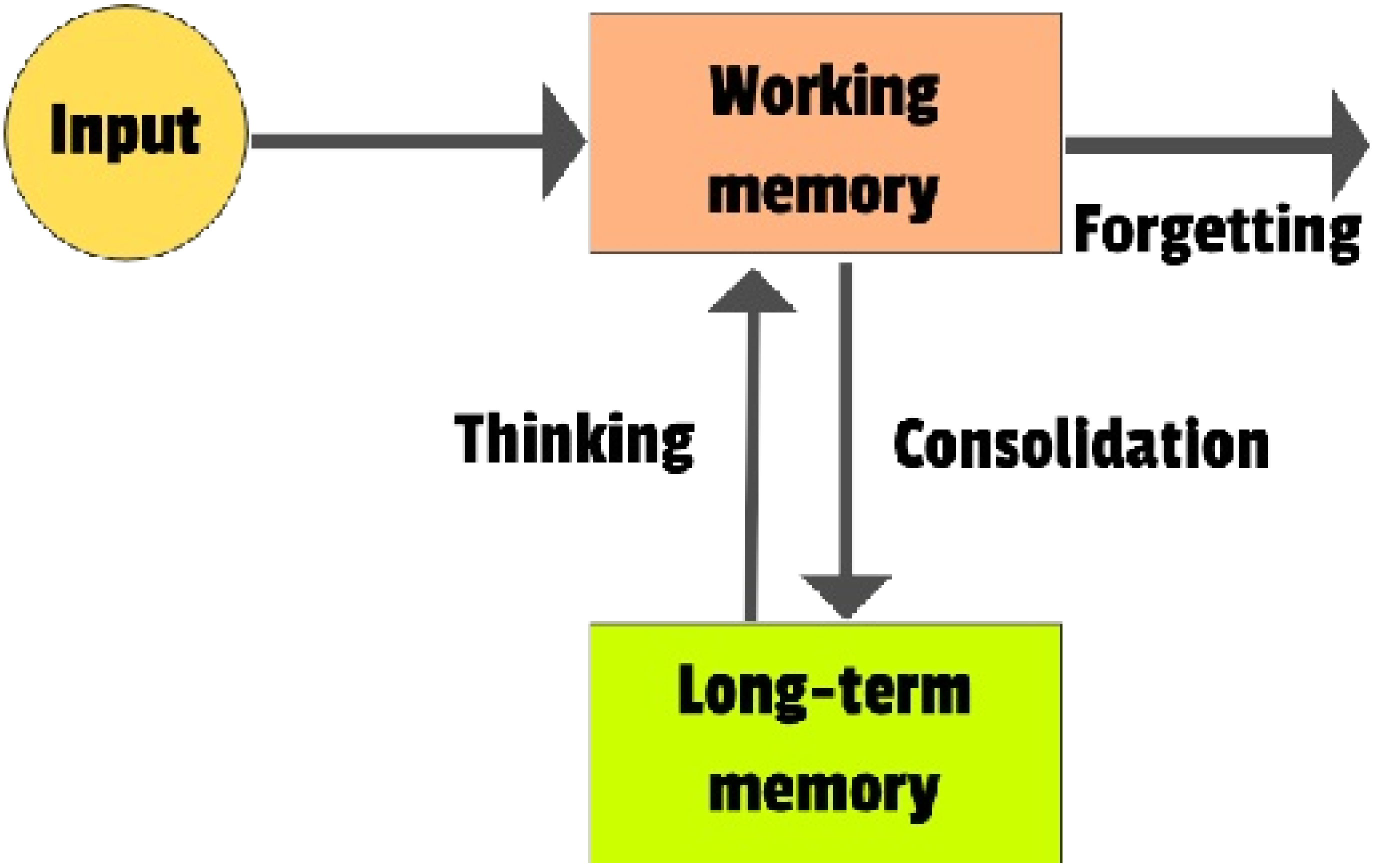
The ultimate goal of any effective learning protocol is retention, and retention is achieved by transferring information from the outside world to long-term memory. This process is known as *consolidation*, and it plays a key role in the learning system you’re about to build. When consolidation has been achieved, you no longer have to utilize as much space within your working memory when thinking about well-understood concepts.

Evidence of these mechanisms at work was provided in a study that focused on the memory abilities of expert chess players [29]. What researchers found was that the best chess players do not necessarily possess superior cognitive abilities. Instead, what they observed were behaviors that were consistent with well-organized long-term memories of different board positions. Whenever one of the masters had to make a move, they weren’t necessarily doing a ton of strategizing and abstract thinking - instead, they were primarily considering mental images of similar arrangements of pieces. From there, they would combine the new information (which is in working memory) about the board, and combine it with their long-term memories of old information.

Because these people had been playing chess for such a long time, they could retrieve old information and combine it with new information almost effortlessly. This gave them the appearance of being superior thinkers, when in many ways they were mostly just very good at using their vast store of experience in new situations.

Another example is when you play word games, like crosswords or Scrabble. When you’re faced with a problem of how to combine letters, your brain’s reaction is to place those letters into your working memory and then start a search within your long-term memory for instances of how they can be put together. Do this enough times, and you’ll begin to rely less on your working memory and more on your bank of memories to come up with new word combinations.

Retention is achieved by transferring information successfully from the outside world to long-term memory. There are ways to do this that reflect our current understanding of retention, and the Learning Factory you’re building takes advantage of them whenever possible [30].



A (simplified) illustration of thinking and consolidation. When you get information from outside of your mind (input), it is first sent to your working memory. When you're thinking about it, the input is being compared to what you have in your long-term memory. If you want to remember it, you ultimately want to place that input in long-term memory (consolidation). Most information does not make it to your long-term memory, and is instead discarded.

Chunking

As we've talked about before, taking on large amounts of information all at once is counter-productive. Your mind can only take on so much, and you need to respect its limits if you want to make any kind of meaningful progress. Working memory has a fixed capacity that simply cannot be exceeded. So if you want to learn efficiently, you need to use tools that work within the boundaries of working memory. One of the best ways to do that is something called *chunking*.

Think of it like this: if you have a string of letters - let’s say they’re M-E-M-O-R-Y - each one of those letters is taking up a single space in your working memory. Examining each one doesn’t grant you understanding of anything, and working memory capacity is being taken up by a meaningless collection of letters. But if you group them all into the word “memory,” those bits are now consolidated into one single unit - a chunk. By doing this, you’re freeing up space in working memory (since it’s a single bit of information instead of 6 bits), and there’s a concept you understand tied to it as well.

Beginning readers often struggle with comprehension for this very reason. They’re processing each letter and word very carefully, and their working memory simply can’t comprehend what they’re reading because it’s overwhelmed by these individual chunks. As time goes on and someone becomes more skilled as a reader, they no longer have to think so carefully about what’s in front of them - they’re compressing the information into chunks of things they already understand.

We’ll get into the *how* of chunking later, but for now just know that slicing big subjects into small chunks will give your mind the opportunity to move information from working to long-term memory. Once you've used this bottom-up approach enough, you'll be able to pull chunks from long-term memory together and start grasping the bigger picture.

There's also a widely-held misconception that is both related to chunking and worth addressing: that memorizing facts is not important. This is patently false, and, although memorizing bits of information without context is indeed an exercise in futility, the idea that you can make big, creative leaps without facts is simply wrong. Many people think that creativity is more important than facts, and the factually correct counter to this is that creativity or facts on their own can only go so far - you need both in order to grow mentally.

In other words, you can't have creative breakthroughs without chunks of information that will provide you with a thorough understanding of a subject. Einstein was certainly a creative thinker, but he never could have come up with relativity with creativity alone. He needed to have a strong foundation of mathematical facts at his disposal so that he could make connections that no one else saw.

A side note about creativity: *Despite what many people believe about creativity and innovation, the bulk of new and useful ideas come from combining existing concepts* [31]*. For example, the Wright brothers created airplanes by combining combustion engines and glider wings, neither of which they invented. Instead, they saw that putting the two together created something entirely novel*

- an engine with wings. Without a deep understanding of both fields, they would not have been able to make the connections they did and create one of the most impactful inventions in the history of humanity.

To make this point even clearer, imagine yourself sitting at a game for a sport that you're very familiar with. You know what's going on because you understand the rules, what players can do with the ball (if there is one), and why players get penalized. This is all built out of chunks you've assembled about that sport. Each one of those chunks comes together to form a picture in your mind about how it should be played.

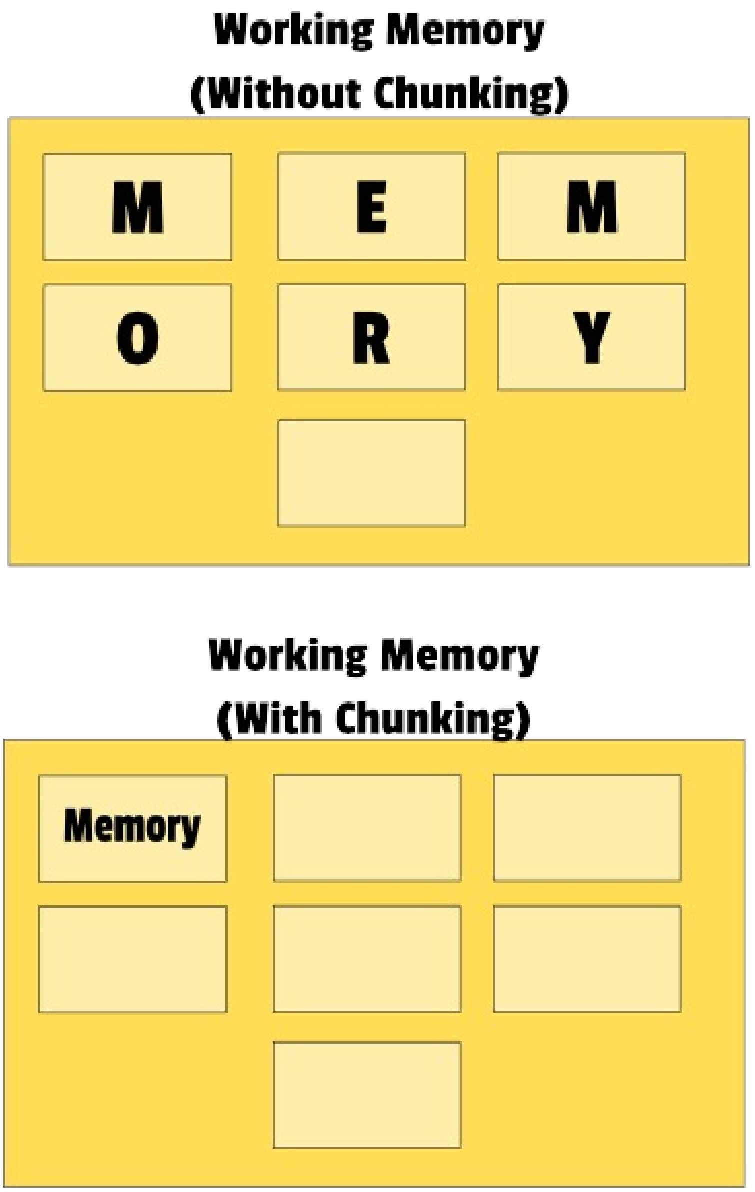
If, however, you were to sit down and watch a sport you knew nothing about, you'd be at a loss. Since there was no context ahead of time, you probably wouldn't have any idea about why the crowd is either cheering or booing, or why a certain player is considered the best. If it's a sport that is similar to something you already know (rugby and American football come to mind for me), you can probably put some things together about this new sport from chunks you have surrounding the more familiar one.

Learning a new subject follows a very similar pattern. If you don't know anything about mathematics, but jump right into learning advanced physics, you'll be completely lost. This is because the problems aren't going to explain the basic mathematical principles you need to know in order to solve them - you're expected to have that information in your mind ahead of time. Once you have the chunks you need, you can read that textbook and not only understand it, but maybe even glean some new insight that hadn’t occurred to you before.

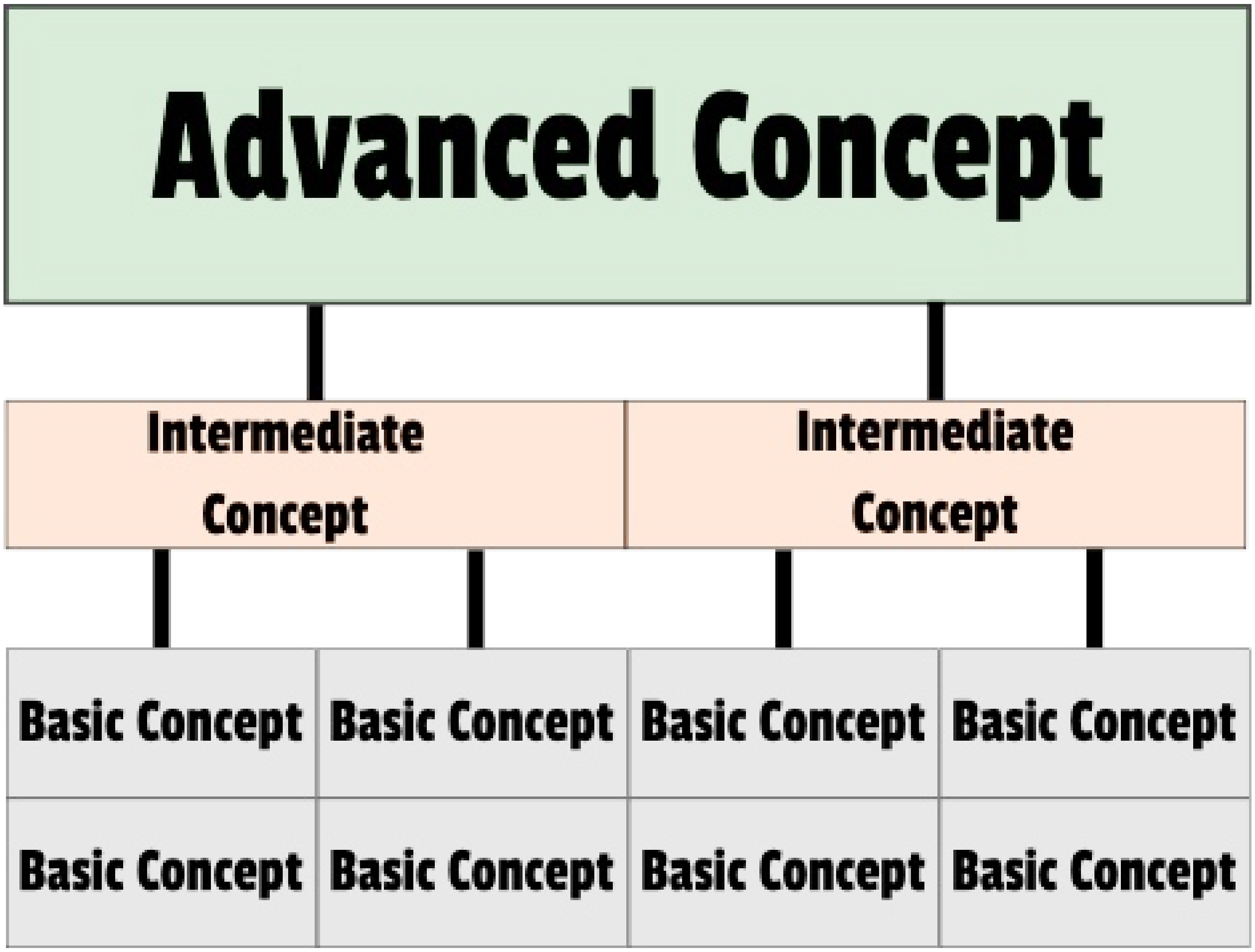
What really differentiates experts from amateurs is the ability to not only call on a vast store of chunks within long-term memory, but to also draw meaningful conclusions about new information. The chess players mentioned before could compare the board in front of them to boards from the past to inform their next move, while a chess amateur that memorized much of the same information would lack the deep understanding for it to be useful. In fact, the experts could come up with whole new strategies for defeating an opponent based on both their vast store of experience and the equally large library of chunks at their disposal.

To put it simply, experts can generate new and unique insights about their field. An amateur may very well have access to the same data, but an amateur won’t likely be able to generate new, useful data as a result.

The bottom line is that you absolutely, positively, *must* have a firm library of knowledge (chunks) at your disposal before you can make progress in your learning. We’ll focus on how you can build that library in later sections of the book. For now, keep in mind that the common refrain of “knowledge is more important than facts” isn’t correct. The two are intimately connected and knowledge cannot be generated without a factual foundation.



An illustration of how working chunking can free up valuable space in your working memory, modeled here with 7 free spaces. If you were to see the letters "M-E-M-O-R-Y" on their own (or you didn't know what they meant when combined), each letter takes up a space. However, if you're familiar with the concept of "memory", then the letters get compressed and use up only one space. Natural language is, in many ways, the best chunking tool available to us.



This is how knowledge is actually built. You must build on a foundation of simple concepts before working your way up to more advanced ones. There aren’t any shortcuts here, and if you try to skip the foundation, your depth of knowledge will be severely lacking.

Task-Negative vs. Task-Positive Thinking Modes

Another crucial component to understand before moving forward is the concept of thinking modes [32]. Each mode will help you to structure your time in order to take advantage of their benefits. These fit well into the idea of work-to-reward ratios when you're studying, and will give you a lift if you're one of those people who feels guilty about taking breaks.

Task-positive thinking is the type of thinking you do when you're focusing on a specific set of information. If you do something like sit in a quiet room free of distractions and start to read a book, your mind goes into task-positive mode. You need to spend time doing this so that your mind can hone in on important information and start the aforementioned process of chunking.

Task-negative mode thinking is when your brain is not actively zoomed in on anything specific, and instead is in a sort of wandering mode. While you're in this mode, your brain can explore more creative routes to understanding a subject that you were previously focused on in an unconscious manner. This is, counter-intuitively, a very important piece of learning.

When your mind is allowed to wander, it will often put things together that never would have clicked if you'd been in task-positive mode. There are countless stories of great inventions and ideas being stumbled upon while someone is engaged in an activity unrelated to their work. Each one of those stories is an example of the task-negative mode at work.

One of the most famous (apocryphal) examples of this was when the ancient Greek mathematician and inventor Archimedes stepped into his bath and noticed that the water level rose [33]. This illustrated an important point about volume that he'd been trying to figure out, and he was so excited by the insight that he reportedly shouted "Eureka!" ("I have found it!") and ran through the streets of Syracuse naked.

Archimedes's brain was operating in the task-negative mode when this discovery occurred - he was doing something very mundane at the time, and it had nothing to do with his work. Likewise, you should ensure that you have time every day when you do something that doesn't require much thought and you can allow your brain to cool off a bit. I personally go for walks on a daily basis, but your taste may lead you to do something else.

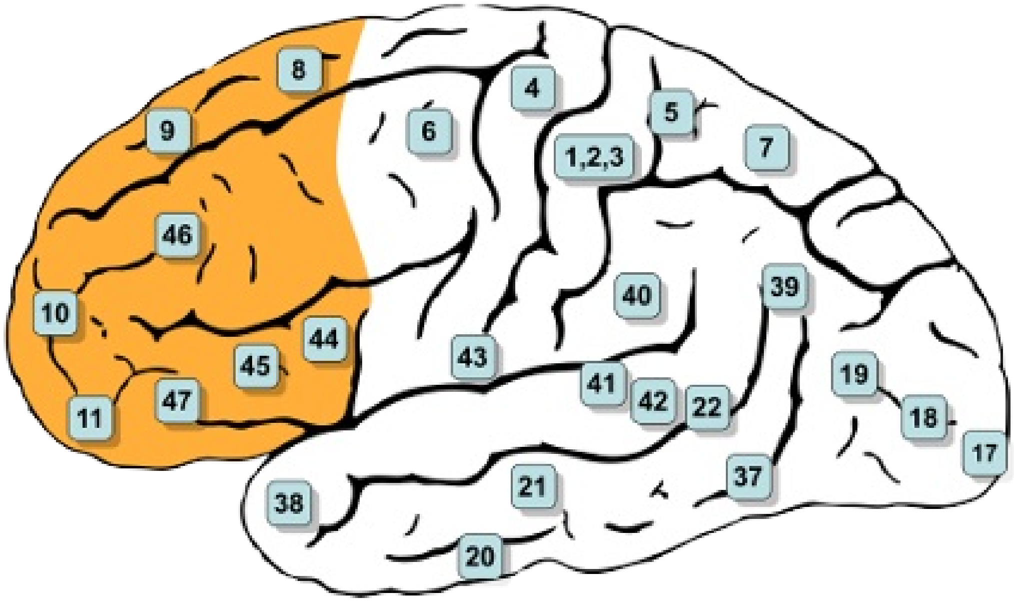
Albert Einstein was known to indulge in plenty of leisure time; he reportedly loved playing violin and riding his bike. In fact, he spent so much time doing enjoyable things while in college that one of his instructors, mathematician Hermann Minkowski, called him a "lazy dog." This goes against many tightly-held beliefs that intense focus is the only way to make progress.

I don't think anyone is going to accuse Einstein of being an underachiever, and you shouldn't think that taking time to enjoy yourself makes you one, either. Make sure you set aside leisure time on a regular basis, as this will also allow you to take advantage of your task-negative mode.

Sleep

It is tragically common to come across people advocating sleeping less to increase productivity. This is, by far, one of the worst things you can do not only for productivity, but for your body and mind's well-being. Lack of sleep has killed lab animals [34], and your brain will effectively shut down areas critical to learning, comprehension and motor skills as long as it is deprived of sleep.

Not sleeping also has a major impact on your behavior. The prefrontal cortex, located in the front of the brain, plays a big part in regulating decision-making, willpower and emotion. When you're sleep-deprived, this part of your brain can't absorb glucose (your body's energy supply) and it ends up in a dysfunctional state. The end result is that your brain (and particularly your prefrontal cortex) is under-fueled and cannot perform at capacity [35].



The prefrontal cortex, the area of your brain linked to decision making and emotion. It is heavily affected by sleep deprivation as a result of its inability to efficiently receive glucose (fuel). (Illustration courtesy of Wikipedia)

You should be worried about this phenomenon if you don't sleep enough. When your prefrontal cortex stops functioning correctly, it means your discipline has a much higher likelihood of going out the window. You'll be more prone to indulging in bad habits, such as eating too much [36], and your emotional state will be much less stable.

What's tragic is that many people consider only a few hours of sleep to be acceptable, which is absolutely incorrect. You need, on average, between 7 and 9 hours of sleep per night to function at full capacity the next day. If you elect to get even an hour less than your body needs per night, you begin to create a sleep debt [37], which your body will force you to pay at some point in the future.

Like many other so-called productivity hacks, not sleeping ends up costing you far more time than it saves. Any gains you make while sleep deprived will be minimal, work you create will almost certainly be of a sub-par quality, and you won't have very good recall of what you were doing. If you get enough sleep, your work will improve and your recall will be much better. You'll probably be far more pleasant to work with, too.

One of the most critical components of sleep is the way it solidifies information your brain has picked up over the course of the day. In other words, sleeping allows your brain to build solid connections between new pieces of information and old pieces of information [38]. This will allow you to effectively move information that you've reviewed from working memory to long term memory, where it can be useful in your everyday life.

The subject of sleep can (and does) fill up many books, so I won't spend too much more time on it. But for your purposes, you should know that not sleeping will absolutely devastate your ability to rapidly learn anything. Its devastating impact on your prefrontal cortex will also make building and maintaining discipline nearly impossible. For more information about the specifics of sleep and how it affects learning, please refer to the reading list at the end of the book.

Exercise

It’s common knowledge that exercise is beneficial, but it’s absolutely crucial for learning. Cardiovascular exercise (particularly intense exercise, such as sprints) has been shown to improve cognitive performance [39], and you should incorporate exercise into your everyday routines. There are benefits far beyond simple cognitive performance boosts that come from regular exercise, but if you’re looking for quick, simple improvements to your learning ability, it’s hard to beat intense exercise.

If you need something easy to start with, just make a point of going for a 20 minute walk every day. Not only will you be giving your body a small amount of exercise, you’ll also be providing yourself with a period of time where your mind can transition into the task-negative mode of thinking that we discussed earlier.

It’s incredible how much a walk can do for your moods as well. Studies have shown that a simple walking program is an effective way to manage depression [40]. Try taking a walk whenever you’re feeling down in the dumps. If you find yourself feeling frustrated or lacking motivation, go for a walk. You’ll be amazed how effective it is.

The finer points of exercise (and the intimately related area of nutrition) are far beyond the scope of my book, so please, I implore you, take the time after you’re done with this book to learn about it. If you’re already an avid exerciser, you’re two steps ahead and have already granted yourself a wonderfully effective cognitive boost.

Quiz

Write these down and try to answer them with memory alone. Once you've done that, look at the answers on the next page and add them to what you've written down. Later on, you'll be given tools for memorizing this information electronically.

1. What is the brain *not* designed to do?
2. Why is the brain not designed to do it?
3. What type of memory is being used when you can pull up information almost instantly?
4. What type of memory is used for thinking?
5. What does your brain prefer to do instead of thinking?
6. What sort of thinking mode are you in when you're studying a textbook intently?
7. Which thinking mode are you in when you're allowing your thoughts to wander freely?
8. What concept will allow you to create a big picture understanding by tying together small bits of information?

9. What is the simplest way to improve your cognitive abilities?

10. How many verifiable cases of photographic memory have been discovered?

Quiz Answers

1. Your brain is *not* designed to think (contrary to public belief).

2. Your brain doesn't like to think because thinking is incredibly energy-intensive.

3. Long-term memory, which acts as your brain's knowledge database

4. Working memory, your brain's staging area for combining new and old information.

5. Your brain prefers to use memory, as it is nearly effortless to utilize long-term memory

6. In this instance, you'd be in *task-positive* learning mode.

7. In this instance, you'd be in *task-negative mode* learning mode.

8. This concept is called *chunking*, and it is of vital importance when it comes to understanding complex subjects.

9. Exercise regularly. Aside from cognitive benefits, there are myriad physical benefits as

well.

10. Zero. Photographic memory (aka eidetic memory) is, as far as we can tell, a myth.

Building Discipline

Before we can begin our journey of self-education in earnest, we need to touch up on the importance of having and maintaining discipline. Without it, you're not just going to fail at building a Learning Factory - you're going to fail in *every* system. Self-control has been shown to have wide-reaching benefits for not just learning, but health, finances and relationships as well [41]. Becoming skilled at anything takes time, and you're never going to make any sort of noticeable progress unless you can consistently work on and improve your current knowledge and experience.

With this in mind, we're going to wade into how to create positive habits and routines that will get you ready for success in learning, which in turn will make you more successful in many other areas of your life. You'll quickly realize how much better life can be when you consciously make better use of your time and can leverage your knowledge to your own benefit.

I'm not going to spend this chapter berating you for not being a model of military-level self control, because I know that's not realistic. Even the most disciplined among us screw up and make undisciplined decisions from time to time. That's not the point. The point is to make better decisions *on average*. At the end of the day, having discipline *helps* you, and when you realize that it becomes much easier to do the right thing for yourself. We're all a little narcissistic, so use it to your advantage.

To take full of advantage of the Learning Factory method, you're going to need the discipline to set aside small chunks of time every day. How long those chunks are depend entirely on your schedule and level of commitment. Whether it's 30 minutes total or 30 minutes per Factory routine, you need to have the neural framework in place that will make the repetition easy to deal with.

The first key to building routines is to *start small*. One of the major mistakes that people make when they first get into a learning process is that they try to go from 0 to Navy SEAL in one day. This is especially prevalent in the world of fitness, where it's not uncommon to see people trying to get into shape by attempting massively difficult workout routines from the get-go.

I did something similar when I was a teenager, and my methods were incredibly unhealthy. I lost a tremendous amount of weight in a short period of time (over 70 pounds in about 4 months) by running until I nearly threw up and then eating nothing but fruit and peanut butter and jelly sandwiches. Yes, I lost the weight I wanted to lose and also got into shape, but I went about it in a fairly dangerous and unhealthy manner.

Most days I was completely wiped out and could barely keep my eyes open due to the massive energy imbalance I was creating for myself. My body ached incessantly from the pain of running primarily on pavement every single day. On top of that, my diet choices were completely devoid of protein, so I ended up being very skinny and not particularly muscular. Looking back, I could have achieved much better results by slowing down and doing it right.

Don’t do what I did. When you’re building a habit, go slowly. If you’re having a hard time staying with it, try using the worksheets at the end of the book that layout all the most important points of a discipline program.

I think it’s also important to emphasize that learning is best done by ***doing***. Don’t just read what I’m telling you, set some time aside today and actually do it. Not tomorrow, not after the weekend - today. Even though your brain might resist the idea of taking action (especially if you’re a chronic procrastinator), I promise that you will feel a million times better about your day if you make a point of starting immediately.

Remember the discussion from earlier about the exploration-exploitation dilemma? Even though you should be mostly exploring at the beginning, start exploiting as soon as you can. The ratio between the two should lean increasingly towards exploitation, and that’s only possible if you’re regularly practicing exploitation.

Also, don’t take the timelines I give here as a reason to set the book down and come back afterwards. Continue through the material and revisit this section as much as you need to in order to stay on track. It may take you a few months to really build up your discipline, but that doesn’t mean you can’t start building the other pieces of your Learning Factory while you’re doing so.

Step One: Pay Attention to Your Routines

Before you can make progress, you need to start consciously evaluating your everyday routines. Start observing what you do in each situation as the day progresses. At first, this will be painful. Your routines are burned into your mind to the point that you do them in a sort of autopilot mode. This becomes a major obstacle because that is your brain’s primary function in action - allowing you to operate on memory so that valuable energy doesn’t get burned out thinking deeply about what you’re doing. Imagine how tired you’d be if you had to really focus every time you brushed your teeth.

So be ready for this to be difficult to start with, particularly if you don’t have any past experience tracking your day-to-day activities. But the initial pain is worth the reward.

If you aren’t sure how to start, I’ll give you some ideas about what to evaluate:

1. When do you usually wake up in the morning?
2. What time do you normally go to bed?
3. How do you normally react when you know you have to learn something new?
4. How often do you exercise?
5. What kinds of foods do you eat on a regular basis?
6. What types of media do you find yourself consuming most often (books, music, video games, etc.)?
7. On average, how much money are you spending each day?
8. What are you spending your money on?

These are not set in stone, and you may very well be tracking some of this information already. However, the point isn't necessarily to know these specific details. The point is that, by carefully observing your actions each day, you can begin to piece together the building blocks for your own customized learning system.

Make sure you're keeping track of what you're observing. I personally use Evernote (a great, multi-platform note taking program that keeps your notes in the cloud) and Microsoft Excel spreadsheets to keep track of what I'm doing, but you don't have to use those tools. If you prefer paper and a pen, use those. The method isn't important; what's important is the fact that you're taking time every day to keep track of your own actions.

You might be thinking, "Hey, didn't you say earlier that you shouldn't be taking notes passively?" Yes, you're absolutely right. What I'm emphasizing here is the *habit* of watching your own behavior - whether you remember every bit of content you create in the process is irrelevant.

As you continue through this chain of steps, continue keeping notes on your progress and how you're shaping your routines.

You want to figure out these key points about your life:

1. What cues throw you off your discipline (e.g., text messages, social networking, etc.)?
2. What you want to learn (e.g., neuroscience, lockpicking, programming, painting, etc.)?
3. How do you approach learning at the moment (e.g., reading, TV, movies, blogs, etc.), if at all?
4. When will you be able to set aside time each day for learning (e.g., mornings, afternoons, evenings)?
5. What can learning do to help you in your daily life (e.g., make friends, start a business, get a job, etc.)?

There’s a variety of different observations you can use to answer those questions, so figuring them out will require some experimentation. What I can nearly guarantee is that keeping track of what you’re doing will have a major impact on how you run your day.

One point that absolutely must be accounted for is finding the cues that destroy your focus. Everyone has different distractions in their lives and yours will inevitably be unique. However, there are some very common distractions that affect a large number of people: email, text messages, Facebook, phone calls and videos of kittens, to name a few.

It’s shockingly easy to look at a difficult problem that needs to get solved in your life and decide that it’s an excellent time to take a break. You open up your browser, cruise over to YouTube and before you know it, four hours have flown by and you haven’t accomplished anything. This is an entirely natural process - we human beings are incredibly pain-averse. If we think we’re going to suffer in the near term, we tend to look for comfort instead.

What you need to realize is that engaging in these avoidance behaviors ultimately causes you more pain. Many people are familiar with the horrible cycle of procrastination that ends up generating self-loathing. You can get in front of it by figuring out exactly what it is that triggers those episodes of procrastination.

These cues are sometimes difficult to wrangle because they have something very powerful attached to them: rewards. Since procrastination is generally done in order to avoid perceived future pain, it is viewed as pleasurable by the brain. Make a conscious effort to identify the whole lifecycle of a procrastination routine and you'll find it much easier to break it down.

Once you have all that down, you're ready to begin the process of building the routines which will be the foundation of your Learning Factory.

Step Two: One Thing Everyday

To get started, find something really minimal that you can do right now and just do it. For example, you could get on the ground and do five push-ups, or walk to a bookshelf and read one page of a book or magazine. One particularly effective technique I used was to make the bed as soon as I woke up, then a set of push-ups as soon as I was done. This killed two birds with one stone: it built two distinct habits, and I knocked two to-dos off the list before my day even started.

It really doesn't matter what the specific habit is, as long as it can somehow aid your learning. Physical exercise has been shown to have wide-reaching effects on mental health, mood and cognitive performance, so I'd recommend you incorporate that into your routine [42].

Once you've selected this one thing, make a point of doing it in the same form every single day for the next week. If you've elected to do five push-ups, then every day settle on a time that you're going to do five push-ups. The idea is that you begin by setting aside an inconsequential amount of time that will not be a hinderance. I don't care who you are, you can set aside a few seconds every day for five push ups.

Don't set a goal for how many days you're going to do this, just tell yourself that you're going to do this one thing every day, no matter what. This will be even more effective if you go a step further and schedule a specific time every day to do it.

Exercise: Think of the first thing you should start doing every day and do it - right now. Put the book down and do that quick task. Congratulations, you've officially started to build up your discipline.

Step Three: Gradually Increase the Difficulty and Complexity

Once you've done that one small thing every day for at least a month (this has been, in my own experience, the most effective length of time), make it more difficult. If you’ve elected to use the example of five push-ups to begin with, bump that number up to at least 10 push-ups.

In addition to the routine you’ve already built, begin doing one other small thing every day, preferably at the same time. If you’re doing something like push-ups, find a mental exercise that you can easily commit to each day at a specific time. For example, commit to reading at least five pages of a book. If you began with a purely mental exercise for your original one small thing, do the opposite: begin doing something physical.

This time, instead of waiting a full month, do this specific routine for two to three weeks. You won’t need as much time because you will have developed a certain baseline level of discipline. At this point, you should have gotten over the most difficult hump in the process, which is starting and maintaining a routine.

Do this for at least five different very simple routines over the course of a couple of months. Some other simple tasks I’ve personally used that can work well include (but are not limited to):

1. Making the bed as soon as you get up

2. Taking three minutes to sit silently and meditate

3. Writing for five minutes

4. Watching at least five minutes of educational video material (YouTube is your friend)

What you absolutely *must* avoid is slamming a huge amount of discipline down your throat at once. I can tell you from personal experience that this will yield only short-term results that quickly get buried under an inevitable burnout. Your brain needs time to adjust to change, and will actively resist dramatic changes that you try to force on it.

For example, many people attempt extremely strict diets in order to reach weights that they find more appealing. Although there are always exceptions, most people that jump straight into a severely different diet will fail. It isn't necessarily because they're weak of mind and spirit. It's because the brain fights furiously against such strict and sudden discipline.

Anybody who has tried to adopt a diet that differs dramatically from their normal eating routine knows how it works. In the first few days, the dieter struggles with overcoming their cravings for foods they know they can't have. These cravings last for a while, but generally dissipate before too long. Then, the dieter finds themselves doing quite well for a brief period of time - perhaps a couple of weeks.

Out of nowhere, a devious, terrible thought arises: "Hey, I’ve been really great for two weeks, I deserve a treat!” They indulge themselves by eating something outside of their diet, such as an ice cream cone. Once the cone is finished, the former dieter decides that a brownie sounds nice as well. This continues until it becomes a full-on binge, and by the end of it any progress the person made is destroyed [43].

Situations like these are easily avoided by simply taking more time to build up the initial stages of the habit. If that same person had just waited a while longer (maybe a month or two, depending on the individual), they could have indulged themselves without too much trouble. By that time, their baseline habits would be altered for long enough that a slight deviation would not disrupt anything. They would have become so used to eating healthy that the indulgence could be viewed by their brain as an indulgence, rather than a return to a less healthy norm.

Tackling any new routine works nearly the same way. Once you’ve done something long enough, you can afford the occasional slip up, and I highly recommend you take advantage of this. (We will discuss the benefits of taking time off in a later chapter.)

Exercise: Drilling and Sparring

Remember our discussion of learning in martial arts earlier? Think about the class structure I laid out, where the first section of the class is dedicated to going through the motions of a set of techniques and the second revolves around live application of those techniques. Consider how you can do the same thing with whatever you’re learning: a slow, methodical examination of the details of what you want to accomplish, followed by some sort of application.

An example if you’re learning to program would be spending some time reading documentation about a specific language/library/framework/whatever, then finding a way (in the same day) to integrate it into your work. If you’re just starting out, it might be as simple as studying the finer points of how your language of choice models arrays and then making a simple counting program that uses arrays. You’ll probably make some mistakes, but that’s OK - what matters is that you’re both exploring and exploiting.

Step Four: Challenge Yourself

By the time you’ve reached this step, you should have established a decent base of discipline to work with. You may still be a long way from top-notch in the self-control department, but you’ve created the foundation you’ll need for building beneficial routines. Now that you’re here, it’s time to figure out some habits that can begin to have real impact in your life.

Keep in mind what we discussed earlier about deliberate practice and how your brain reacts to difficulty. Don't try to become a discipline Rambo overnight - you'll just end up shooting yourself in the foot via burnout and frustration. It's especially important to keep this in mind for physical activities, as overwork is one of the most common causes of injury for beginning exercisers.

Another thing you should focus on is a shift from specific number of repetitions to time-defined processes. It is a good idea to start out using simple routines with small numbers of defined repetitions, but once you've gotten further into the process, it becomes far more important to simply work on a skill or subject for set periods of time.

A great way to demonstrate this is textbooks. Sure, you could set a goal of plowing through 50 pages in a technical textbook - organic chemistry, for example - but will you really understand what you've just read? The unfortunate truth is that, unless you have an abundance of prior experience with the subject, you most likely won't. You'll need to take as much time as you need to focus on and absorb the material. There will be times when you need to stop, reread and/or research something further before moving on to more advanced material.

The only way to do that is to not set a goal like "read 50 pages per day." If you want to start building the habit of reading that textbook, something simple like "read at least

2 pages each day” is perfectly fine. But if you’re looking to really get into that subject, start setting a time-based goal, such as “read for at least 30 minutes each day.”

For mental activities such as writing, challenge yourself to focus exclusively on that activity in short, distraction-free bursts. I highly recommend you try using the Pomodoro technique, which involves setting a timer for a set period of time, then working non-stop until it is completed. Once that’s done, you take a mandatory break. The length of the break depends on how long the work period is, but a good start would be 25-5 (25 minutes of work followed by 5 minutes of a break).

You can find more about the specifics of the Pomodoro technique by going to its official website, PomodoroTechnique.com. I created a tool, AceTimer (52aces.com/acetimer), on my website specifically for the readers of this book that want to use Pomodoros.

This can be accomplished by adding obstacles such as time constraints. An example of this is when professional chess players play speed chess with set timers in order to improve their rapid decision making. Try incorporating a bit of pressure into your routines every few days and it will undoubtedly improve your results.

Step Five: Define Some Rewards

Willpower is like a muscle. It gets stronger the more you exercise it, but no matter how strong it gets there is a point at which you simple cannot exercise it any more. To avoid this failure of willpower, need to find a way to reward yourself for all of your hard work. Without rewards, you'll end up disillusioned with the process and have a much higher chance of failure.

Use the cues you found in step one to determine how to reward yourself. Oftentimes, building new routines is a matter of simply using the same sorts of actions that are normally associated with procrastination. But instead of jumping straight to the pleasurable thing, you commit to doing it only *after* a new action has been executed [44].

For example, if you find yourself looking at cat pictures or videos on YouTube when you procrastinate, use those activities as your reward. This would mean you use some technique to define a specific period of time for doing something (again, I highly recommend the Pomodoro technique) and then make absolutely sure you reward yourself at the end.

It's also important to set stopping times every day. This works on several levels: you have that mild stress we talked about being applied to your work, and you get to have guilt-free downtime. This gives you a nice boost of productivity and helps to prevent burnout.

This part is absolutely, 100% non-negotiable. Without rewarding yourself occasionally, you will fail while building your routines. Just be careful not to fall into the trap of rewarding yourself excessively.

Step Six: Evaluate Your Progress

Read through your notes at this point and start to pick through the routines that you've inserted into your life. How consistent are you with each one? Do you feel that you're focusing sufficiently on the problem areas in your routines? What impact has the randomness of everyday life had on your ability to maintain consistency?

Do your best to honestly appraise yourself and make adjustments to your routines that will maximize your learning. This may include rearranging your schedule, defining new rewards or, if you find that your goals have changed, shifting your routines so that you're exploring new skills or subjects.

Step Seven: Remove Your Crutches

Some people are really intent on tracking everything in their lives. There's even a whole "movement" associated with collecting data about yourself on a regular basis called Quantified Self (called QS from here on out). In fact, not too long before writing this book, I went to a local QS Meetup group where one participant had a particularly bizarre story about self-tracking that involved food.

One of the most common metrics to track within the QS community is food intake. It’s relatively simple to watch, and progress can be measured by simply stepping on a scale. In fact, it’s become so common that there are now a plethora of apps that will do the work of tracking your food intake for you. But this person took it a bit further than that. He tracked the weight of all the food that went into his body...and the weight after it came out. *Nasty*.

The point of that story is that tracking is fine - to a point. Was that guy really gaining insights by weighing his own poop? I doubt it. And even if he was, think about the logistical and social implications of that. I shudder to think how he handled bathroom visits while in public places or at social gatherings (assuming he was invited to any). Keep track of what you’re doing, but don’t go overboard.

If you want to continue tracking, by all means do so. I personally try to be as self-reliant as I can, and part of that means I don’t want to rely on structured tracking and/or apps to ensure that I’m doing the right thing in the long-term. So after I’ve worked on incorporating a new routine into my life for between one and three months, I’ll either stop tracking it completely or tone down the level of detail.

This has made me far more self-sufficient, and I’ve found that I have no trouble keeping on the right path once I’ve done something long enough. On top of that, I’ll define a goal I need to reach that will require me to keep a pace that is either the same or similar to what I had before. I’ll then set a date for checking my progress on that goal, and if I’m not making adequate progress then I will start tracking again.

Most of the time, I don’t need to do that. But when I do, I hop back on the tracking wagon with the same enthusiasm I had before. Once I’ve done that for long enough, I can try going off again to see how well I do. Rinse and repeat.

Failures

There will be times when, for one reason or another, you’ll fail to maintain discipline. It can happen at any stage of the process. If and when this happens, keep this in mind: **it’s not the end of the world**. Everyone screws up and you shouldn’t expect yourself to be perfect as you work to improve yourself. Take notes on what you did wrong and how you can do better next time, then start the next day fresh.

I will say this, though: don’t use this as an excuse to make the same mistakes over and over again. Occasional slip-ups and cheat days are to be expected, but not regular mess ups. If you’re finding your discipline slipping on a regular basis I suggest you take an inventory, start collecting data and figure out why you’re not making progress.

Quiz

1. What type of tasks should you be using to build your discipline at the earliest stages?

2. What should you define in order to keep yourself motivated?

3. What technique can you use to stay focused for short periods of time?

4. What should you do if you allow your discipline to slip?

5. What should you be doing on a regular basis to further develop your discipline?

Quiz Answers

1. Simple, fast tasks that don’t require much thought or commitment. By doing this, you’ll be able to build up a steady routine that can later handle more complex tasks.

2. Rewards! Make sure you have some rewards defined so that you can get some psychological relief from the stresses of working and learning.

3. The Pomodoro technique, which uses short periods of focused work followed by small, unfocused breaks.

4. Take notes on what you did wrong and move on - don’t dwell!

5. Challenging yourself, but make sure you don’t go overboard - if you do, it will end up being counterproductive.

A Sample Discipline Program

Here’s a program you can use to get yourself started. It incorporates mental and physical activities that will act as an incredibly beneficial baseline for you. I encourage you to modify the types of activities and times to reflect your personal needs and schedule, but to keep strictly to the general guidelines when it comes to frequency of repetition.

As you continue to read this book, find ways to incorporate the outlined activities into your routines. This is why I only assign a small number of activities to begin with - you’ll need to fill in other things (such as flashcard review, which we’ll talk about later) as you go. Remember: this is just a baseline framework for you to use. Play with your routines and shape them until you’re on the path to whatever it is you’re trying to accomplish.

Stage 1 (Weeks 1-2)

Make bed after waking up

5 reps of bodyweight exercise (push-up, pull-up, etc.)

1 page of reading or writing at 9 AM

Stage 2 (Week 3)

Make bed after waking up

10 reps of bodyweight exercise (push-up, pull-up, etc.)

15 minutes of mental work (writing, reading, etc.) at 9 AM

Stage 3 (Weeks 4-6)

Make bed after waking up

20 reps of bodyweight exercise (push-up, pull-up, etc.)

2 25-minute pomodoros (with defined 5 minute rewards, such as browsing Facebook) of mental work (writing, reading, etc.) starting at 9 AM

Stage 4 (Weeks 6-8)

Set a goal that forces you to gradually build every day. For example, you could say “I want to have a book written by the end of next month.” In order to do this, you’ll probably need to spend at least an hour a day writing. On the physical side of things, you could say “I want to run a marathon within three months.” That will require you to train consistently and make good decisions relating to your physical health. Either way, goals such as these are not things you can just “cram” for (trying to either write a book in a day or run a marathon with only one day or practice under your belt will probably not end very well!).

Another important point about setting this goal is that it must be specific. People often like to give themselves vague goals because it becomes much easier to disregard the work that’s required to achieve them. Common examples would include things like “Live a happier life” or “Get skinnier/stronger.” These are far too subjective to be useful.

Set a goal for yourself that can be quantified. Rather than say, “Live a happier life,” figure out what will make you happy in the next three months and set a goal for that. One common example of this is travel. Many people (including myself) love to travel, and want to do more of it. Figure out what it will take to do that thing more often and then set a goal to achieve it. This might mean something along the lines of “save $1000 by August 31st” so that you can buy a plane ticket.

Using the physical example is much easier because you can clearly define goals in terms of weight. Instead of trying to be skinny or strong, define what that means by saying “Lose 10 pounds by March 25th” or “Bench press 300 pounds by June 2nd.” In order to accomplish these things, you’ll need to maintain discipline - a resource you should have at your disposal at this point.

Evaluate yourself at the end of this period and review your progress. Did you achieve your goals? Whether you did or not, you’ll have processes to improve upon. Be honest and critique yourself to determine how you could have done better. If you didn’t make it because of discipline issues, go back a stage or two and stay there until you’re confident you can wean yourself off of tracking your everyday activities.

Once you’ve gone through all of these steps and have built up your discipline, build a list of goals for the future. Then use your own variation of this program to knock them out, one at a time.

Bonus: Hacks

If you really want to up the level of your productivity, you can use a few of these time and/or effort-saving tricks that I've used over the years.

Pomodoro Tools

Rather than just timing yourself with a stopwatch, you can now use a multitude of online and mobile apps that will take care of your Pomodoro periods for you. I personally use my own app, AceTimer (www.52aces.com/acetimer), on my computer and Clear Focus on my phone. If you want to try another tool, another one I've used successfully is Tomato Timer (www.tomato-timer.com). Using an app in this manner will save you the time and brainspace required to use a simple stopwatch and give you audio cues (such as a buzzer) to remind you when to stop.

Pomodoro Queues

Another easy and effective concept you can use is what I call the Pomodoro queue. It’s very simple and straightforward, but having one in place will help tremendously when you’re first starting out and want to build a Pomodoro habit. Decide on several activities (I recommend no more than three if you’re just starting out) and put them into a list of some kind. For each subject, figure out a beneficial way to either learn about it or work on something related to it in a Pomodoro time frame.

This will give you a linear, easy-to-follow list of items that will keep you on track. I also recommend that you put the most difficult subjects/activities first. The more you do this last part, the more you’ll start to realize that the difficulties you perceive aren’t that bad, and subsequent Pomodoros will be much easier (even pleasurable) to deal with.

My personal technique for using Pomodoro queues is to place the subjects I want to study for the day into a Google Docs spreadsheet (you can use Excel or even a word processor, but I prefer this setup for its cloud-based access and flexibility). The format looks like this:

Date	1	2	3	4	5
1/1	Writing	Reading	Programming	MOOCs	Anki

I’m currently in my “Writing” Pomodoro, and I’ve been using this format to write this book. It’s an incredibly easy and powerful way to ensure that you focus all of your energy on a certain task, particularly because there’s a reward waiting at the end. I like to watch YouTube videos (especially documentaries) whenever my Pomodoro periods are up, but use whatever you think will be relaxing and rewarding.

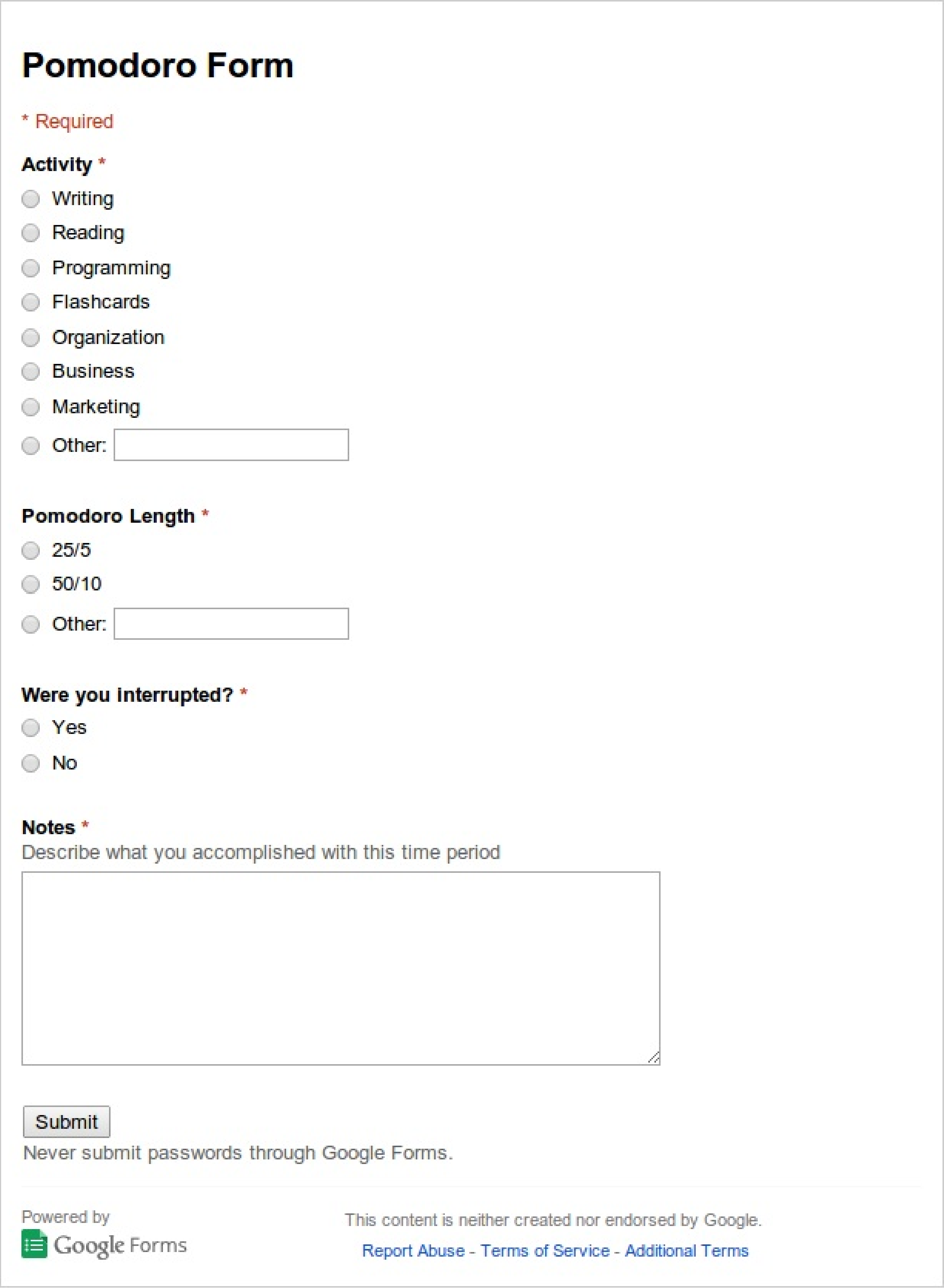
You should view each one of those subjects as possibly having multiple Pomodoro sessions. For example, in my own system I usually will do at least two Pomodoros of writing before moving on to whatever is next that day. The quantity of Pomodoro blocks per subject is highly dependent on my schedule, but I make sure I do at least one for each topic.

You can create something similar, although I recommend you hold off on doing five Pomodoros until you've had some time to build up the habit. You're better off doing one or two at the beginning and going up from there.

Use Google Docs Forms to Track Yourself

Online forms used to be things that were understood exclusively by those who worked with web technology, such as web designers and developers. However, Google has changed all of that with the introduction of Docs and its accompanying Forms document type. Forms allow you to quickly and easily create forms and, as an added bonus, the responses get recorded in a spreadsheet. To top that all off, with the click of a menu button the responses can be graphed so you can view a statistical representation.

I’ve used this for various things over the years, but you can use it for keeping track of what you’re doing while you learn. One idea you can use is the Pomodoro tracker, which is simply a form that you use to record what you’ve done with each focused work period you undertake.



Pomodoro Form

* Required

Activity *

○ Writing
○ Reading
○ Programming
○ Flashcards
○ Organization
○ Business
○ Marketing
○ Other: ______

Pomodoro Length *

○ 25/5
○ 50/10
○ Other: ______

Were you interrupted? *

○ Yes
○ No

Notes *

Describe what you accomplished with this time period

Never submit passwords through Google Forms.

This is a simple Pomodoro form I created to keep track of what I do with each period. This idea can be extended to anything you want to *track: exercise, books you’ve read, places you’ve been, etc.*

As you can see from this example, it is a simple, straightforward form. This is done to ensure that filling it out doesn’t become a huge chore. It gets to the core of what I want to track: what I did, how long I did it and whether there were any issues. If you’d like to know more about creating forms like this, take a look at Google’s guide here.

Small Wins

As you go through this book, I want you to keep this idea in mind: **it’s all about accumulating small wins**. By achieving small goals successively and consistently, you’re setting yourself up for success later on. If you don’t know anything about a subject and decide to dive into a hopelessly complex project right off the bat, you’ll only discourage yourself.

By accomplishing small, manageable goals on a regular basis, you’ll get a huge psychological boost and will avoid burning yourself out early on. Even more importantly, your small wins will eventually compound themselves into a few large wins, but don’t focus on that now. Right now, you should only care about your daily process.

Think of it as if you’re climbing Everest. While you’re at the bottom, you can take many steps and, when you look up at the summit, you’ll feel like you haven’t made any progress. But if you keep taking those steps, you will eventually reach the top. Whenever I go hiking and I’m climbing a big hill, I prefer to just keep my eyes forward and not look up. You should do the same thing when it comes to learning. Focus on the steps directly in front of you and, before you know it, you’ll be looking out over the majestic view from the summit.

To paraphrase the ancient Chinese philosopher Laozi: “A journey of 1,000 miles begins with a single step.”

A Note About Flexibility

There are going to be times when, for one reason or another, you simply won’t be able to handle your daily tasks. This is to be expected, and, in some situations, can be a good thing. For example, if you have an opportunity to do something incredible that may put you in a situation where you can’t use your daily program, take my advice: do it anyway! Don’t turn down the opportunity to grow as a person and/or experience new things just to maintain a rigid schedule. You can always come back to it later.

Another inevitable phenomenon you should be ready for is not being able to put in adequate time for each bit of your routine. I’m not giving you an excuse to slack off (we all know how easy it is to say “I just don’t have time” when you’re really just procrastinating) - what I’m talking about are extraordinary circumstances.

I’ve been consistently writing this book every day, but there have been days when I’ve had to travel all day. On those days, I still ensure that I take care of my daily routines - including writing. Unfortunately, this sometimes has meant that I can only contribute a paragraph or two. On a couple occasions, the contributions have been as small as a couple of sentences.

Life often gets in the way, and what matters is that, regardless of circumstances, you should do your best to contribute at least a little bit even when circumstances are far from ideal. Every little contribution helps, even if it isn’t massive. That mentality will keep your streaks of consistency alive, and provides a nice psychological boost.

It’s weird - once you’ve done something everyday for long enough, the prospect of breaking your streak starts to feel downright uncomfortable.

Starting the Learning Process

The first thing you must do before embarking on the quest of learning is to figure out exactly what it is you want to learn. Even more importantly, you must define *why* you want to learn it. In my experience, you’re far more likely to stick with something if it has real-world, practical application.

For example, learning another language can be tricky if you don’t have an immediate need for that particular language. After a trip to Paris in 2011, I came back with a fervent desire to learn French. Unfortunately, my desire dissipated quickly because, once I got home, there was really no need to learn it. It was essentially a luxury to learn French, and more practical pursuits quickly trumped it in importance.

Although in many ways this was a failure of discipline on my part, it also reflects a very basic truth about learning something difficult: **if it’s hard to learn, it better be practical**. To use language as an example, you should have a concrete reason in your mind for learning a new one. Having a direct correlation to your salary is an especially potent motivator. Perhaps you work for an international company that will give you a raise if you move to a certain country. Learning the native tongue of that nation could end up making you far more valuable to your employer.

Nearly everything worth learning is going to require a substantial and consistent commitment, so be sure you know exactly why you want to learn something before starting. Otherwise, you’re just wasting resources you can never get back: time and energy.

Once you’ve (hopefully) taken at least a small amount of time to figure out the *why*, you need to start working on the *how*. Determine sources of information that you’ll get the most benefit from in the shortest amount of time. There are a variety of ways to accomplish this, but here is the process I use:

1. Go to Wikipedia and type in the most general term you can think of related to what you want to learn. For example, if you’re trying to learn how to program, go to the Wikipedia page for “computer programming.”

2. Read through the article and, as you’re reading, start a list of topics that show up consistently. To continue using the example of computer programming, you’d likely want to include algorithms, variables, programming languages and so on. Keep this list handy, but don’t do anything with it yet.

3. Look around for online communities that

focus on the topic you’re interested in. Probe around for relevant subtopics, books, online classes or anything else that might be useful for a beginner. Seek out the recommendations for people that have experience with the subject, and heed warnings about bad learning materials that might be a waste of your time.

4. Create a booklist with as clear of a progression as you can create. Start with books that are going to be easier to understand and give you the basic building blocks you’ll need later on, then work your way towards advanced texts.

A Warning About Recommendations

As you’re doing all of this, embrace the fact that, even with extensive research, you won’t know exactly where to begin. You’ll find a million different answers to the question of “Where do I start?”, particularly when you’re asking for recommendations from seasoned practitioners. While there is plenty of good advice to be gleaned, be wary of advice from those who recommend overly complex and/or difficult tasks right off the bat.

The problem is that many people with experience don’t remember what it’s like to be in your position. They also might have had experience ahead of time that gave them a leg-up on learning, and they either don’t recognize it as an advantage or just don’t factor it in when they consider how they started. This isn’t universally true, of course, but this does happen quite frequently. Additionally, if someone has been in a field for decades, they probably learned the subject at a time when it was much different and/or the materials available were of a much lower quality.

Both of these issues are readily apparent to anyone wanting to learn fast-moving skills such as programming. If you ask about where to begin in that field, get ready for salty old grey beards to tell you to begin with the simplest and oldest programming languages around (such as C or, if they’re really bitter, Assembly). On top of that, they’re probably just going to tell you to read a book and code everyday. That’s probably how they developed their skills, and they’re going to believe it’s the best way to do things.

Although this sort of method can be effective, it is truly the longest, most inefficient way to learn. Many fields, especially programming, have come a very long way in a relatively short period of time, both in terms of available learning materials and technologies used by practitioners. Sure, if you have time to burn, you can learn Assembly (which, to you non-computer people out there, is one of the most arcane and difficult languages to pick up), but the difficulty involved will probably turn you off to the subject if you’re just starting.

We’ll talk more later about how books and everyday practice aren’t quite enough to make progress in a timely fashion, but for now just know that you will never find the “ideal” starting point. You will end up feeling overwhelmed by some of the material you’re going through and it will take some time for you to figure out what you’re capable of understanding during the early stages in your learning.

Learning Funnels

What bogs down many people (and I include my past self in this) is a lack of organization. Structure is, in many ways, what makes people view college as a prerequisite for high-level learning. There's some truth to that, but I'm going to show you a way to keep yourself on track so that you don't need to go to school in order to gain real depth of understanding.

The first piece of your learning system needs to be a series of what I call *learning funnels*. These provide you with a reference for what you're learning and methods for learning it. It's a great way to keep yourself from becoming distracted by every interesting-looking book, MOOC or other material that you come across. This is something I struggled with tremendously, as I find myself drawn to a wide variety of subjects.

There's a great deal of value in being well-versed in many subjects, but you'll find that spending concentrated chunks of time focusing on one thing at a time is a much better way to expose yourself to each subject. The trap that most people fall into is that they become habitual generalists - they simply see something interesting and dive into it. Don't do this. Instead, use your previously determined goals to create a linear progression of learning that will ultimately lead to exponential growth in your knowledge.

There are a variety of ways to do this, and you may create a better one yourself later on, but for now I have an easy to use method that anybody can pick up today. It’s simple, effective and will keep you on track without much effort.

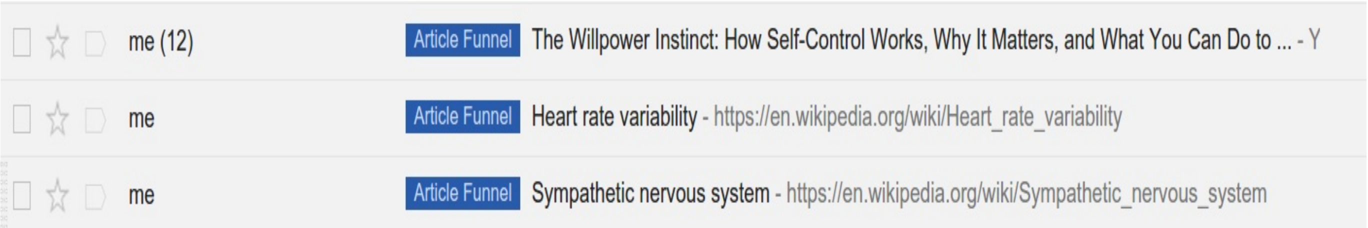
Article Funnel

This part depends heavily on which email provider you use, but I personally prefer Gmail. It’s easy to set up an account, the interface is simple and it integrates with Android very nicely.

No matter what provider you use, create an email address. This is an address that you will never, ever give to anyone and will be used exclusively for your learning funnel. I’d recommend you give it a name like “ learningfunnel12345@gmail.com” or something along those lines so you won’t be tempted to use it for anything else.

If you’re an advanced enough user to know how to tinker with your settings, go ahead and set up forwarding so that everything sent to that email address ends up in your regular inbox. This will save you time, as you won’t have to open up a new window to check that specific address. Gmail even has a “filter” feature that will automatically slap a label on messages of a certain type, and I personally use it to clearly label items for my article funnel.

The end result is that my inbox has items that I can immediately recognize as being part of my article funnel. Messages that get sent to the funnel get the words “Article Funnel” with a blue background placed next to the subject line.



me (12) Article Funnel The Willpower Instinct: How Self-Control Works, Why It Matters, and What You Can Do to ... - Y

me Article Funnel Heart rate variability - https://en.wikipedia.org/wiki/Heart_rate_variability

me Article Funnel Sympathetic nervous system - https://en.wikipedia.org/wiki/Sympathetic_nervous_system

A few items in my current article funnel. The top-most item is actually part of my book funnel, which will be discussed later.

As I mentioned at the beginning of the chapter, spend some time on Wikipedia and the web exploring articles related to the subject you want to learn. My personal process is to start with Wikipedia, then move on to using Reddit (reddit.com), which usually has plenty of links to relevant articles and discussions. I generally look for a sub-forum (called a subreddit) about the subject and go from there (for example, a subreddit for learning to program exists called /r/learnprogramming).

Your other sources may vary, but I cannot recommend starting with Wikipedia highly enough. The articles can be verbose and hard to decipher at times, but they are very thorough and can provide a great springboard for learning the ins and outs of a subject. The sheer amount of links you'll find in a base category article (pages such as "Spanish", "Language" and "Computer programming") alone is enough to keep your learning funnel filled for the foreseeable future. Once you find some articles you feel are relevant, send the links to the email address you just set up.

I find myself doing this with Wikipedia's mobile app just about every day. You can also send links from other websites as mentioned, since many Wikipedia articles are verbose and difficult to understand (especially those that are related to really technical subjects) and you may have better luck elsewhere.

At the early stages of your learning, this material is going to be unfamiliar and you're almost certainly going to start feeling overwhelmed by the sheer amount of stuff you are unfamiliar with. This is normal, and don't let it stop you from reading through each article anyway. We'll discuss how to parse this information in a constructive manner in the next part of the book, but for now you need to focus on building up a small database of facts that you can start to use immediately. Again, you need a library of facts before you can generate knowledge and understand context, so you should start doing this on day one.

You should now have a nice little list of items to work through. Do yourself a favor and don’t send 50 links on the first day. As mentioned before in the section on discipline, you should start small and progress from there. Limit the number of articles in the email funnel to 10 when you’re first getting started.

This is an easy to use tool and, once you’ve used it long enough, you’ll find yourself constantly sending messages to your article funnel. It’s great for those times when you stumble upon a chunk of knowledge you know will be useful in the future and want to remind yourself to study it later.

For example, some time ago I was having a debate with a friend of mine about the pros and cons of investing in real estate. He brought up 1031 exchanges, which provide a way to defer capital gains, and I realized I knew nothing about them. As a finance person, I realized this was relevant to what I did for a living.

After we finished talking, I immediately pulled out my phone, opened the Wikipedia app and opened the article on 1031 exchanges. Rather than reading it right then and there, which would have accomplished very little, I used the app’s “Share” feature to send it to my funnel.

When I got home that night, I opened up my inbox, found what I’d sent to myself (which is specifically labeled as educational material) and then proceeded to run the relevant information through my Factory.

I highly recommend you get into the habit of doing this. Many people like to carry notepads around, but I find this to be a much more organized and efficient way to keep track of things I want to learn. It also saves time: since you probably check your email every day anyways, this allows you to kill two birds with one stone: check your email and progress through learning materials at the same time.

Note: If you set up forwarding to your normal inbox as I suggested earlier, you can create a real incentive for yourself by making a goal of having an empty inbox everyday. This will ensure that you take care of all of the items in the funnel ***and*** *you'll have a clean inbox.*

Article Funnel: Alternatives to Email

Some of you might not be particularly thrilled at the prospect of potentially adding to the clutter of your already overflowing inboxes. This is understandable, and, as a result, I'm going to provide some alternatives you can use instead.

The simplest way to avoid using an inbox is to use a word processor document. This isn't the most convenient method since you'll have to open it and copy and paste each new article URL into it, but it does work. To cut down on the inconvenience, I would recommend you use a cloud-based word processing solution, such as Google Docs. Doing it this way, you can access your funnel from anywhere (including a smart phone) and you won't have to worry about excessive articles clogging up your inbox.

If you want to do it this way, adding items is pretty straightforward. All you have to do is create a new document, add an ordered list, then copy and paste URLs for each article into the list. It ends up looking like this:

1. https://en.wikipedia.org/wiki/Procedural_memory
2. https://en.wikipedia.org/wiki/Implicit_memory
3. https://en.wikipedia.org/wiki/Explicit_memory

As you process each item, delete it from the list. Again, you should avoid overwhelming yourself (at least in the beginning), and focus on a small number of fundamental topics.

If you're looking to utilize an app for your learning funnel, I can suggest two that have worked well for me in the past: Evernote and Pocket.

Evernote is one of the most useful apps on the planet, and I've used it very successfully for article funnels in the past. Although I prefer to use email for my funnel and challenge myself to have “inbox zero” at the end of the day, you may find Evernote to be more suitable.

Evernote does have the ability to hold entire articles, so if you prefer to not look at the original source and keep everything consolidated in one place, this app may be what you’re looking for. If you do choose Evernote, you have one of two options for using it as a funnel: create an ordered list (just like using a word processor) or you can just send the article to Evernote. Either way, you’ll have the ability to create tags and organize your articles in a more orderly fashion than might be possible with email.

Pocket also offers a decent solution that focuses exclusively on article reading. There’s a browser plugin and a phone app that you can use to capture articles, which are then presented in a grid interface. It offers a very polished, clean way to read articles that I recommend if you’re looking for a solid app dedicated to keeping track of articles.

One reason I prefer not to use solutions outside of email is that I don’t want to continue expanding the number of apps I use. More moving parts means more complexity, and more complexity means more maintenance. I want to keep things simple. However, you may have a different philosophy and if that is the case Evernote and Pocket are both good solutions.

A slightly more sophisticated solution is an app called

Pushbullet. Pushbullet allows you to send files and links between your phone and your computer, and I’ve been using it more and more since I discovered it. It allows for all the functionality and ease of a basic email funnel without clogging up your inbox.

Book Funnel

The next funnel is a list of books for you to read. I personally use the Goodreads service and a “To Read” list to keep track of what I’m going to read, but you can just as easily create one with a word processor or even a regular piece of paper. Goodreads (goodreads.com) is my preferred option because I can reference the list wherever I am and I don’t have to haul anything around with me.

Either way, make a list of books related to your subject. Keeping in mind my previous advice about recommendations from industry veterans, assemble a small list of books. I previously mentioned Reddit as a great place for finding articles, and it turns out to be a pretty good place to find books as well. Many subreddits even have recommended reading lists that you can reference.

Hold off on reading those books for now. You don’t want to start going through your list until you’ve learned how to effectively transfer the information in the pages you read into your long-term memory. For the moment, just focus on picking out some books and structuring your reading list how I describe in the following paragraphs.

After trying many different methods, I’ve found that the best way to get started is by reading small, simple texts before progressively moving on to larger, more complicated volumes. This gives you a chance to get a taste of a subject and have some small wins without burning you out.

The bit about getting a taste is important because you may very well find that a subject, although interesting from afar, is something you just don’t like very much. There are going to be some subjects that I personally believe have too much usefulness to be ignored (particularly mathematics), but maybe your previous admiration of Ancient Roman history will be diminished by a closer examination.

However, if you find that you’ve plowed through a short intro and are hungry for more, finishing the book will motivate you to move forward with your learning.

There are several ways to structure your reading list, but I’ll focus on the two that are the most applicable to the highest number of people. The first is a list for someone that has a single subject they want to be an absolute master of, and the other is for someone that wants to learn multiple subjects.

If you want to learn just one subject the structure is pretty straightforward. Start with small, easy-to-digest volumes at the top, and end with difficult, dense books at the bottom. The books at the top should be of the “For Dummies” variety - simple guides designed for the layperson. Aside from the “For Dummies” books, you can usually find simplified introductions for whatever subject you’re trying to pick up.

This first approach is well-suited to people who already have a degree of experience with something and are looking to upgrade their understanding and/or skills. It’s also a good method if you’re strapped for time and can’t afford too much dallying.

A good alternative to the “For Dummies” series that covers many different subjects is the “A Very Short Introduction” series by the Oxford University Press.

For those of you that, like me, are wanting to explore more than one subject, then the structure is a little more involved. Rather than just one long list for one topic, build a large list with chunks of subjects that you’re interested in. Chunks are made up of three to five books, all of roughly the same degree of difficulty and length.

The chunks then depend on where you are in your learning process. Subjects that you’re entirely unfamiliar with should obviously have initial chunks that are of the “For Dummies” variety. Assuming that you found the subject interesting and/or useful, your later chunks should be more advanced.

The idea here is to focus intensely for a short period of time on each subject. If you have only one book on a subject in your list, then chances are you won’t get much depth to your knowledge [45]. However, if you’re looking to become well-versed in a subject (but not necessarily a master of it yet) breaking your learning into chunks is a nice middle ground.

Another key concept to keep in mind is that once you’re past the beginning stages you’ll need to start reading books about specific areas of the subject. It’s easy to believe you’re well-versed in something after reading a book that gives a sweeping overview, but to really understand it you’ll need to start diving into the various branches of knowledge.

Take, for example, the study of World War II. It’s somewhat time consuming, but otherwise fairly easy to get a general idea about the timeline of the war and how it played out. However, if you really feel like you’re an expert, put this book down and take a trip to your local bookstore. Once there, find the area dedicated to World War II. After seeing the mountain of volumes dedicated to specific time periods within the war, units that fought and the multitude of battles waged, do you still think you know everything about it?

That effect is even more pronounced when you look at technical subjects such as computer science or mathematics. You could easily settle on a single obscure branch of one of these topics, spend a lifetime studying them, and still not know everything.

No matter how you decide to create your list, make sure you intersperse unrelated, pleasurable books into your list. Aside from the psychological relief and burnout prevention you get from it, this also allows your brain to wander a bit and make potentially unique high-level connections to what you’re learning [46]. Intellectual wandering can also provide unexpected inspiration.

To use myself as an example, I find myself drawn to stories of struggle and have come to find a much deeper appreciation for what I have and how discipline can save lives. Reading books about people such as Louis Zamperini (*Unbroken*), Shin Dong-hyuk (*Escape from Camp 14*) and Solomon Northrup (*13 Years a Slave*) made me realize that, despite my perceived difficulties in life, things could always be much, much worse. They also encouraged me to develop a strong mind and body so that I stand a better chance of surviving real hardships.

I also occasionally indulge myself in science fiction and fantasy, such as Douglas Adams’ *Hitchhiker's Guide to the Galaxy* series and George R. R. Martin’s famous *A*

Song of Ice and Fire books. After reading an abundance of nonfiction, it's nice to let the mind relax a bit. It's also exceedingly easy to read these books, as comprehension isn't the goal and I don't generally put these sorts of books through my learning system.

Throughout the course of this book, there will be an emphasis on taking brief breaks and rewarding yourself for your hard work. More on that later.

Bonus: Finding Good Information

With the vast number of books available today, you might be wondering how to find the best material for your book funnel. It's painfully easy to find books that claim to be "science for the layman" that are really just selling debunked and/or unproven phenomena to prove a point (Deepak Chopra, I'm looking at you, pal). I use a relatively straightforward process to separate the wheat from the chaff:

1. **Determine if there's evidence**

   Search around for the concepts and studies the author uses as a basis for their conclusions. Look to see if there is any significant amount of controversy and, more importantly, if the author and/or their sources have been outright discredited. There are a fair number of books out there that sell themselves as being firmly rooted in science even though the concepts involved are about as scientific as alchemy.

Some authors don’t try to sell their work this way, and present their information in a more casual, “This is just how I see it” manner. This has its place, and I personally appreciate it when an author is willing to admit that their ideas are not necessarily scientific.

If a book passes the initial screening, you should then focus on how the evidence is presented in the book. A big warning sign for me is when the book relies primarily on anecdotes. Quite a few sales and business books use this format: “Anne, a sales executive from Omaha, was losing clients left and right - until she started doing A, B and C. Now she’s the head of her very own multi-million dollar company!” Sorry, but this doesn’t equate to evidence. Anecdotes, especially anonymous anecdotes, should be viewed with skepticism.

2. **Consider the source**

You should always consider who wrote the book you’re about to read. What kind of credibility do they have? Have they been caught lying and/or exaggerating in the past? Is their primary motive to sell books, or educate people? You may also want to look at academic credentials, although I will say that there are plenty of authors with impressive titles that abuse their position. Doctor Oz, a world-renowned heart surgeon who peddles junk “alternative” medicines, is an excellent example. Another person who fits this mold would be Eben Alexander, a neurosurgeon who published a book (*Proof of Heaven*) about a supposed visit to the afterlife that received substantial criticism from medical professionals [47] .

There are also some relatively average people that have written some incredibly useful, scientifically sound books as well. One person that comes to mind is Charles Duhigg, who graduated from Yale with a history degree and wrote an excellent book about the science of habit formation (*The Power of Habit*).

One thing that I personally view as a big red flag is when the author sells themselves as the oppressed bearer of truth. If their message revolves around other professionals in their field simply not “getting it,” you should steer clear. Usually these people are on the fringes for a reason.

3. **Read reviews**

   Although everyone has their opinions, I think it’s worth checking to see if, after a large number of reviews, a book has a low rating. Sometimes people on Amazon give a book bad ratings for silly, overly subjective reasons (such as shipping issues, which is not what Amazon ratings are supposed to rate). Other times, a couple of bad reviews from cranky readers will spoil a book’s rating, making it difficult to determine the quality of the material. However, if a book has a 1-star rating after a few hundred reviews, it’s worth considering the possibility that the book just isn’t very good.

This is not a foolproof system, and you’ll still have your time wasted every now and then. However, by consciously examining the books you’re going to read ahead of time, you stand a much better chance of finding worthwhile material.

Experience Funnel

This part is fairly straightforward and of serious importance. While learning, you need to ensure that you’re also getting as much first-hand experience with the subject as you can get. Of paramount importance is to practice somehow every day. As we discussed in the discipline section, you’ll need to start small and work up from there. A good starting point is around 30 minutes per day. If you can do 30 minutes per day for even a month, you’ll find that upping the time and difficulty of your practice routine will become easier and easier as time goes on.

This is simple to accomplish with readily available and hands-on activities such as computer programming, math or language learning, but can be a bit trickier with less tangible or available areas such as learning to fly an airplane or driving race cars. Unless you are a professional in an area such as this, you’ll have to find some kind of reasonable substitute that will allow you to build your skill somehow. In the examples given, you could do this by using simulators in between real-life experiences. You won’t get the same sensory experience, but you can at least become intimately familiar with the systems involved with flying, driving or whatever else it is you’re trying to learn.

No matter what you’re doing, you need to ensure that your practice routine challenges you on a regular basis.

This will be very easy to accomplish when you first begin, since everything is new and challenging to you anyway. It becomes far less trivial once you reach an intermediate level and find yourself plateauing in skill. Don’t fear the plateau, as it is a natural part of the learning process. Learn to identify when it’s happening to you and work to overcome it, no matter how difficult it seems.

To once again return to the concepts in the discipline section, identify a goal to work towards once you’re into the advanced-beginner/intermediate stage of your learning. This will give you the motivation to push yourself through obstacles and look into new areas of the subject that you have not previously explored.

An easy way to combine the two of these is to use tutorials. Not only will you be able to practice whatever subject you’re learning, you’ll also be able to get insights from people who know what they’re doing. They’ll also sometimes give you the ability to build sample projects which can provide a goal to work towards. Even if they don’t, many will give you problems to work through that will test your knowledge and give you an opportunity to be creative.

Aside from getting much-needed practice, being around people who have more experience than you will give you all kinds of benefits you simply cannot get from working alone (primarily in the form of feedback). I can’t count how many times I’ve been to events where I had a previously vexing problem cleared up or question answered in brief conversations with experts.

What those experiences are is highly dependent upon what it is you’re trying to learn. Some ideas that you can use are conferences, Meetups (my personal favorite), trips and classes. It depends heavily on what you’re trying to learn.

Classes are an especially effective tool now that MOOCs (Massive Open Online Courses, pronounced “mooks”) are so widespread. Because they were created initially by computer people, there is a large emphasis on computer science topics in the world of MOOCs, but every day there are more course topics introduced. One example that comes to mind is a science-based cooking class I took on Coursera a while back, which was both delicious and educational.

What’s truly great about MOOCs is that they’re free. While some are now offering to grant credits for completed courses, you can go through them at your own pace without spending a penny. Just about every MOOC also has a discussion forum that you can use to interact with other students, as well as the standard quizzes and exams you’d expect from a normal college-level course.

There are new MOOC providers sprouting up all the time, but here are the providers with the biggest and highest quality course catalogues (in my opinion, of course):

1. Coursera (cousera.org) - The juggernaut of the MOOC world, this site has courses in a seemingly endless variety of topics and is closely affiliated with Stanford University.

2. edX (edx.org) - A close second to Coursera, edX has a very large number of available courses, and is affiliated with both MIT and Harvard.

3. MIT OpenCourseWare (ocw.mit.edu) - This incredible resource has been available for years, and is filled with wonderful material for those that really want top-notch understandings of technical subjects. These courses are difficult (it's MIT, after all), but if you want to master a topic, this is a great resource.

4. Udacity (udacity.org) - Udacity is, as of this writing, primarily focused on computer science topics, but a great site nonetheless. Their format is top-notch and encourages interaction over long lectures, so I'd suggest at least taking a look at what they have to offer if you aren't looking to learn how to program.

5. Khan Academy (khanacademy.org) - Although not officially a MOOC provider, if you want to learn fundamental math and science topics, Khan Academy is an excellent website

to start with. Sal Khan, the creator of the site and a highly-educated former hedge fund analyst, started making videos in 2003 to help his cousin learn math. As such, his videos are formatted for easy understanding and are generally pretty short.

There are many more MOOC websites out there, but this should keep you adequately busy in the meantime. A site, Class Central, recently popped up that allows you to browse courses from MOOC providers all over the world. If you want to explore the full depth of free education on the internet, I highly recommend you visit their site at www.class-central.com.

If you're trying to learn Spanish, make a point of going to a Spanish Meetup nearby, or taking a short trip to a Spanish-speaking country. If you want to learn how to paint, sign up for a workshop at your local arts college or go to a gallery. Either way, set a goal of doing something a set number of times within a certain timeframe.

To use learning Spanish as an example, this would translate to going to at least 1 Spanish Meetup per week, then maybe setting aside a 3 day trip to Mexico after doing that for a few months. Similar to how the difficulty and complexity of your reading should ramp up over time, you need to be putting yourself in increasingly substantial situations as you progress.

This funnel can be tracked via a calendar, either digital or paper, and a simple word processor. I prefer Google Calendar and Google Docs for their excellent features and top-notch mobile integration, but use whatever works for you.

Side Note: The Importance of Tutors

While it is possible to learn a great deal of information entirely on your own, you should understand right now that **you're selling yourself short by doing everything on your own**. Working with someone who has "been there, done that" will not only enhance your understanding of a subject by virtue of being around a knowledgeable practitioner, but will shorten the time needed to get better. The reason for this is that domain experts have a far greater understanding of what the most relevant knowledge is within that domain, while a new person is going to waste a lot of time on trying to figure out what to focus on.

My own experience with learning to program has been heavily influenced by people I've worked with and interacted with in the sphere of software engineering. Having conversations with senior engineers at local Meetups has saved me countless hours of effort by pointing me towards what technologies and concepts are most valuable (from both knowledge and economic perspectives).

This isn’t just a belief of mine, either. In the 1980s, education researcher Benjamin Bloom studied the effect of tutoring on the performance of students and found that the **those who had received tutoring performed better than 98% of students who did not receive tutoring** [48]. The results are now referred to as *Bloom’s 2 sigma problem*, since the tutored students performed 2 standard deviations better. If 98% superior performance is a priority for you, then you can’t ignore the benefits of getting one-on-one instruction.

A couple of caveats here:

1. Tutoring is expensive. Not everyone can afford the services of a quality tutor.

2. A low quality tutor is arguable worse than no tutor at all, since they’re more likely to reinforce bad habits and/or not provide the feedback you need.

Bottom line: if you can afford a quality tutor, don’t hesitate. You won’t regret the decision.

Projects

Projects should become part of your experience funnel as well. As with everything else in your Factory, you should start small and work your way up. These are much harder to plan, as you can’t necessarily know ahead of time what you’ll be capable of doing. Instead, commit to creating lots of small projects as you progress. Each one should reflect your current skill level, as well as incorporating components of that are just beyond what you think you can do.

Don’t start out trying to build something massive and complex. Instead, consider each piece of a more complex project and try to create each component on its own. Every subject has a project like this that can be broken down into many different pieces, so keep your eyes open and actively think about what you can build while you’re learning.

Bonus: Information Overload

One mistake that many beginners make is trying to cram way too much information into their minds at once. Even worse, they often try to expose themselves to advanced material from the get-go. For example, when I first started programming, I read some pretty advanced books thinking that I’d eventually just “get it.” I believed that just getting through a tough book was the mark of someone destined for greatness, but I was sorely mistaken.

What ended up happening instead was I crammed my head with lots of factoids that were far beyond my current understanding of the subject. Although I could say I’d heard of a concept, if I were pressed to explain it, I would have been at a loss for words. Don’t make this mistake: take the time to understand what you’re learning. Master the fundamentals, then move on.

Doing this ensures you won’t get caught in the same trap I did. You need to learn to crawl before you can walk, and you need to walk before you can run. The same can be said for learning. Start simple and your long-term results will be exponentially better.

Example Funnel Systems

Here is a very simple, straightforward funnel you can use as a template if you're just starting out. If you're not in the beginning stage of your learning, adjust these as needed and take into account what I've said about splitting the books into chunks and starting to focus on specific subfields.

Substitute the word "Subject" with, you guessed it, the subject you're looking to learn.

If you're just starting out, here's a beginner funnel you can use:

Articles (sent to funnel123@example.com - not a real address):

1. *Base Wikipedia article (Examples: Computer programming, Spanish language, etc.)*

2. *Article from base 1 (Examples: Programming language, Spanish grammar, etc.)*

3. *Article from base 2*

4. *Article from base 3*

5. *Article from base 4*

6. *Article found on Reddit*
7. *Tutorial on (Subject)*
8. *Discussion found on Reddit 1*
9. *Discussion found on Reddit 2*
10. *Discussion found on Reddit 3*

Books (listed on Goodreads under “To-Read”) (single subject):

1. *(Subject) For Dummies*
2. *A Very Short Introduction to (Subject)*
3. *(Subject): A Guided Tour*
4. *(Unrelated nonfiction break book)*
5. *Intermediate (Subject)*
6. *(Subject) for Practitioners*
7. *(Subject) mid-level textbook*
8. *(Unrelated nonfiction break book)*
9. *Advanced (Subject)*
10. *(Subject) advanced textbook*

Experiences (tracked on Google Calendar and Google Docs):

1. *Practice (Subject) for 30 minutes per day (or 1 Pomodoro 25/5 period)*

2. *Go to at least 1 (Subject) Meetup event every week*

3. *Have at least 1 tutoring session every week*

4. *Watch at least one MOOC video on (Subject) every day*

5. *Travel to (Subject) convention in (Destination 1) on 4/1*

6. *Take trip to (Destination 2) for immersion in (Subject)*

Here's a sample beginner funnel using the subject of computer programming, with an emphasis on using the Python programming language:

Articles (sent to funnel123@example.com - not a real address):

1. *Computer programming (Wikipedia)*

2. *Programming language (Wikipedia)*

3. *Computer program (Wikipedia)*

4. *Algorithm (Wikipedia)*

5. *Software development process (Wikipedia)*

6. *Read the FAQ in /r/learnprogramming*

7. *A Beginner’s Python Tutorial (wikibooks.org)*

8. *Discussion about object-oriented programming in /r/learnprogramming*

Books (listed on Goodreads under “To-Read”) (each name after title is the author):

1. *Think Python (Downey)*

2. *Introduction to Computation and Programming Using Python (Guttag)*

3. *Fate is the Hunter (Gann)*

4. *Code: The Hidden Language of Computer Hardware and Science (Petzold)*

5. *Introduction to Computing (Evans)*

6. *Data Structures and Algorithms in Python (Goodrich)*

7. *An Astronaut’s Guide to Life on Earth (Hadfield)*

8. *Learning Python (Lutz)*

9. *Mathematics for Computer Science (Lehman)*

Experiences (tracked on Google Calendar and Google Docs):

1. *Do at least 1 25/5 Pomodoro of coding every day*

2. *Go to at least 1 programming meetup per month*

3. *Watch at least one video from a programming MOOC per day*

4. *Attend Python seminar in 3 weeks*

5. *Go to coding bootcamp in San Francisco in August*

Here’s a sample book funnel that covers several subject chunks, with unrelated break books in between:

1. *Pre-Calculus for Dummies (Kuang)*

2. *Calculus Essentials for Dummies (Ryan)*

3. *Statistics I and II for Dummies bundle (Rumsey)*

4. *Flash Boys: A Wall Street Revolt (Lewis)*

5. *The Power of Habit (Duhigg)*

6. *The Upside of Irrationality (Ariely)*

7. *Thinking, Fast and Slow (Kahneman)*

8. *What Makes Sammy Run? (Schulberg)*

9. *Meditations (Aurelius)*
10. *The Enchiridion (Epictetus)*

In this case, the subject chunks were calculus, psychology and Stoic philosophy. The break books were *Flash Boys* and *What Makes Sammy Run?*. These are just random topics I picked out, you can obviously decide on what interests you and choose your reading list accordingly. The key is to follow the pattern I’ve laid out.

Part Two: Tools

At this point, you’re now in possession of enough information to proceed to the real meat and potatoes of your Learning Factory. You should also have, at a minimum, a system of funnels for information that is going to be processed. This is where the core of what I’ve learned over the years starts to show itself, and you’ll find in the following pages a concise guide on how to build up a framework for learning nearly anything in a fast, efficient manner. And, if you’re really motivated to do so, you can use it to master a subject or skill.

Active Recall & Spaced Repetition

We've already discussed the nature of working and long-term memory, and now it's time to discuss how we can move information from one to the other. There are a variety of methods for accomplishing this, but the learning system I'm going to unveil to you relies very heavily on the concepts of *active recall* and *spaced repetition*.

Studies [49] have [50] shown [51] that you learn and retain information much better if you actively engage your memory (active recall) while you're learning. This simply means that, as you're learning, you should test yourself on the information you're absorbing. But within this system, we'll take it one step further and utilize a specific type of testing, known as spaced repetition.

When most people want to memorize something, they generally will reread, relisten and/or verbally repeat the information many times in a short period. At first blush, this seems to be the natural way to go about placing information into the long-term memory. While this method *will* work after a while, by doing this you're wasting precious time and energy that could be spent learning new information.

Instead, what you should be doing is looking at that information for a brief period, then waiting a day to review it again. If you have no problem remembering the material, you put it away again, but this time you don’t review it for 3 days. Each time you review the material and find you’re still remembering it, you increase the interval of time between reviews.

Spaced repetition is an incredibly efficient way to remember chunks of information. Although I firmly believe that daily exposure to a subject is necessary for it to really click with you, the chunks you learn along the way do not follow the same guidelines. As counterintuitive as it sounds, you’ll actually learn and retain information much better if you space it out rather than using rote memorization.

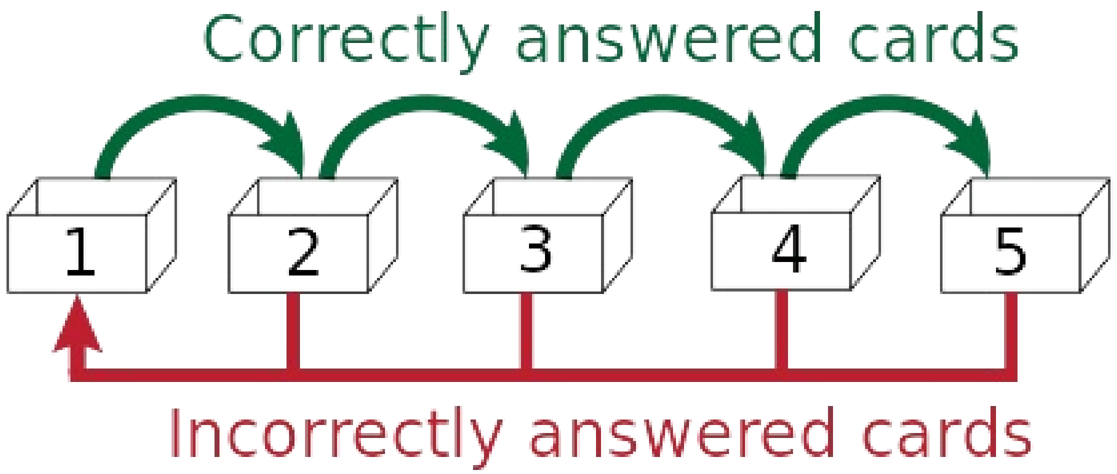
What you’re doing is testing yourself right as the information that you want to remember is slipping from your mind, and every time you review it you refresh your memory. Consequently, when you review the material you build a slightly stronger memory of it. Do this enough times and the information will be transferred to your long-term memory and remain there indefinitely.

If you decide not to review the material, you begin to rapidly forget it. Although the exact rate of decay is debateable, you should expect to halve your memory of newly learned knowledge in a matter of days or weeks if you don’t review it. This is officially referred to as the *forgetting curve*, and it’s something you should always keep in mind while you’re learning.

When it comes to holding on to information, the phrase “use it or lose it” applies.

There will be times that you’ll forget the information during one of your reviews. Although you’ll find it happens less and less as time goes on, it will happen. When it does occur, you simply start the interval cycle over again. On the day you fudge the review, you’ll simply review it again the next day.

Although there are a variety of ways to do this with physical, low-tech mediums, I’m not going to spend much time discussing them. If you’re anti-technology and/or don’t have access to a computer or smartphone, you can create a box system with index cards. Each box is labeled for a specific time interval, and you move the index cards from one box to another as you go through your reviews. For more information on how to do this, look up the Leitner system (the Wikipedia page is very informative).



An illustration of the Leitner system (courtesy of Wikipedia). Each box represents an interval of days. Every time a card within a box is reviewed, it is placed into either the first box (if you forgot) or the next one (if you recalled it correctly).

For those of you who are open to embracing technology, there are far better solutions available. They come in the form of flashcard programs with algorithms under the hood that find the optimal spacing for you. There are numerous benefits to using these programs instead of physically handling your learning materials, many of which we will explore, but this is one of the most important.

Software

The era of software-based spaced repetition started in 1985 with the introduction of SuperMemo, a program brought to life by a Polish programmer named Piotr Woźniak [52]. SuperMemo was the first spaced repetition program I used, and, although I'm grateful to Piotr Woźniak for making it and popularizing the concept of spaced repetition flashcards, it was a painful experience.

SuperMemo is very difficult to use, and Piotr Woźniak has made it clear that he intends for it to be used primarily by himself and people who "get it" (see: agree with him) when it comes to his views on flashcards and life in general. It's also incredibly buggy, and I learned to keep constant backups of my SuperMemo collections as every (rather frequent) crash destroyed all of my progress. The fact that it's a program you have to shell out $60 (as of this writing) for also doesn't help.

After going through this agonizing treadmill for a few months, I looked around for a better solution. I experimented with several programs, but I decided to go with Anki (which utilizes a version of the algorithm that powers SuperMemo) after using it and experiencing its wealth of features. It's free and, although it may appear simple at first, is incredibly flexible and powerful in the right hands. The fact that it has built-in cloud backup and mobile apps for both iPhone and Android didn’t hurt, either.

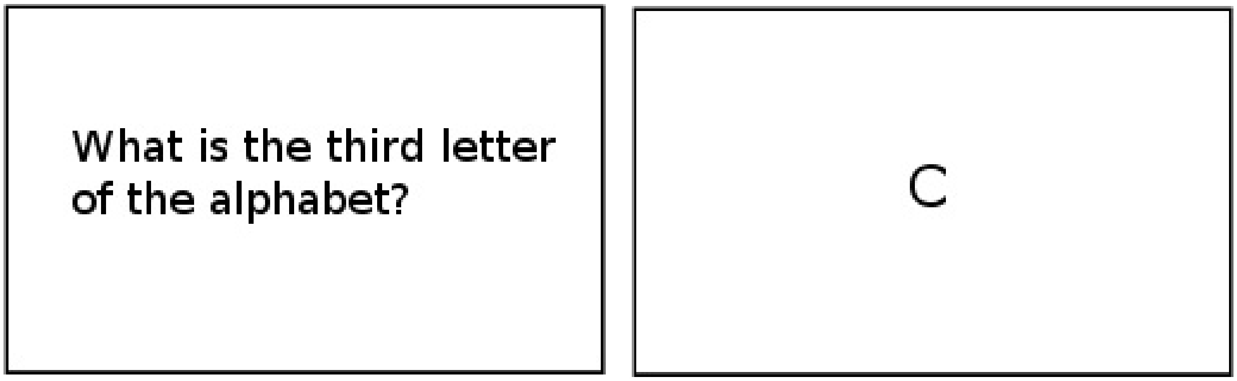
As such, I’m going to be using Anki to demonstrate what you should and shouldn’t be doing with flashcards. I’ll do my best to make it program-agnostic so that it can remain useful for a longer period of time, and so you can adapt what I’m offering to another program if that’s what you prefer. Anki gives a great deal of flexibility when it comes to formatting cards, so if you prefer to use another program, please keep in mind that what I’m instructing you to do may or may not be possible with your preferred program.

Before moving on, please install Anki or another spaced repetition flashcard program (if you really hate Anki, my second recommendation is Mnemosyne) on your computer. If available, you should also install a mobile version onto your smartphone.

One last suggestion before we start diving into the flashcards themselves: keep backups! Even though Anki is a very robust program, it’s not perfect and the potential is there for a corruption of your flash card collection. I’ve worked very hard on perfecting my Factory over the years, and I have over 18,000 cards as of today. As you can imagine, I keep several backups of my collection.

How Spaced Repetition Flashcards Work

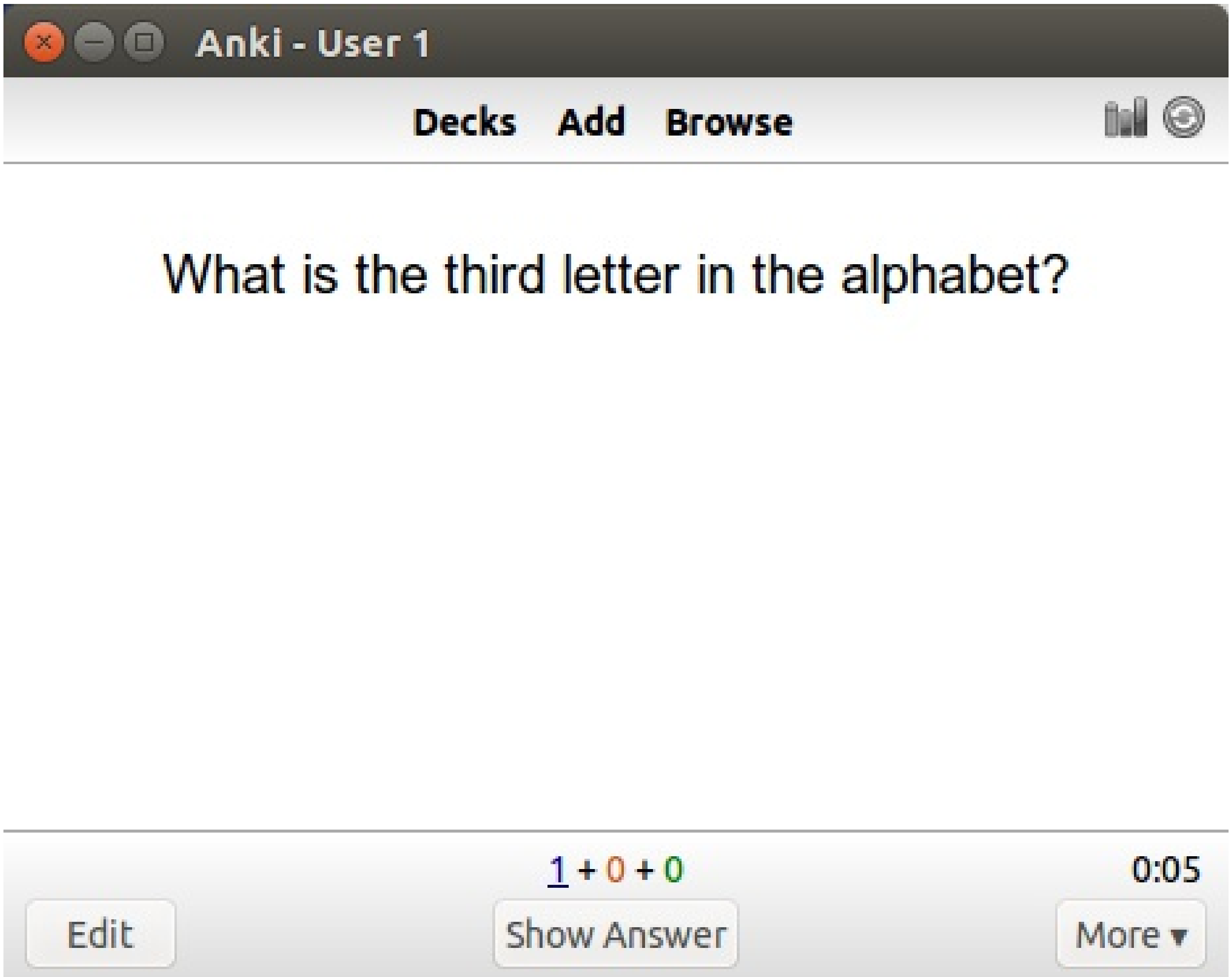
The simplest way to structure a traditional flash card is to make it two-sided:



What is the third letter of the alphabet?

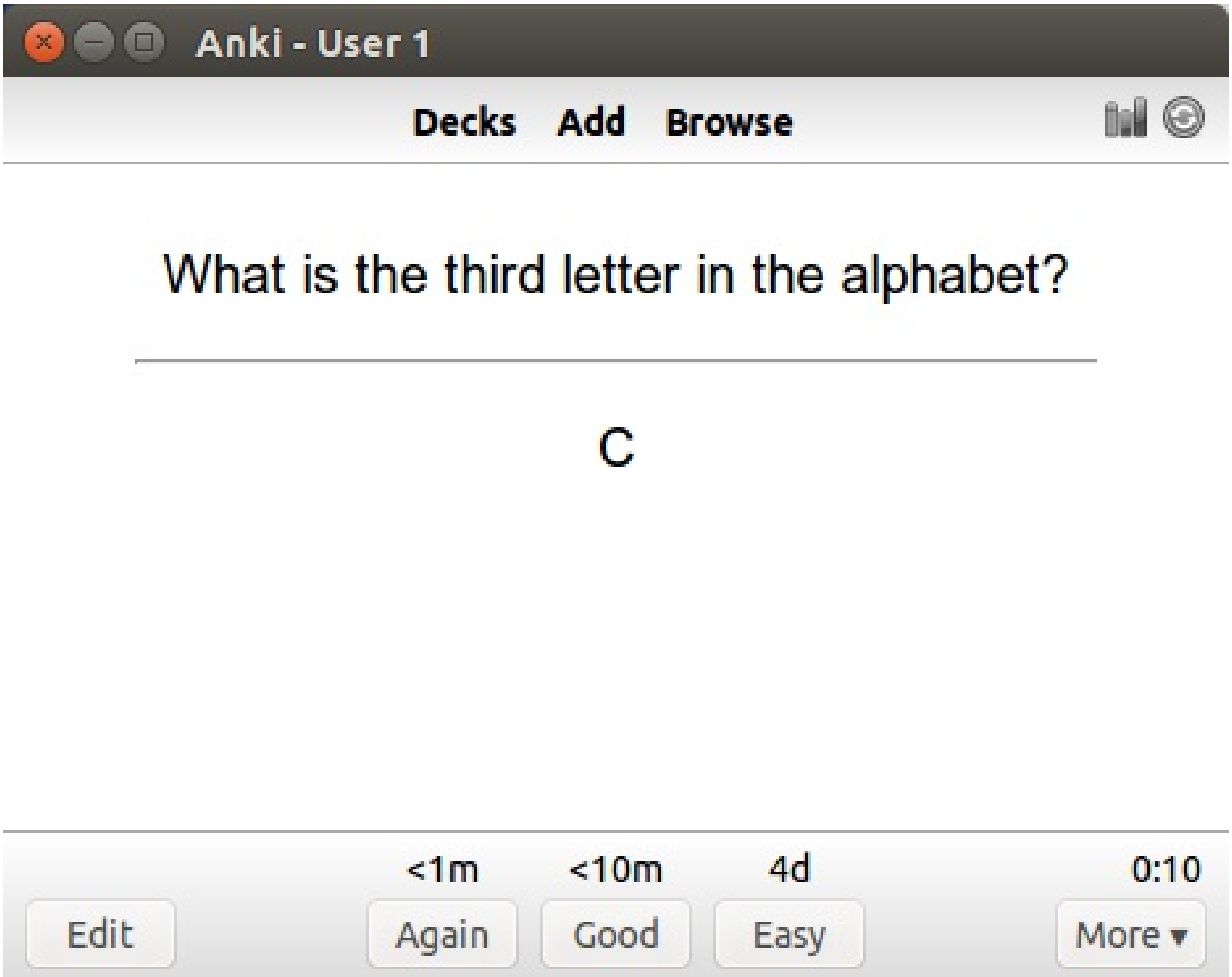
C

This is a format that works, and every spaced repetition flash card program out there comes with a prepackaged card type that functions exactly like this. Here’s how it looks in Anki:



What is the third letter in the alphabet?

This is the front of the card. After you've thought about the answer, you press the "Show Answer" button on the bottom to see the back side of the card.



What is the third letter in the alphabet?

C

This is the back of the card, where the answer to your question is stored.

From here, you pick one of three options. If you don’t remember it at all, you click “Again” (or press the number 1 on your keyboard). It will then be reviewed sometime in the next minute. If you recalled it with a little bit of effort, you would click “Good” (or 2 on the keyboard). The card will then be reviewed within the next 10 minutes. And, as I would hope would be the case for you on this particular card, an instant recall means you click “Easy” (or 3 on the keyboard). Pressing “Easy” means you won’t see the card again for an interval of 4 days.

I personally don’t use the “Easy” button very often, as I prefer slightly more exposure to a card when I first create it. It’s also worth noting that the “<1m” and “<10m” time intervals only apply if you have enough cards to have intervals that long. For example, if you only have one card to review, you’ll instantly review that card again if you press “Again” or “Good.” Within Anki it’s also the case that, if you don’t press “Easy”, you’ll review each new card twice and then the interval you get on the second review will be no longer than one day.

This may all sound confusing at first, but I promise it makes perfect sense once you start to use these programs on a regular basis.

These times may be different for you, but the principle is the same across flashcard programs. You are presented with a card, you judge how well you recalled it, then the program determines an interval for your next review. At first your review sessions will be very short, but as time goes on they’ll begin to get longer. My current average for daily reviews is between 300 and 450 cards, which normally takes me at least 40 minutes to go through completely.

Be warned: if you don’t review every day, your reviews will pile up. If I were to skip even one day, I’d end up with over 600 cards that need to be reviewed next time I opened up Anki. This isn’t much of a problem at first, since at the beginning stages of using a flashcard program you’ll find that the number of reviews is sparse. It only starts to become an issue once you have a decent number of cards (in the thousands).

Either way, *review every day*. Some days you'll undoubtedly find that you don't have anything to review, as the intervals will be too long for the low number of cards you have. But don't let that stop you from checking your program every day. Stay on top of it, and build a habit out of it. Since the reviews are so minimal at the beginning, it actually works out perfectly for building a habit - you're forcedto start small and easy, then build up from there.

I personally do my flashcards first thing in the morning on my smartphone via Anki's mobile app. My phone sits on a table next to my bed, and after I wake up I grab the phone and plow through my daily review. This gives me a sense of accomplishment and starts my day off on the right foot.

If you can't do that, find another time every day when you can focus on doing your flashcards. Riding on public transportation can provide you with a great opportunity (I've done this many times while traveling on a tight schedule), as can a lunch break at work. You'll have to figure out what works for your schedule and temperament, and it will take time to adjust to reviewing every day. But, as someone that's missed only five days since beginning several years ago, I can tell you that not reviewing becomes an abhorrent idea - especially knowing how many cards I'd have to review the next day.

How to Structure Information

Now that you know the basics of how flashcards work, let's talk about how you should structure yours. Your memory is designed to take in and retain information in specific ways, and you need to create cards that cater to your brain's preferences. By doing these things, you'll greatly enhance retention and, as a result, your ability to understand whatever it is you're learning.

Rule #1: Use Cards As Supplements, Not Sources

This is an incredibly common mistake to make, and I count myself among the hordes of people that, once they've seen how wonderful learning with flashcards can be, decide to make a card for everything they come across. Don't do this. Instead, focus on learning about something and using the flashcards to supplement your other learning methods (such as reading books, taking MOOCs, etc.).

Many people, upon discovering Anki or another flashcard program, decide to download other people's decks as a way to avoid the trouble of making their own cards. This is a huge mistake, as you’re essentially doing the opposite of what flashcards are designed for. The information on those decks is unknown to you and lacking context, so it is, for all intents and purposes, worthless.

Flashcards are designed for retention, not learning. The learning comes when you read, engage with the subject matter and starting putting the information you have into a useful context. It’s very difficult to learn effectively without retaining lots of information, which is where flashcards come in. But don’t make the mistake of believing that you can genuinely learn just by looking at context-free flashcards.

Imagine yourself downloading someone else’s deck that revolves around the subject of chemistry. Even if you’ve studied chemistry, the information that is in there might not be information you’ve studied or are interested in, meaning you won’t remember the bits that you would be specifically relevant to you. If you haven’t studied chemistry, you could potentially memorize the information in the deck, but it will be a slog (since you won’t know what the information is actually about), and you won’t have any idea how to apply the information you’ve learned. There isn’t any context, and you’ve therefore just taken up space in your memory for no reason.

Downloading someone else’s deck is setting yourself up for failure. Don’t do it.

Instead, make cards out of information that is both relevant and interesting to you. By doing this, you'll leave a lasting imprint on your memory since the cards are going to contain chunks that you've personally selected. You also get a certain degree of quality control by making your own cards, since other people's decks may very well contain inaccurate, unsourced or ambiguous information.

The bottom line is this: the most effective, time efficient way to use flashcards is to make them yourself as you're learning a subject. It sounds like the hard way, and in a sense it is, but in the long run you'll save yourself a lot of wasted time by making cards that are personally relevant.

Rule #2: Break Information Up Into Small Chunks

Resist the temptation to use a single card for storing a complex and/or large chunk of information. Your memory is not designed to remember huge blocks of information, and will remember far more effectively if you break it up into several smaller cards that each contain one aspect of the information you're trying to retain.

Here's an example of how someone trying to learn all the member states of the European Union would create an overly complex card:

Front: What countries make up the European Union?
Back: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, …

As you can imagine, this card will be very difficult to remember. That's a very long list of items to keep in your working memory, and making the transfer to long-term memory, while possible, is going to take a ton of effort.

Instead, find ways to break down that information into bite-sized chunks that you can easily recall.

Here is a much easier way to break the list down:

Front: What European Union countries have names starting with "G"?
Back: Germany and Greece

You could then do this for all the letters that apply.

This method of breaking big blocks of information into smaller chunks can be used with every flashcard program out there, and can even be utilized by those using plain paper flashcards. However, with digital flashcards, and Anki in particular, there's something called a *multi-sided* card that allows us to derive multiple chunks of information out of a single template. We'll explore how and why you should use these in a bit.

Rule #3: Make Your Cards Vivid

It’s pretty easy to make simple front/back flashcards that have nothing but text, which is why most people stick to that format. Sort of like rereading a book 100 times, it also works, but is incredibly inefficient. Instead, you should focus on making your cards as stimulating as possible.

By “vivid” I mean place as many bits of audio and visual stimulation on your cards as you can. Whenever possible, include images and sounds on your cards that will stick out to you. By doing this, you make the act of recalling the information much, much easier for your brain [53]. Our minds were designed for remembering visual and audio stimulus (which was very useful when we were still living in the wild), and as such you’re giving your brain exactly what it wants to remember.

Using distinct images and sounds also avoids the issue of *interference*, which occurs when one memory overlaps with another [54]. When this happens, your recall of one or both memory items suffers. In practice, this means that you should avoid using the same images and sounds for different bits of information you want to remember.

For example, I made a card for “Episodic memory” not too long ago. This is the part of your memory that is invoked whenever you want to remember the who, what, where and when of a specific event from your past. After thinking for a few minutes about which events both stand out to me and can be expressed in a picture, I decided to use a snapshot from when I went salmon fishing on a friend’s boat in 2012.

It was the first time I’d ever been out on the ocean, and the 15 foot swells made both me and my (professional sailor) friend seasick. It also stuck out in my mind because the fish I landed that day were the biggest I’d ever caught.

The image I used for “Episodic memory”: seasick me (notice how I’m holding on to the railing) with a 20+ pound salmon.

Not only is that image going to jog my memory of that specific event, but it also gives me a contextual clue about the meaning of the term. Episodic memory is about specific events in your past, and this is a specific event that stands out to me personally. Whenever I need to conjure up the meaning of episodic memory, I can have a picture reference stored in my mind that correlates to its meaning. Although it’s not always possible, do your best to combine both context and vividness into the images you use for your flashcards.

On top of that, I always record a sound file of myself saying the term using a high-quality microphone on my desk. This gives me an extra memory boost, as every review of the “Episodic memory” card gives me both an image and a sound to make the information stick.

Making your cards vivid requires a little bit more work, and if you’re technologically deficient then this part might be a little painful for you. However, I encourage you to get over the proverbial hump and do your best to follow my advice on this. Without images and/or sounds, the imprint that each card leaves on your mind will be noticeably weaker.

Rule #4: Put Everything in One Deck

Another tendency of beginners is to create a huge number of decks for each subject they want to learn. When I first started, I had upwards 30 different decks, some of which had sub-decks. Unfortunately, when you do this you create a predictable pattern in which information will be presented to you, and you lose a certain element of usefulness as a result.

Think about it: does the world neatly present you with information in a linear, predictable way? No, of course not. It comes from all over the place and at unexpected intervals. As such, you should keep everything in one deck, and allow the flashcard program you use to randomize their order automatically. This will force you to rely on your memory of the chunks being presented to you, rather than any memory you have of the cards' presentation order.

For example, I have cards for Spanish and French that randomly pop up as I go through my reviews. No matter what subject I'm currently focused on, every so often I need to recall words in a foreign language. The random insertion of these vocabulary words keeps me on my toes and makes it easier for me to conjure them up in a demanding environment, such as French lessons.

You need to stay vigilant against your brain's endless struggle to not think, and this is an excellent way to do that. When you create topic-specific decks, they'll get presented to you in a specific order and your brain suddenly discovers it has a mental loophole for recall.

Rather than pulling contextual information about the card in front of you, it will start to instead focus on its memories in the order those cards were presented. Don’t give your brain that chance to cheat you out of progress!

Exception to this rule: I have actually stopped doing this for my own deck because the volume of my reviews is such that it became borderline painful to have to blast through 400-500 cards in one sitting. So, in the name of making the review process easier, I’ve organized my deck into several sub-decks. I still keep it pretty general, but it makes it much easier for me to study in smaller blocks.

For beginners, I still recommend that you keep everything in a single deck and challenge yourself. You won’t be reaching the level of reviews that I have for quite some time, and by then you’ll know how to divvy up your decks if you feel the need to do.

Rule #5: Stay Organized

When you’re creating cards, it is of the utmost importance that you keep both the cards themselves and the media they use (such as images and sounds) organized. It’s exceedingly easy to not be organized, but you’ll find that having your cards in order is priceless when your decks get into the 1,000+ card range. Making changes to specific cards becomes very difficult when you don’t have a way to find them or the media they use in a clear, simple manner.

Anki allows you to create small snippets of text that allow you to give searchable, contextual clues about your cards. They’re called *tags* and you need to get into the habit of using them for every single card you create. Your very first card should have at least one tag on it, and every subsequent card after that should as well.

Tags should act as a substitute for categorized decks. This works out because Anki doesn’t sort cards by tags, but tags give you the ability to group cards if you need to do things like make changes to all cards of a certain category. So if you’re making cards related to psychology, don’t make a deck for psychology, simply add a “psychology” tag to those cards.

They can also be combined, so, to continue with the psychology example, you could also attach a tag for “memory” if the card relates to the psychology of memory. To use an example from my own collection, I make cards with biographical information about people and I add tags about their nationality, profession and whether they’re still alive or not.

My card about Fritz Haber, the creator of the both incredibly important fertilizers and the first chemical weapons, are as follows:

Germans Nobel-Prize chemistry chemists dead people science scientists

The spaces between tags denotes each one separately, and tags with more than one word (such as Nobel Prize, which is there because he won a controversial Nobel Prize in his lifetime) are given dashes in between them. This is because if I were to put “Nobel Prize” as a tag, Anki would read that as two distinct tags (“Nobel” and “Prize”).

As for media, you need to ensure that you’re naming it in such a way that you can easily find it if you’re looking through Anki’s media folder (which, as of this writing, is called “collection.media”). Don’t just throw sounds and images you find onto flashcards - I promise you that you’ll end up regretting it later on. As someone who’s changed the way cards in my collection handle media more times than I can count, I can tell you that having my files organized has saved me countless hours of frustration. If I’ve ever wanted to find and make a change to a file being used by a card or a set of cards, I simply look for the clearly labeled named on the file and make the desired changes.

Anki has a “feature” that allows you to directly copy and paste media from external sources right into your cards. I advise you to **not** use this. Although it’s convenient, it automatically generates a long, random filename for each file and it also looks hideous to have your files placed directly onto your card’s template. Finding the correct media files in the folder quickly spirals into a nightmare. Using this feature also makes re-using media very difficult, meaning you'll end up replicating those files over and over again.

Rule #6: Keep Track of References

Information is everywhere, and it's of crucial importance to ensure that the information you're getting is of the highest quality possible. One way to do this is to ensure that all of your cards have a way of providing you with the source of their information. Although this doesn't guarantee quality in your cards, it will give you the ability to trace your steps if you find out your information has changed in some way or somehow turns out to be false (both of which have happened to me).

The best way to keep track of references is to provide at least two types of reference fields (don't worry, we'll talk about what fields are in a bit): **online** and **offline**. This is so you can have either direct links to where you got the information, or at least some sort of external starting point if you need it. I personally use the offline reference field to keep track of information I get from books. Online references are just hyperlinks, so if I find something on a website, I'll copy and paste the URL into the online reference field.

For example, if I were reading *The Art of War* by Sun Tzu and came across something I wanted to put into a flash card, I'd place the following into the offline reference field: "The Art of War (Sun Tzu)". This simple trick allows me to know exactly where I get all of my information and go back to that source if I want to mine for more nuggets or check to see if what I have is the best possible information.

Rule #7: Focus on Subjects, Not Factoids

Although a base of factual information is of paramount importance, you need to understand what sort of facts are useful and what are not. For example, if you're learning how to multiply, the best way to use flashcards as an aid is not to make dozens of flashcards with equations on them.

When you do that, your sneaky, sneaky brain is once again going to see a loophole and sprint for it. Rather than remembering the process of multiplication, what you're doing is simply memorizing the result (in other words, you memorize that specific problem instead of learning *howto get to the solution*). If you want to have a useful understanding of multiplication, then this is a terrible approach.

Instead, you should make cards that will give you contextual facts about how multiplication works. Rather than have a card with the answer to something like 4 x (2 x 4), you should create cards about the order of operations or the various properties of multiplication (distribution, identity, etc.). You want to learn how to multiply, so learn the facts that will allow you to do that - *don't memorize results that don't enhance your understanding.*

Rule #8: Don't Make Cards For Things You Already Know

If you are already intimately familiar with something, you really don't need to make a card about it. For example, if you want to learn how to speak French, you don't need to make an object card for the French language. You can (and should) use the "French language" Wikipedia article to find information about it you didn't know beforehand, but not the language itself.

The reason you shouldn't do this is simple: it's a waste of time. Certain things will already be in your long-term memory and won't need any reinforcement for you to remember them. Do you think you need a flashcard to remember your parents' names, or your significant other's birthday? I sincerely hope not.

It is also, in my opinion, a form of procrastination to make cards like this. Rather than challenging yourself, you’re just generating cards for no reason. Your card count goes up, but your understanding of the world stays stagnant. It’s fine to have lots of cards, but don’t make cards specifically so you can achieve a certain number of them - quantity should take a back seat to quality.

Making Your First Cards

Now that you know the principles you'll need to make effective flashcards, let's create some in Anki. Again, I need to remind the reader that this geared specifically for Anki and although I want to make this system as transferable as possible, I can't promise that what I recommend here can be done with other programs. Anki may also have changed since this was written, so be sure to consult Anki's manual (which you should really read through anyway) if something recommended here doesn't work or isn't available in your version of the program.

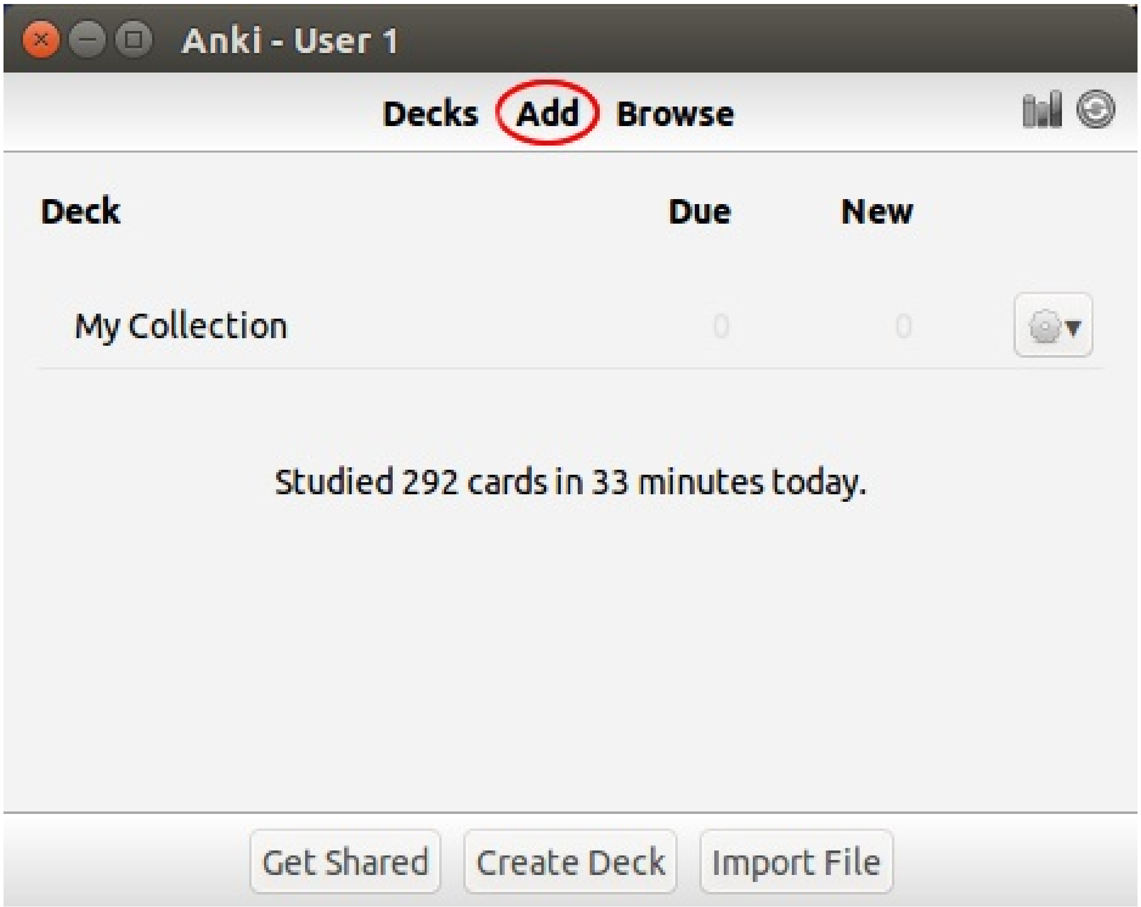
It's also worth mentioning that I'm using Linux, so my version of the program may look slightly different than yours. Functionality should be identical across operating systems, but there may also be a divergence when it comes to how the program functions at some point in the future.

Notes and Cards: Anki's Template System

The first thing you need to know is that, although I use the word "card" quite frequently, in this part of the book we're going to be focused primarily on "notes." What are notes, you ask? They’re Anki’s way of giving you an incredibly powerful, flexible template that will actually generate flashcards for you automatically. When you’re making flashcards for yourself, you should actually be focusing on making notes that will in turn generate specific cards for you.

Since I’m sure this is confusing for newcomers to flashcards (it certainly was for me), allow me to demonstrate what I mean. First, before we move any further, **open a desktop version of Anki**. You really do need to follow along here, otherwise it just won’t click. It should also be noted that making cards on the mobile versions isn’t really an option at this point, as they just don’t have the needed complexity to effectively do it.

Assuming that you’ve followed my directions, let’s start by clicking on “Add” at the top of the opening screen.

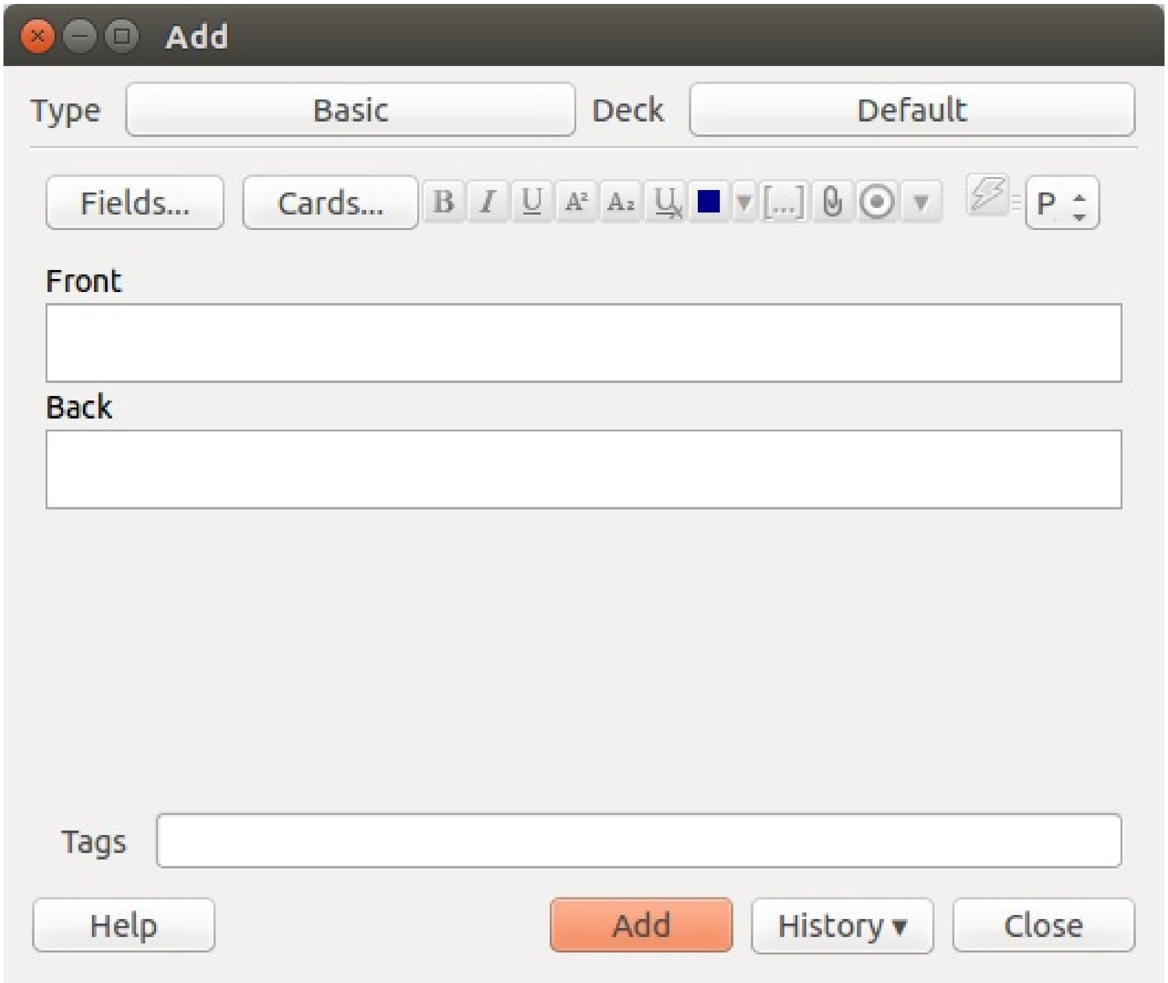


Deck	Due	New
My Collection	0	0

Studied 292 cards in 33 minutes today.

The opening screen of Anki, with the “Add” button highlighted

A new window will pop up that looks something like this:



The window that pops up when you press "Add"

The new window is where you create notes, which, in turn, generate cards. To demonstrate why you want to use notes, let's imagine that you want to create a series of flashcards about a certain person. Let's say that person is Grace Hopper, an incredibly influential computer scientist and US Navy rear admiral who did pioneering work with computers in the mid-20th century.

If you were to use a normal two-sided card format to remember things about her, you would do it by simply creating a bunch of cards for each point you wanted to remember:

Front: Who is this? <insert picture of Grace Hopper>
Back: Grace Hopper

Front: What did Grace Hopper do for a living?
Back: Computer scientist/US Navy rear admiral

Front: What is Grace Hopper’s most famous invention?
Back: The first compiler

At first glance, this seems like an OK approach. After all, we’re respecting the principles we’ve laid out before about creating small chunks and, in the case of the first card (which has Admiral Hopper’s picture), using vivid images to solidify the information. However, this is very inefficient and there are several other ways to create flashcards that may be more appropriate.

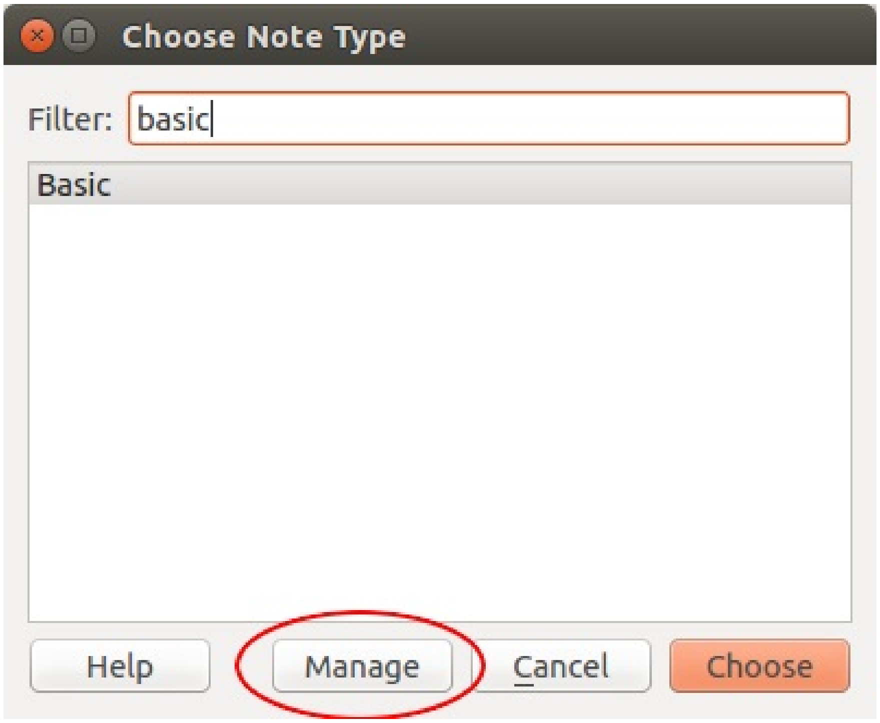
Cards about people are a perfect example. If you wanted to know the same sorts of information about another person, you’d have to type up each question and answer individually. I call cards that are created in this format *trivia cards*. There’s a better way to format information about people, places, things or concepts, and it’s called a *note*. Notes are templates that use constructs called *fields* to place information on and **generate** *cards*.

Trivia cards are useful for either providing contextual questions about a subject or for highly specialized bits of information that wouldn’t be worth creating a note template for. Notes are best used as a means of creating a series of purely informational cards around a single subject.

Since talking about this is probably making your head spin, let’s walk through how to create a note that can be used not only for Grace Hopper, but for any person that you want to remember basic information about. By doing this, you’ll be able to understand first-hand why this is the superior way to create flashcards.

I call the specific type of note we’re about to create an *object note*. That’s because these notes focus on various aspects of a single object, such as a person, place or concept. If you’ve ever programmed in an object-oriented language, you can think of notes as being very similar to classes and the derived cards as similar to instances.

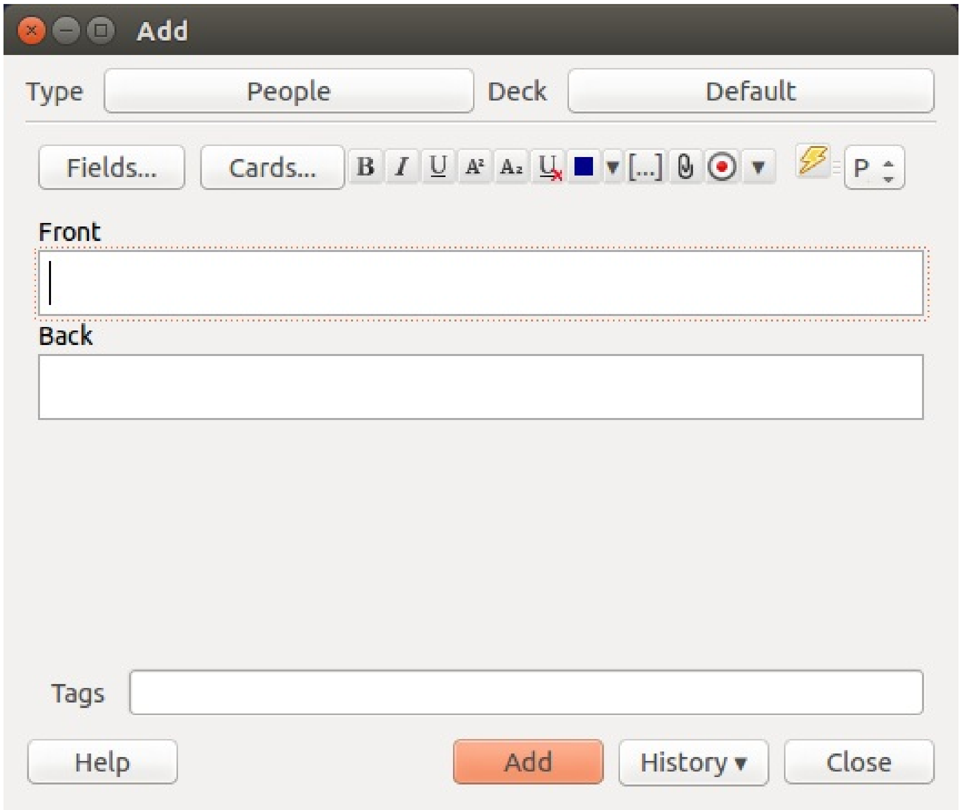
Start by clicking the button next to “Type” (in the above screenshot, it says “Basic”). This should bring up a screen that displays your available note types. In the bottom of the screen, there should be a button that says “Manage.” Click that, and yet another screen should pop up that gives you a choice of note types.



In that window, you should see and then click on a button labeled “Add.” There should be an option within the “Add” window for “Clone: Basic.” Highlight that option and click OK. When it asks for a name, call it “People” (minus the quotes, of course).

Once you’ve done that, go back to the original “Choose Note Type” screen, select the newly-created “People” and then click “Choose.”

Now you should be looking at a screen that looks like this:



Type: People

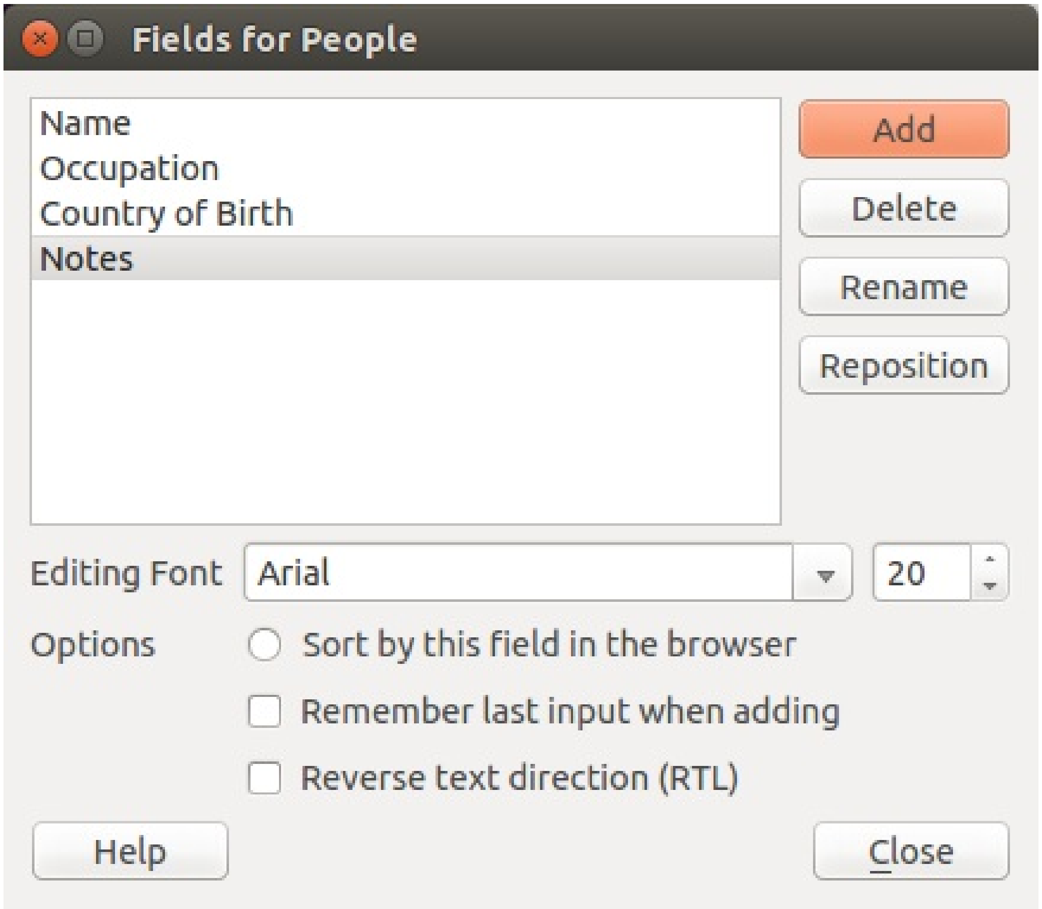
Deck: Default

Your newly-created “People” note type. Note the “People” name next to the “Type” field in the top left corner.

Now let’s start turning this basic note type into a powerful template that can be used to create many, small useful cards.

The first step is to click on “Fields” (look in the above screenshot for reference - it’s in the top left corner of the “Add” screen). Fields are what the note will use to generate cards for specific things. Since we’re making cards for people, let’s create some fields for information we’re likely to find useful about people we want to remember.

In the fields, screen, click on “Front” and then rename it to “Name.” Once you’ve done that, rename the “Back” field to “Occupation.” We’ll use this field to give us information about what the person did (or does) for a living. Next, click “Add” and create a field called “Country of Birth.” Lastly, create a field called “Notes.” We’ll use this last field to denote unique features about this person. Your fields window should now look like this:



Fields for People

Name
Occupation
Country of Birth
Notes

Editing Font: Arial, 20

Options

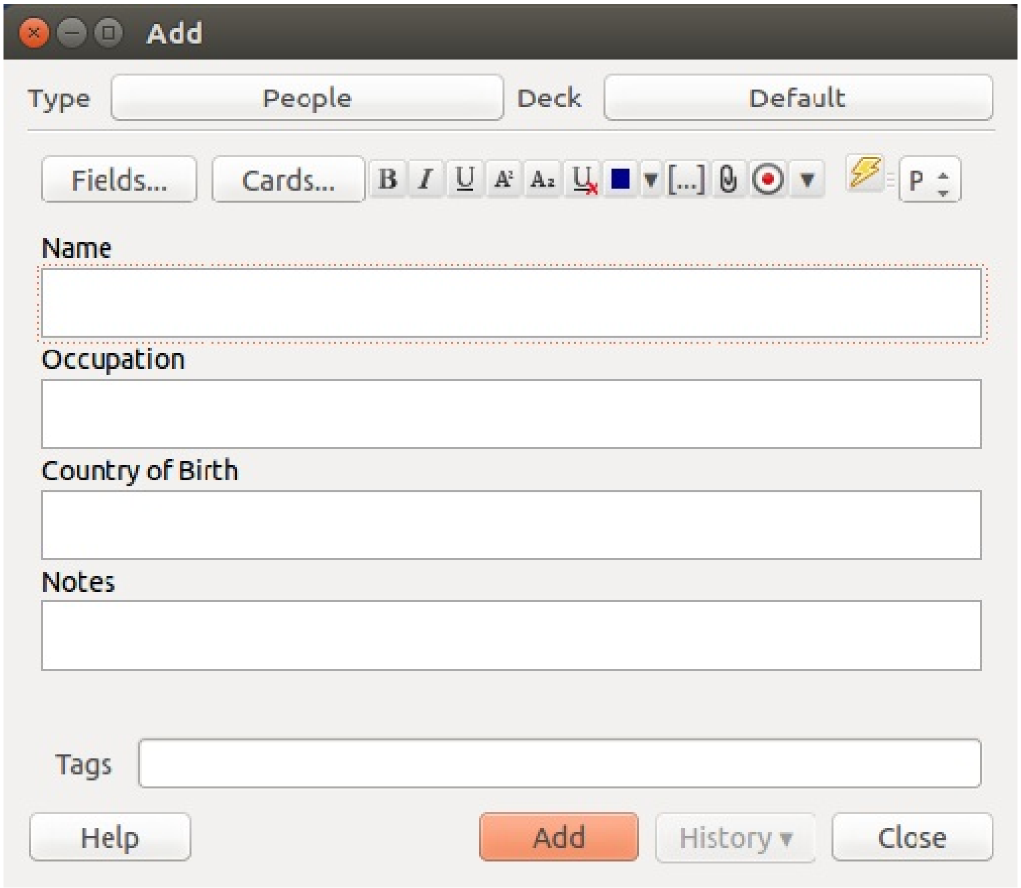
○ Sort by this field in the browser

□ Remember last input when adding

□ Reverse text direction (RTL)

Your note’s new field types.

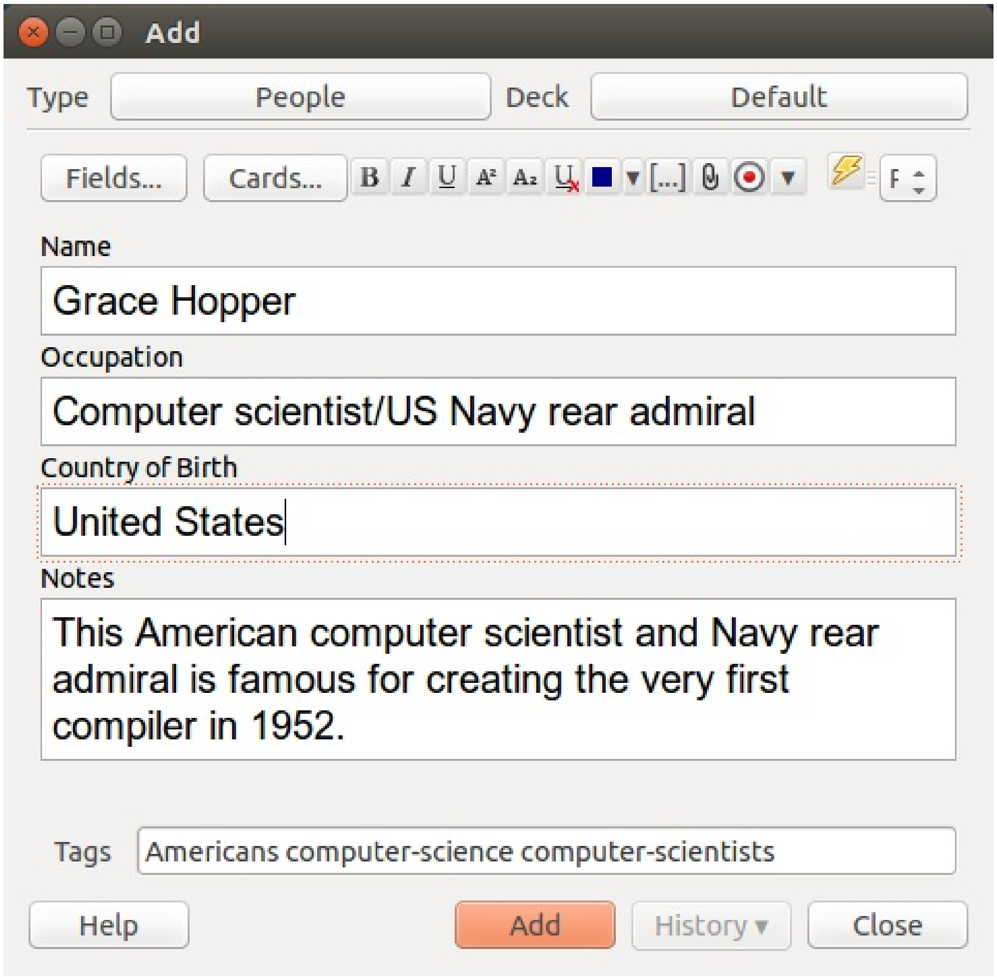
Now click “Close” and your note entry screen should have transformed into this:



Your new note entry screen.

Now we’re making progress. Now let’s enter some information. We aren’t going to add it to our deck yet, but we should have information added so we can see how it looks for the next step.

Here’s how I filled it out:



Name: Grace Hopper

Occupation: Computer scientist/US Navy rear admiral

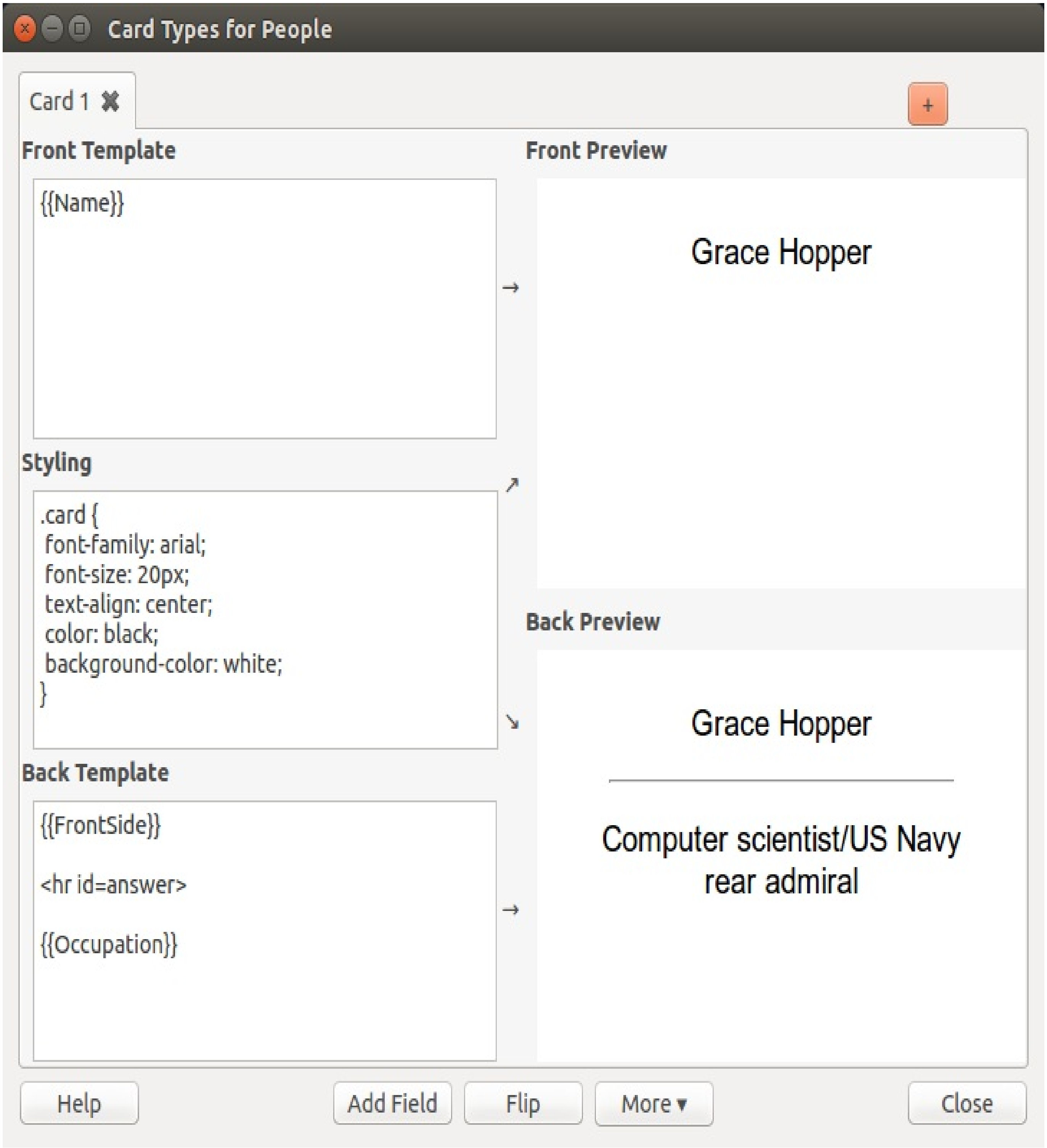
Country of Birth: United States

Notes: This American computer scientist and Navy rear admiral is famous for creating the very first compiler in 1952.

Tags: Americans computer-science computer-scientists

Notice how I've added tags to the bottom of the card already. Since Ms. Hopper was an American, I put "Americans" and the other tags are because of her involvement with computer science. *Make sure you're doing this from the very start!*

Now we need to define what each of those fields do and what kinds of cards they're going to generate. Click on the "Cards" button in the top left of the "Add" screen now. The window that pops up will probably intimidate you if you've never done any sort of HTML or CSS work, but I promise you it's much easier to manipulate than you think. If you have any experience with web design and/or programming, then this section will be a breeze for you.



Front Template

```
{{Name}}
```

Styling

```
.card {
 font-family: arial;
 font-size: 20px;
 text-align: center;
 color: black;
 background-color: white;
}
```

Back Template

```
{{FrontSide}}

<hr id=answer>

{{Occupation}}
```

Front Preview

Grace Hopper

Back Preview

Grace Hopper

Computer scientist/US Navy rear admiral

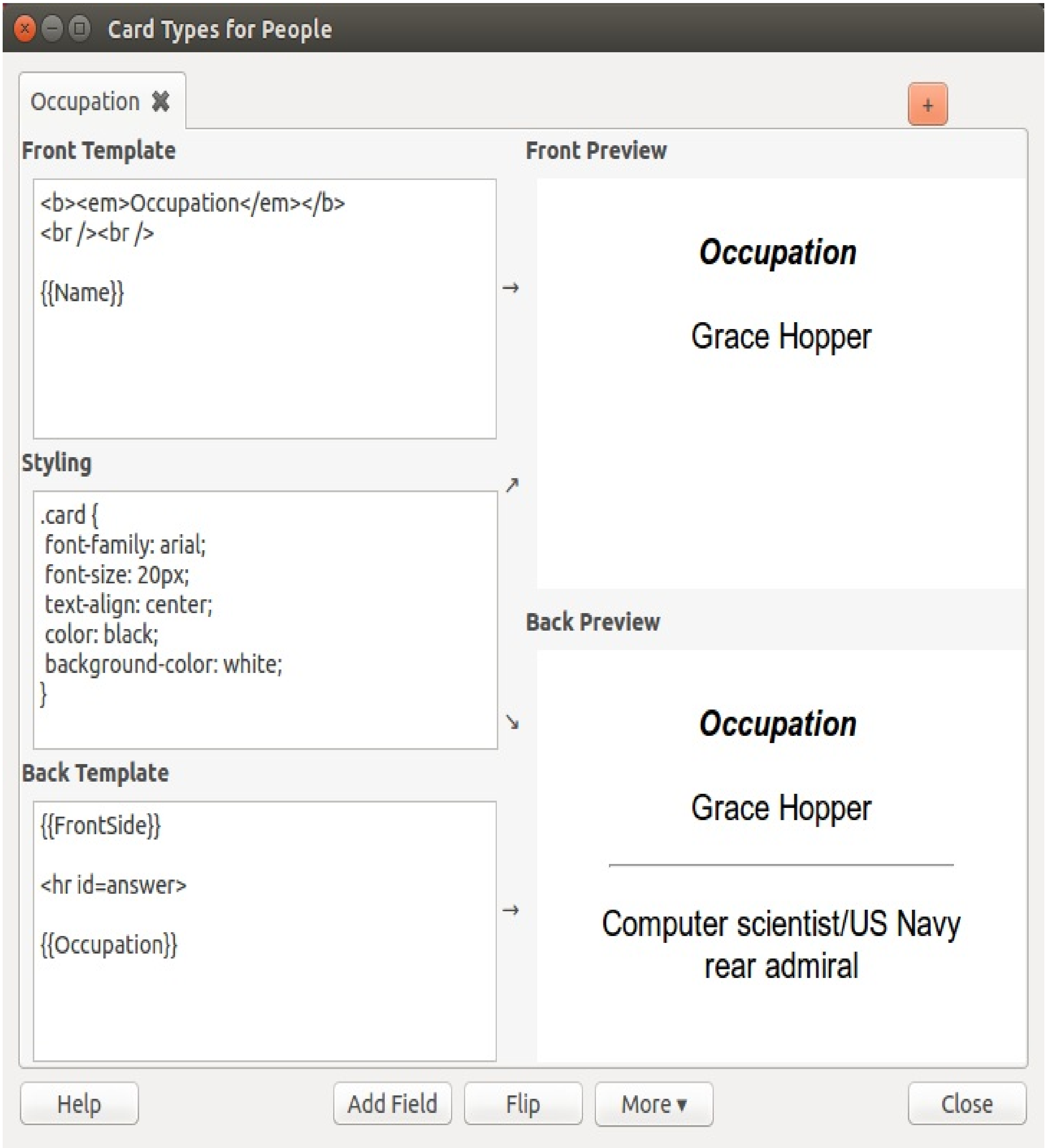
So what’s going on here? First, take notice of the items on the left side enclosed in squiggly braces (such as **{{Name}}**). These represent fields, and, if they’re filled in, they will become whatever it is you’ve entered into that field. For example, since “Name” is filled in with “Grace Hopper” on your note entry, the resulting card will have “Grace Hopper” wherever the **{{Name}}** element is present. Likewise, if you look on the bottom half of the screen, you can see that **{{Occupation}}** is on the template site and the resulting output is, you guessed it, the information you put into the “Occupation” field.

Let’s make this specific card about occupation. We can do this by doing a couple of things. First, we need to make it explicit on the front of the card that you need to remember information about the person’s occupation. Click on the window labeled “Front Template” (where the {{Name}} element is) and enter the following code:

```
<b><em>Occupation</em></b>
<br /><br />

{{Name}}
```

The <b> and <em> (bold and italics, respectively) elements make for a distinct header that indicates the card is for remembering a person’s occupation. The <br /> elements below that simply put space between the header and the field element (in this case, **{{Name}}**). Since Anki uses CSS and HTML, simply pressing Enter to create space between things on a template won’t actually do anything - you need to explicitly define spaces using either <br /> or CSS rules (if you don’t know what any of that means, don’t worry about it for now).

Next, click the "More" button on the bottom of the window. From there, click on "Rename" and enter "Occupation" into the screen that pops up, then press OK. You now have the first card template for your note type.



```
<b><em>Occupation</em></b>
<br /><br />

{{Name}}
```

```
.card {
 font-family: arial;
 font-size: 20px;
 text-align: center;
 color: black;
 background-color: white;
}
```

```
{{FrontSide}}

<hr id=answer>

{{Occupation}}
```

Occupation

Grace Hopper

Occupation

Grace Hopper

Computer scientist/US Navy rear admiral

Your very first card template!

At this stage, you’re probably wondering what’s so magical about being able to do this. You’re right to wonder this, but I’m now going to show you exactly why this is so great. Click on the “+” symbol (which is the orange button on the top right in the above screenshot). Now you have an exact clone of the “Occupation” card template, from which we will spawn another card template.

All you need to do is change the names in the top header (“Occupation”) and the field element on the back (**{{Occupation}}**). Since the note entry window is still visible while doing this, I can see that we have two other fields we can use: “Country of Birth” and “Notes”. Let’s do the really simple one, “Country of Birth”, first.

First, remove the “Edit to Customize” text - that’s there to remind you to edit the card template. Now all we need to do is change the header on the front to “Country of Birth” and the field element from **{{Occupation}}** to **{{Country of Birth}}** on the back. The template system is case-sensitive, so be sure that what you enter is exactly what you see in the fields of your note entry screen (i.e. **{{occupation}}** with a lower-case “o” will not work when the field is “Occupation”).

Second, rename the card (Click “More”, then “Rename”) and then you’re done with that card. Now click the “+” once more and call the new card template “Notes.” The notes card is going to be a little different, so don’t skip ahead here if you think you already know what I’m going to say.

The “Notes” type is what I like to call an *identifier* card. Rather than asking for memorized information, the card instead asks you to identify a person or thing based on a short description. I use these on a large variety of cards, and I’ve found they help tremendously with remembering specifics about whatever person or thing I’m learning about.

On this new card, rather than just subbing out fields, I want you to delete the {{Name}} element from the front of the card. Then I want you to also delete the <b>, </b> and <br /> elements from the front. You should be left with the following code on the front template:

<em>Country of Birth</em>

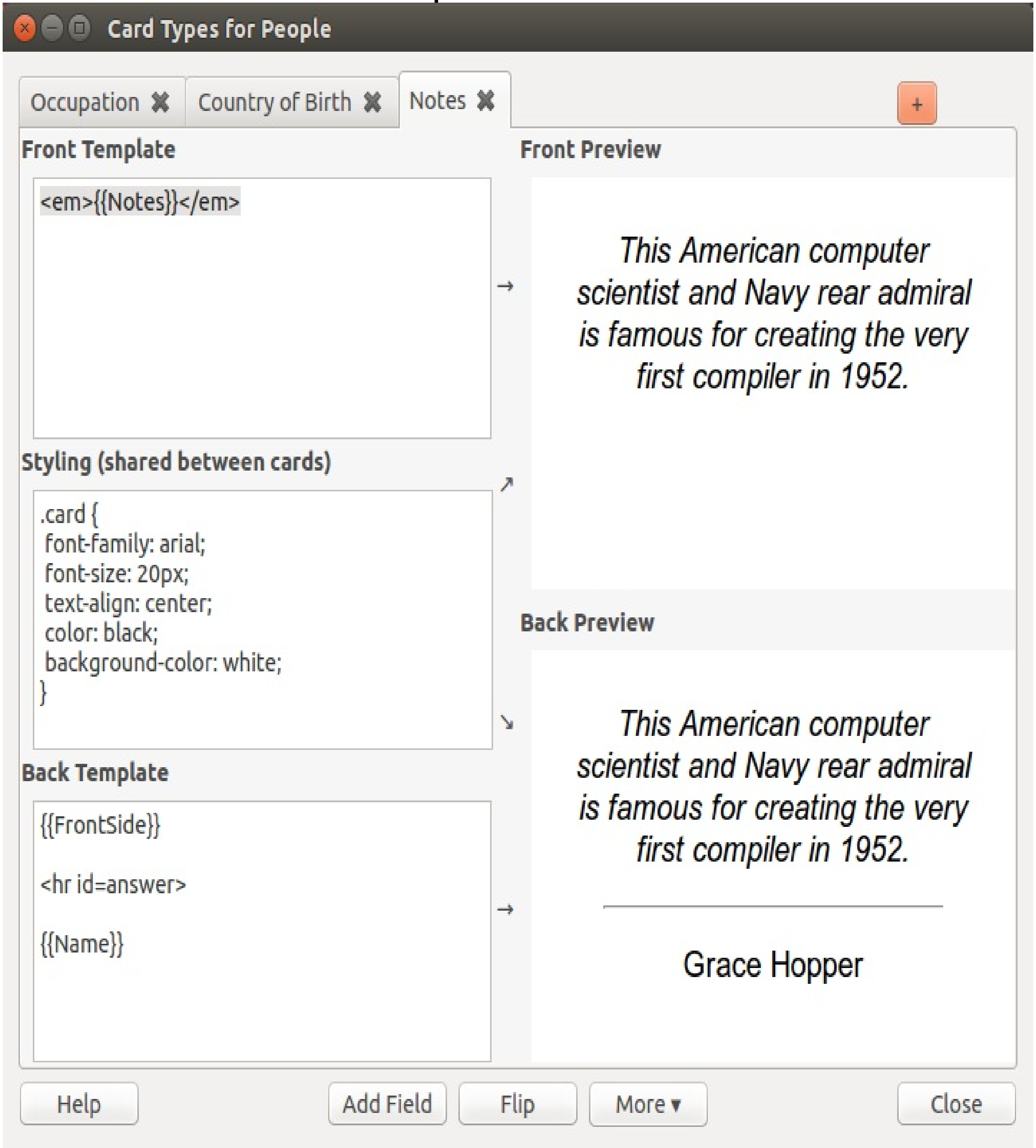
Now change the text (“Country of Birth”) to {{Notes}}. The front template should now look like this:

<em>{{Notes}}</em>

The front preview window will now show what you entered into the “Notes” field in the note entry window. It’s also in italics, which is one way I recommend to make clear you’re dealing with an identifier card.

Now look at the back template on the bottom of the screen. You’ll see that {{Country of Birth}} is there and is entirely out of place. Change that to {{Name}} and you're now done with the identifier card.

Here's how the finished product should look:



```
<em>{{Notes}}</em>
```

This American computer scientist and Navy rear admiral is famous for creating the very first compiler in 1952.

```
.card {
 font-family: arial;
 font-size: 20px;
 text-align: center;
 color: black;
 background-color: white;
}
```

```
{{FrontSide}}

<hr id=answer>

{{Name}}
```

This American computer scientist and Navy rear admiral is famous for creating the very first compiler in 1952.

Grace Hopper

Our work here is done. Click close and return to the note entry window. Once there, click the “Add” button and you’ve now officially generated 3 new flashcards. You can now use this template any time you want to remember information about a person, and you won’t have to create a new card every time you want to learn something about them.

An added bonus: **by using only one note to generate cards, you don’t have to add tags to all of them**. Since the cards are tied to the same note, if you add, modify or remove tags from even one of the cards, all other cards from that note will inherit those tag changes as well.

Notice how the first, non-note way of adding information about Grace Hopper involved you typing up questions every time you wanted to remember a detail? Now you don’t need to do that - all you need to do is pull up the “People” note type, fill in the fields and you’ll have the information you need added to your collection.
If you’re having a hard time understanding how fields and notes work, just remember these points:

- *Notes make cards*
- *Cards are made from fields*

This is obviously a very simple note template, but hopefully outlining the principles of how notes work has given you the inspiration you need to utilize them.

Adding Images and Sounds

Given that the key elements of effective flashcards are vivid imagery and sounds, I think it’s worth spending at least a small amount of time talking about how you can add them to your templates. Let’s start with images.

First, you need to find an image that you want. Continuing with the Grace Hopper example, I went to Google Images and typed her name in. I found a suitably good picture of Grace, resized it (originally 2400x3000!) with GIMP (a free image editing program) and saved it as “**_Grace Hopper.jpg**”. The underscore is crucial here because Anki will delete images that aren’t present in cards, and the way we use them in our templates will make Anki think that they are not in use [55].

Once I did all of that, I placed the file into the “collection.media” folder within my Anki user folder (which is usually under Anki’s main content folder - exact location is impossible for me to know, so look it up on Anki’s user manual). Now we need to go back to Anki’s main window (*not* the note entry window) and click on “Browse.” This will bring up the card browser, which will give you a view of every card you’ve created so far.

Click on the “Added Today” icon on the left side of the browser and then click one of the cards related to Grace Hopper’s occupation. Now click on the “Cards” button on the bottom right portion of the screen. This will bring up the card template page once again, with the focus being on the “Occupation” card (since that’s what you selected in the browser).

Now I want you to type the following code in between the twin **<br />**s and **{{Name}}**:

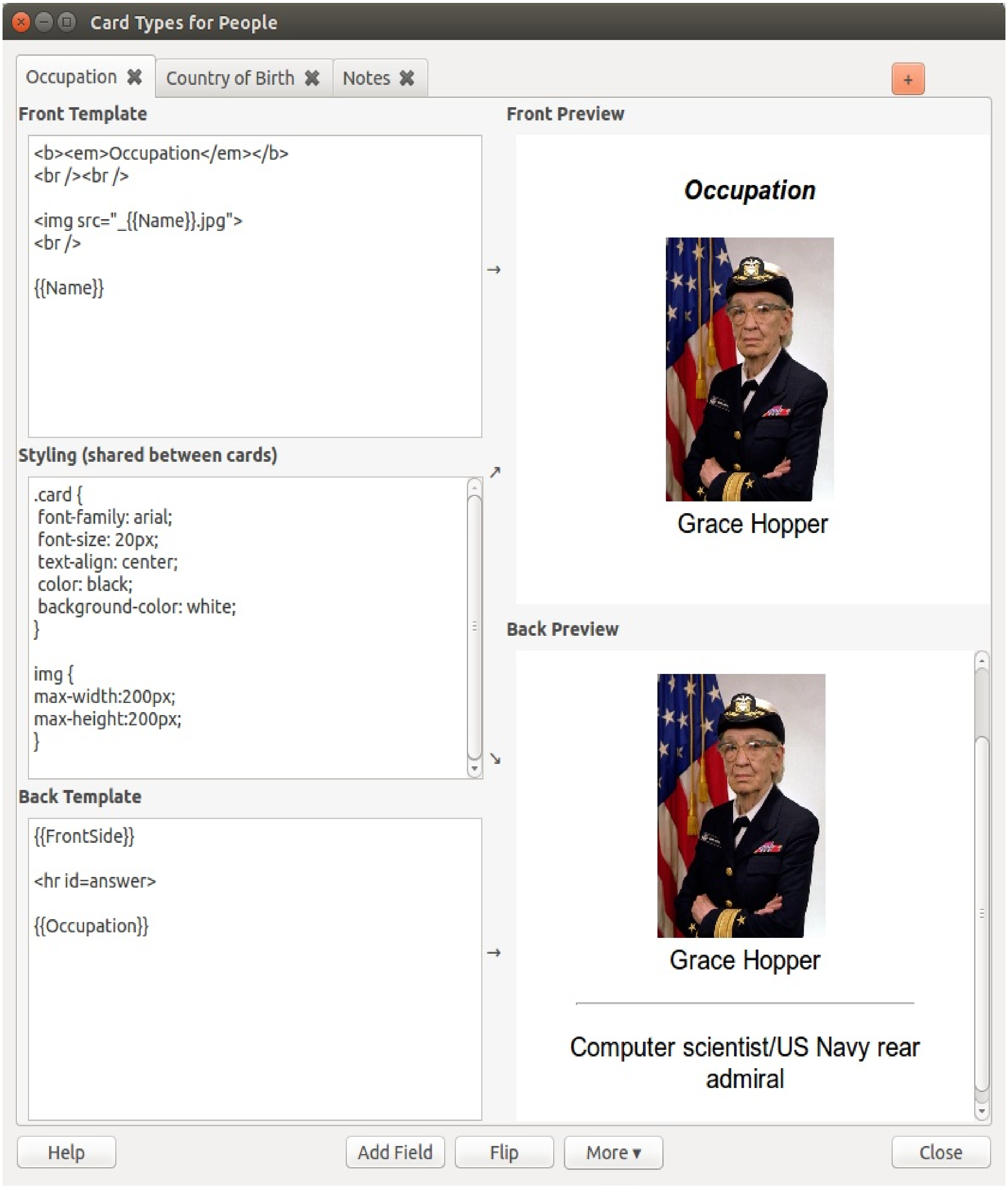
<img src="_{{Name}}.jpg"> *[Note: field elements can be used in filenames.]*
<br />

The right side of your screen should now display a picture of Grace Hopper. If you used a picture like the one I used, it’s probably too large. This can be fixed by either resizing or by invoking a very small amount of CSS that will restrict the size of images. Let’s use the CSS solution, since it is the easiest.

Right below the last squiggly brace in the “Styling” section on the left side of that window, put the following code in:

```
img {
max-width:200px;
max-height:200px;
}
```

This code will ensure that images on your cards never get bigger than 200px, which is particularly useful for when you’re reviewing cards on a mobile phone (which obviously has a much smaller screen). Here’s how it should look now:



Front Template

```
<b><em>Occupation</em></b>
<br /><br />

<img src="_{{Name}}.jpg">
<br />

{{Name}}
```

Styling (shared between cards)

```
.card {
 font-family: arial;
 font-size: 20px;
 text-align: center;
 color: black;
 background-color: white;
}

img {
max-width:200px;
max-height:200px;
}
```

Back Template

```
{{FrontSide}}

<hr id=answer>

{{Occupation}}
```

The styling code will remain constant for every card type within the template, but you will need to go to each card and add the **<img src=”_{{Name}}.jpg”><br />** part if you want them to have images. In this example, you’ll need to ensure all of your images are named **_<filename>.jpg**, otherwise they won’t show up. Some people prefer other image formats (such as .png), so if you’re one of those people, by all means, change the extension to something else [56].

Using images also allows you to create an important sort of identifier card that doesn’t involve any text at all. Rather than having contextual information about Grace Hopper, you’re simply presented with her picture and made to remember who you’re looking at. This is an easy card type to make, as you only need an image on the front and the “Name” field on the back. You could also throw in the occupation on the backside if you want to cram another piece of information into the card.

Sounds are added very similarly, but Anki has a specific syntax you need to use in order to utilize them. First, you need to either create the sounds or find them somewhere on the internet. I like to create my sounds with a desktop microphone, but I will make exceptions if it’s a foreign word and I don’t know how to pronounce it. This ensures that I recognize the correct pronunciation if I hear it out in the real world.

If you’re learning a foreign language with flashcards, this is especially important. Don’t just say the words - go to a site like Forvo and download an MP3 of a native speaker pronouncing it. Neglecting to do this means means you run the risk of etching an incorrect pronunciation into your memory, making it very difficult to fix later on.

Either way, once you have the file, add an underscore to its name and give it the name of a field. In this case, we want the name of the person, so the file should be named "**_Grace Hopper.mp3**". Once we've done that, we go back to our templates and add the following code:

[sound:_{{Name}}.mp3]

This tells Anki to look for a MP3 file that corresponds to whatever is in the name field on your note. For this particular type of note, the rule of thumb is to place the sound file on whichever side has the person's name and picture. So sounds should be inserted into the front templates for "Occupation" and "Country of Birth" and the back template for "Notes" (since the identifier card has the person's name on the back, not the front).

Adding References

You don't have *have* to use references for your flashcards, but I highly recommend that you do. For one, by using sources on your all your cards, you have a way to retrace your steps if you suspect that something on the card is inaccurate. Secondly, it provides a sort of discipline that forces to you include only sourced information in your flashcards.

Adding references in Anki is straight-forward and is basically identical to adding any other field to a template. The only differences are in how the references are displayed on the resulting cards, which is why I’m going to walk you through how to do it.

Create a new field using the steps above, and call it “Reference.” This field will hold sources that originate from the web and will consist of URLs (web addresses). For example, if you wanted to use some information you found in the user manual for Amazon Web Services, you’d enter "https://aws.amazon.com/documentation/gettingstarted/” (minus quotes) into the field. Now click on the “Cards” button to open up the template editor. Click inside the “Back Template” window on the bottom left of the screen and enter this bit of code:

```
<hr>
{{#Reference}}<a
href=”{{Reference}}”>Reference</a>{{/Reference}}
```

You’re probably asking yourself, “What do those extra Reference things mean?” Those are called *conditional replacements*, and they specify whether something should be displayed or not on a card. When you enclose a field within a conditional replacement, you’re simply telling the program “show this field if it is (or is not) empty.”[57] These ensure that only information you enter ends up on a card.

This specific type of conditional replacement tells the card to hide the field unless it has something in it. In this case, if the “Reference” field is totally empty, you won’t see anything in the resulting card. However, if you put even a single character in “Reference” it will display the output.

The “<a href…” part is simply an HTML link, meaning that the URL you enter into the “Reference” field will be clickable. We’ve done this so you can simply click on a source link within a card when you need to, rather than having to open the card up and copy-paste the URL into a browser. The “<hr>” is a horizontal rule, which will separate the reference information from the answer on the card (this will make more sense when you see the final result).

Close the template editor and create another field called “Reference (Offline)”.

“Reference (Offline)” is, just as it sounds, a way to keep track of sources that are not necessarily on the web. I use this field for books, presentations, classes and anything else that isn’t directly linkable. Input for this field comes in the form of a title and author, usually in a ***Book Title (Author)*** format. For example, if you want to add a reference from my book, you could put this in the field: ***The Learning Factory (Eddleman)***.

Open up the “Cards”/template editor again and add this code below the “Reference” code:

```
{{#Reference (Offline)}}<br /><br />
<em>{{Reference (Offline)}}</em>{{/Reference (Offline)}}
{{#Wikipedia}}
```

Once again, we’re using a conditional replacement to ensure that only inputted text ends up here. The difference is that this isn’t a clickable link, and is instead just italic text (hence the <em> tags [58]). This part is optional, I just use italics because it makes the text distinct and book titles are generally styled that way. The “<br />” bit just ensures there is a vertical space between the “Reference” output and anything above it [59]

Close the template and add one more field called “Wikipedia.” This is a field I created after I found myself constantly copy-pasting full Wikipedia URLs and decided there had to be a better way. The solution I came up with is a field where you only enter the name of the Wikipedia page, not the full URL. Open up the template editor one last time and put this below the “Reference (Offline)” code:

```
{{#Wikipedia}}
<br /><br />
<a href=”
https://en.wikipedia.org/wiki/{{Wikipedia}}>Wikipedia</a>
{{/Wikipedia}}
```

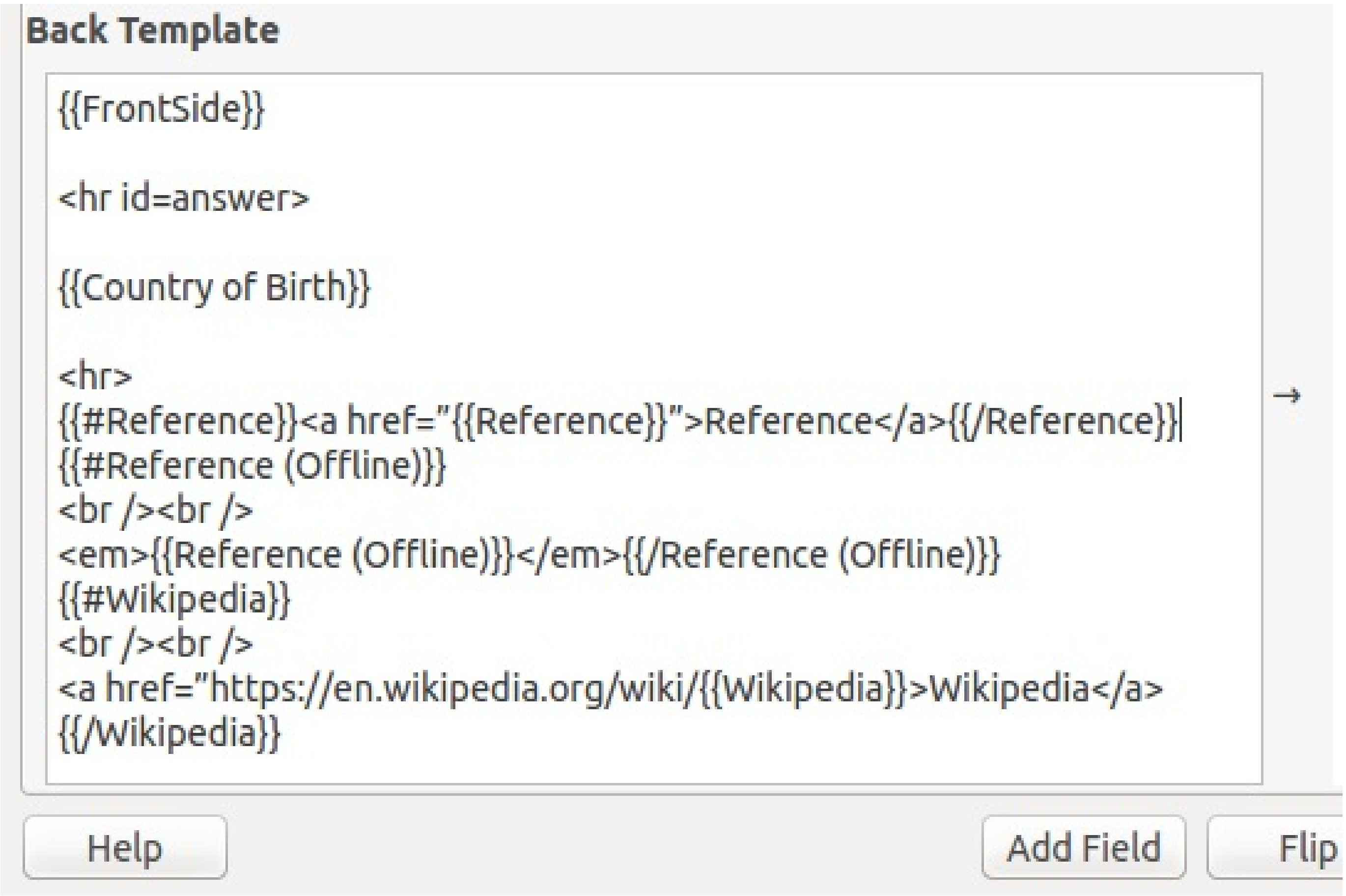
The only difference between this code and the snippet you used for “Reference” is that there is a piece of code that points you to a Wikipedia web address. When you fill out the “Wikipedia” field, you only have to enter the name of the Wikipedia page and not the entire web address.

For example, you can now enter “Neuron” into that field instead of dropping “ https://en.wikipedia.org/wiki/Neuron” into the “Reference” field. This is because the field is being used to fill in only a portion of the link address.

You now have a solid group of fields you can use to keep track of your learning sources. You’ll need to add all of these pieces of code to each card in order to make use of them, so here are all three snippets together:

```
<hr>
{{#Reference}}<a
href=”{{Reference}}”>Reference</a>{{/Reference}}
{{#Reference (Offline)}}<br /><br />
<em>{{Reference (Offline)}}</em>{{/Reference
(Offline)}}
{{#Wikipedia}}
<br /><br />
<a
href=”https://en.wikipedia.org/wiki/{{Wikipedia}}>Wikipedi
{{/Wikipedia}}
```

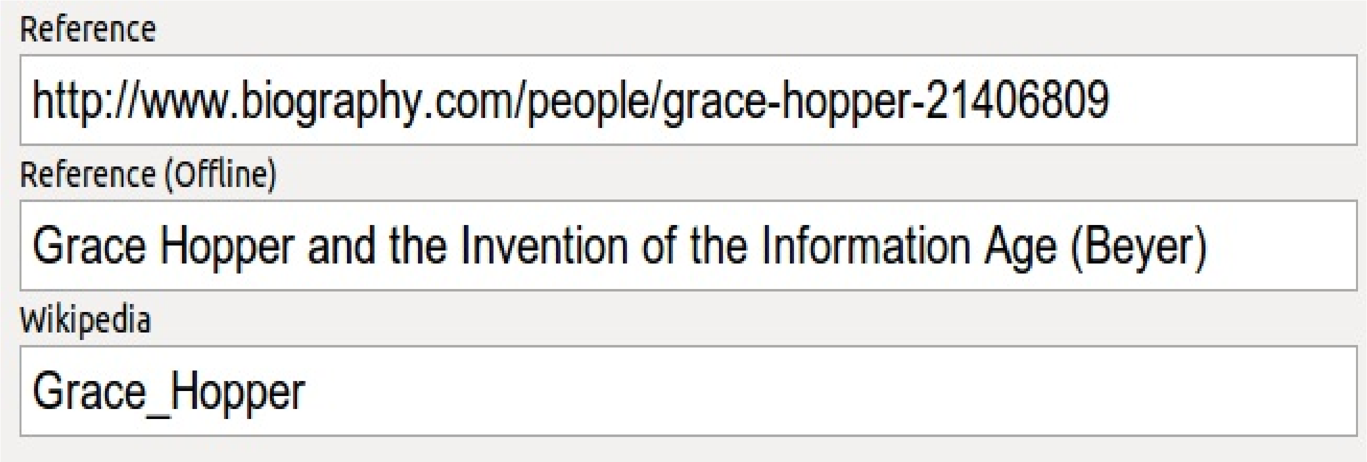
Here’s how it should all look in the template editor:



```
{{FrontSide}}

<hr id=answer>

{{Country of Birth}}

<hr>
{{#Reference}}<a href=”{{Reference}}”>Reference</a>{{/Reference}}
{{#Reference (Offline)}}
<br /><br />
<em>{{Reference (Offline)}}</em>{{/Reference (Offline)}}
{{#Wikipedia}}
<br /><br />
<a href=”https://en.wikipedia.org/wiki/{{Wikipedia}}>Wikipedia</a>
{{/Wikipedia}}
```

Again, *you need to add this to the back template of every card within the note*. If you only add it to one card, you will only see it on one card.

Let’s see what happens when we add some input to these new fields. Since writing this book would probably not be possible without her contributions, let’s keep using Admiral Hopper as an example.



Reference

http://www.biography.com/people/grace-hopper-21406809

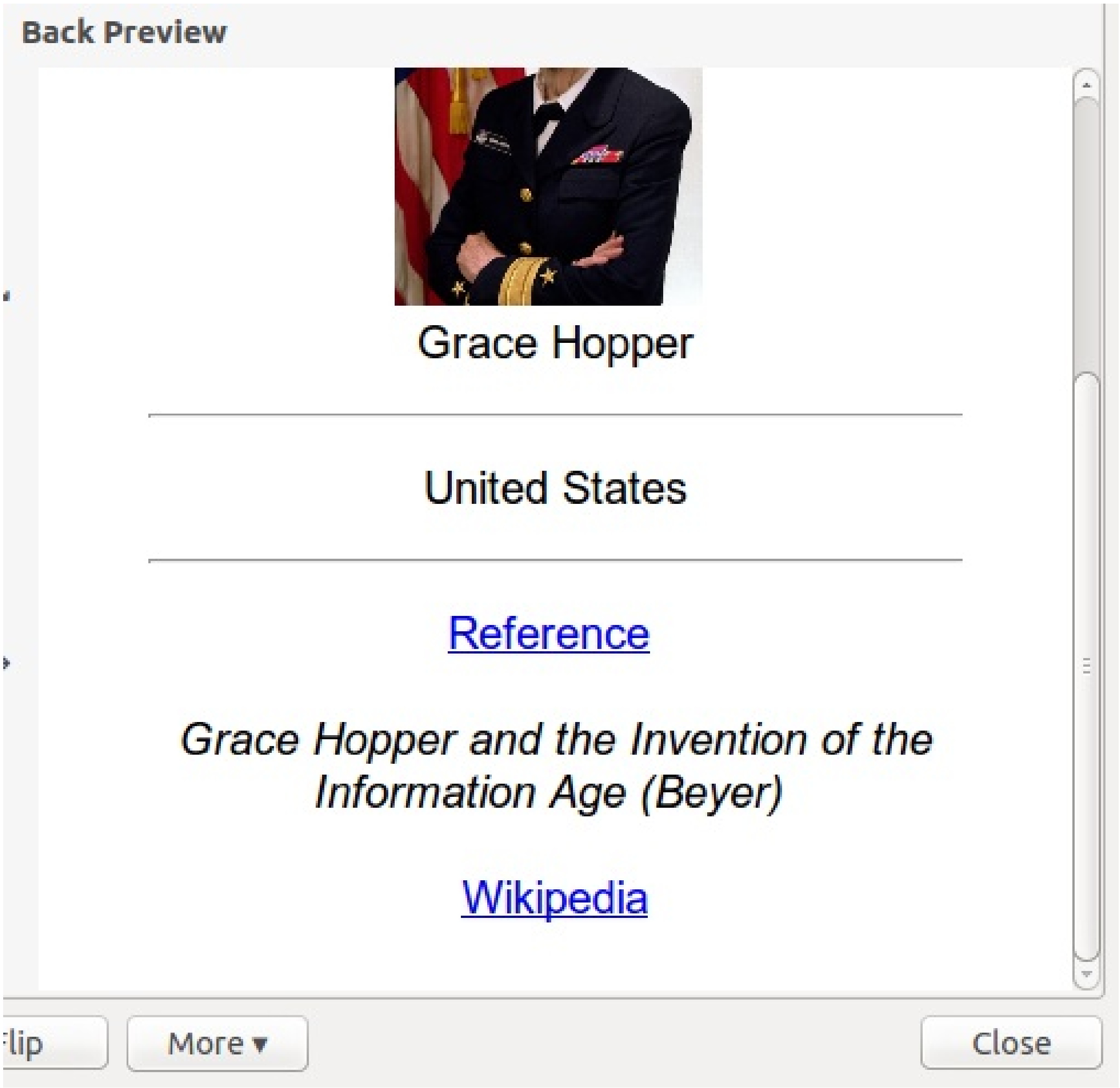
Reference (Offline)

Grace Hopper and the Invention of the Information Age (Beyer)

Wikipedia

Grace_Hopper

I’ve added a URL for a website that has biographical information, a book and her Wikipedia page. Let’s see how that looks on a card:



Grace Hopper

United States

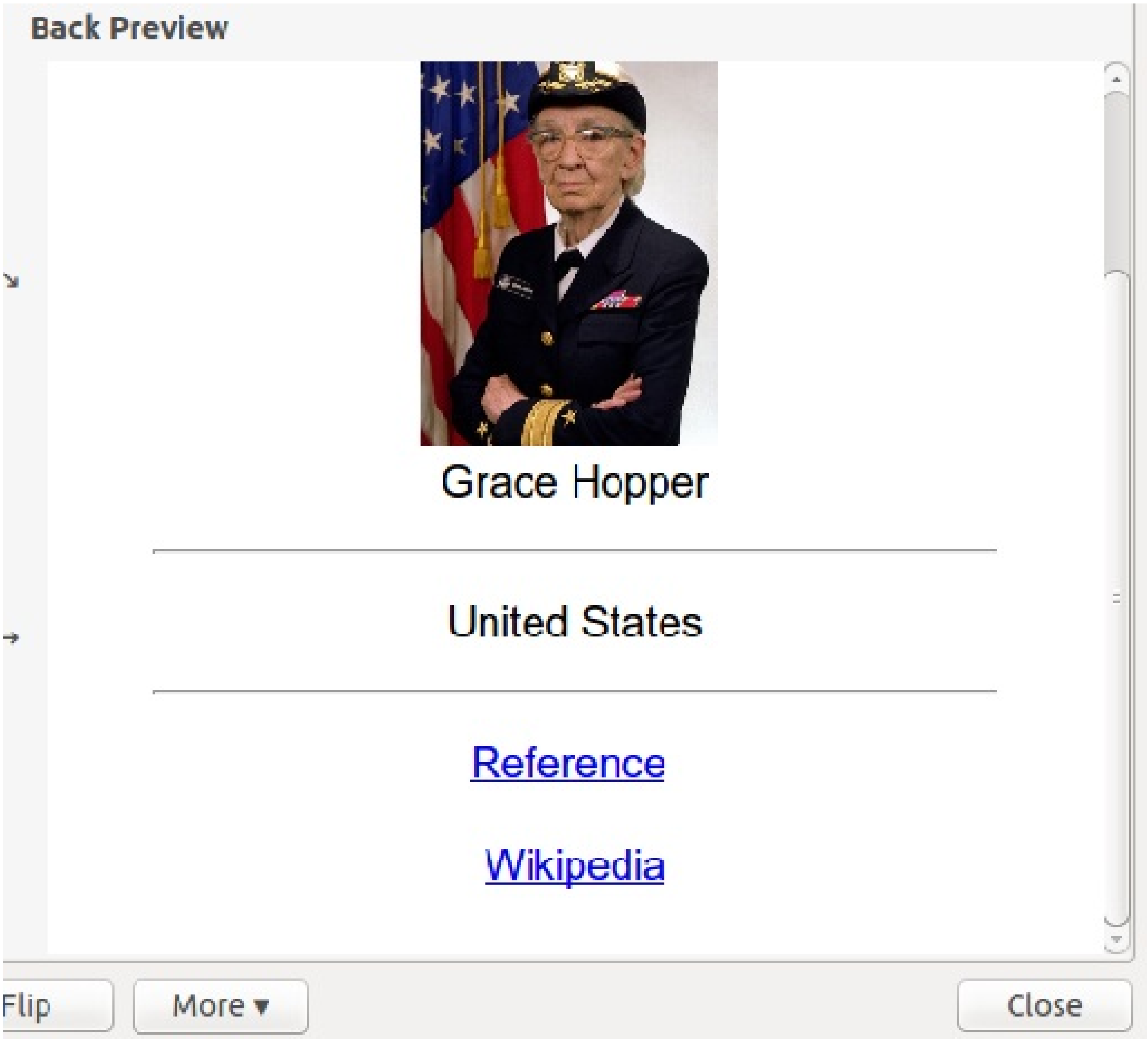
Reference

Grace Hopper and the Invention of the Information Age (Beyer)

Wikipedia

This illustrates why references formatted this way are so useful. Want to double check something or perhaps learn more about the subject? Click on one of the links. The offline references also allow you to keep track of what you learned from every book that you've read. The "<hr>" above the "Reference" code should make sense now, as the horizontal rule (which is just a grey bar) ensures that the answer on the card is separate from the various references below.

Keep in mind, too, that these fields are only showing up because there's input present. Let's see what happens when I delete the offline reference input:



Grace Hopper

United States

Reference

Wikipedia

Now all we get are fields that have input.

When to Create Fields

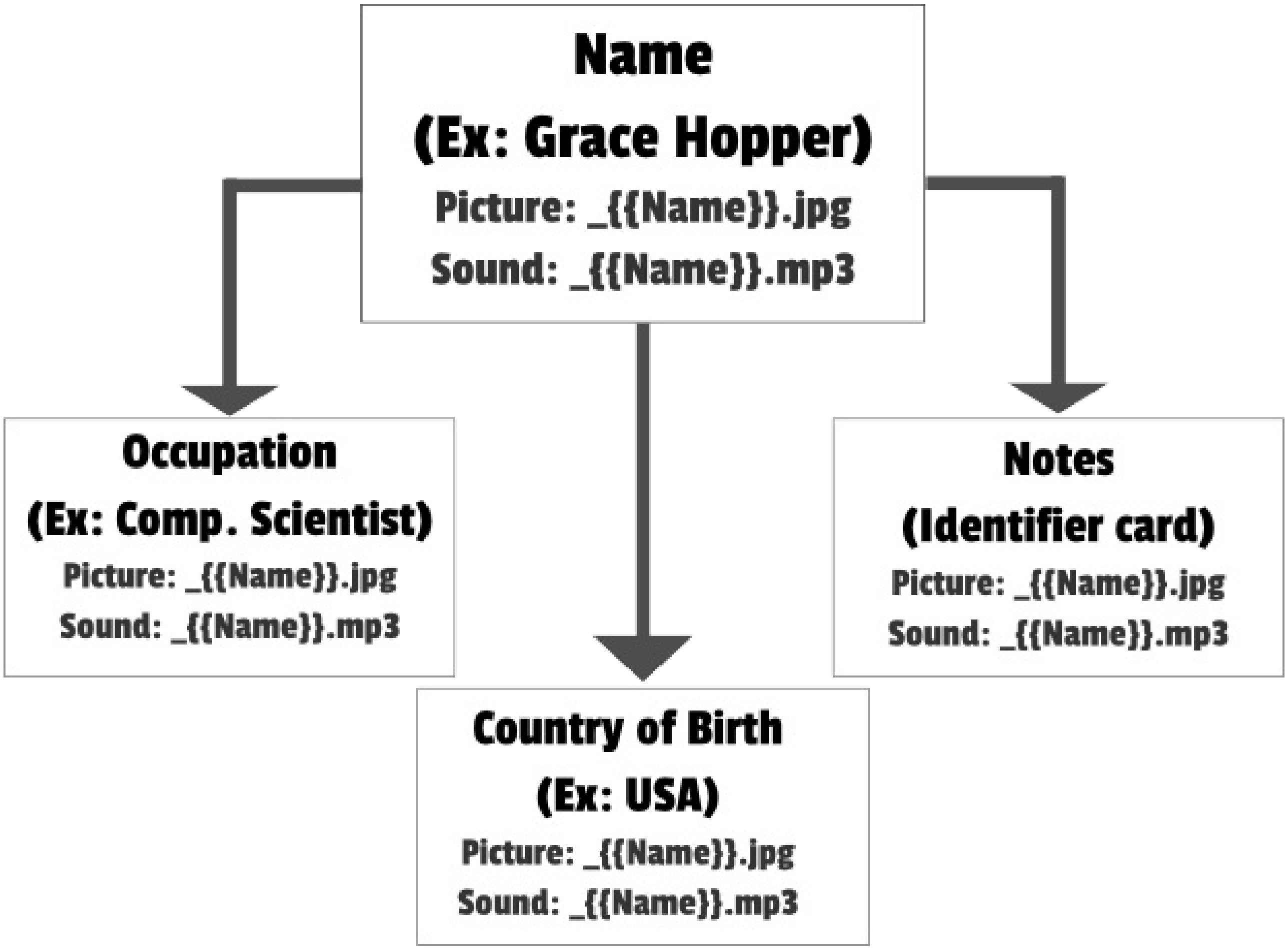
Sometimes the information that is most relevant to you isn’t necessarily obvious. You may also find that, after using an object note, some of the information you’ve decided to place in your long-term memory isn’t all that important. This happened to me while developing my own “People” object notes.

I started out, like most novices, eager to absorb every last bit of information about the people I created notes about. There were fields for date of birth, date of death, religion, political party, net worth and a variety of other trivial points. Looking back on it now, I can’t help but laugh at how needlessly complex they were.

My suggestion is this: start simple, and add as needed. Think about what features of an object are absolutely crucial for your understanding and focus on those. Don’t fall victim to the same rote memorization-style trap that I did. If I had been smart, I would have just added a few fields like the ones we just created with the Grace Hopper example above and progressively added fields as needed.

One rule of thumb I use is fairly simple: if I find myself constantly cramming information about one aspect of an object into a note, I’ll make a field. For example, on my “People” notes, I kept adding people’s nicknames like this: Grace Hopper (“Amazing Grace”). Rather than add that extra clutter to the field, it’s much better to just create a new field. In this example case, I just added a “Nickname” field. This chopped the information into smaller, more easily digestible chunks, and cleaned up the information in my “Name” fields.

Here’s a diagram to help you visualize this concept:



This is how you should ideally construct note types. At the top you have a clearly defined object (a person) that can be identified by one attribute alone (name). Other information can be derived from the name, and the media files (_Name.jpg and _Name.mp3) can be reused on each card’s template.

To give you a hint, if you wanted to make notes for airplanes instead of people, you could maintain the first field (“Name”) and change the other fields into more relevant bits of information about airplanes. Instead of

“Occupation” you could have “Top Speed” and rather than “Country of Birth” you could have “Max Takeoff Weight.”

You could also expand the number of fields to match however much information you need on each object. I have plenty of note types with upwards of 15 fields, although not every field necessarily generates a new card (reference fields are a good example of this). I would advise that you don’t make your notes too complex at first - figure out how to use the system before going further down the rabbit hole.

Tip: Don’t Style Fields, Style Their Outputs

It’s worth mentioning that you shouldn’t style what you put into your fields. A better policy is to style the outputs on the resulting cards and keep the inputs as plain text. An example of this would be my “Offline Reference” field.

When I put information into “Offline Reference”, it is simple plain text on my notes. However, when it is displayed on a generated card, it has italics (a choice I made because book names are usually in italics). So the card template looks like this:

<em>{{Offline Reference}}</em>

By doing this, you’re actually decreasing any amount of maintenance you’d need to do in the future. If you want your inputs in a field to change at some point, you don’t need to go to each card to do it - you just change the resulting output.

Exercise: Make Your Own Object Note Type

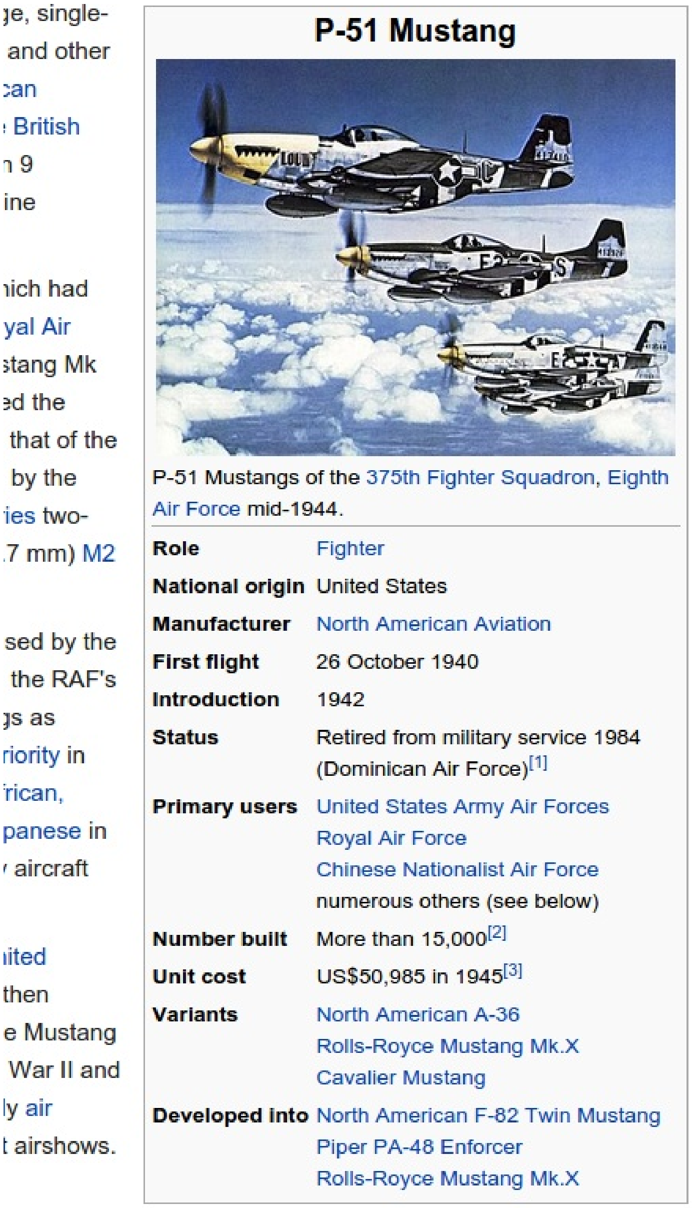
Try making your own note type that can apply to a wide number of items in an area you’re interested in. Here are some ideas that you can try:

- Airplanes
- Boats
- Cars
- Countries
- Cities
- Sports

Remember to use a format that allows you to use one base data point, such as a name, that will allow you to both easily generate cards and reuse media files. In our “People” note type, this is represented by the fact that each person has a name. Using this name, we can build cards around that subject and place one or two media files into our collection folder that can be used by all of them.

Bonus: Using Wikipedia for Fields

If you aren’t sure what fields might be useful, take a look at a Wikipedia page that applies to what you’re trying to learn. Using the previous example of airplanes, let’s take a look at the P-51 Mustang’s Wikipedia article. You’ll notice that (at least right now, things may change in the future) there is a box of information on the right side of the screen.



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P-51 Mustang

P-51 Mustangs of the 375th Fighter Squadron, Eighth Air Force mid-1944.

Role	Fighter
National origin	United States
Manufacturer	North American Aviation
First flight	26 October 1940
Introduction	1942
Status	Retired from military service 1984 (Dominican Air Force)[1]
Primary users	United States Army Air Forces Royal Air Force Chinese Nationalist Air Force numerous others (see below)
Number built	More than 15,000[2]
Unit cost	US$50,985 in 1945[3]
Variants	North American A-36 Rolls-Royce Mustang Mk.X Cavalier Mustang
Developed into	North American F-82 Twin Mustang Piper PA-48 Enforcer Rolls-Royce Mustang Mk.X

I’ve included a screenshot of the box I’m talking about so you can see for yourself. Now, when looking at this, you can see some basic information that could potentially be used for learning about airplanes. This information will be useful if you’re trying to remember things like where an airplane is/was built, who builds/built it, number of units built, and so on.

With this one panel, I could create an airplane-oriented object note type. I could create fields for Name, National Origin, Manufacturer and Introduction which would be useful not just for learning about the P-51, but that could be applied to any airplane. This sort of universal application should be your primary objective whenever you’re making object note types.

Cloze Notes

Another effective method for remembering information is to use something called a *cloze* note type. These notes generate “fill in the blank” cards where you have to remember specific bits of text. These are incredibly useful for remembering concepts that do not fit neatly into the other note types we’ve already examined.

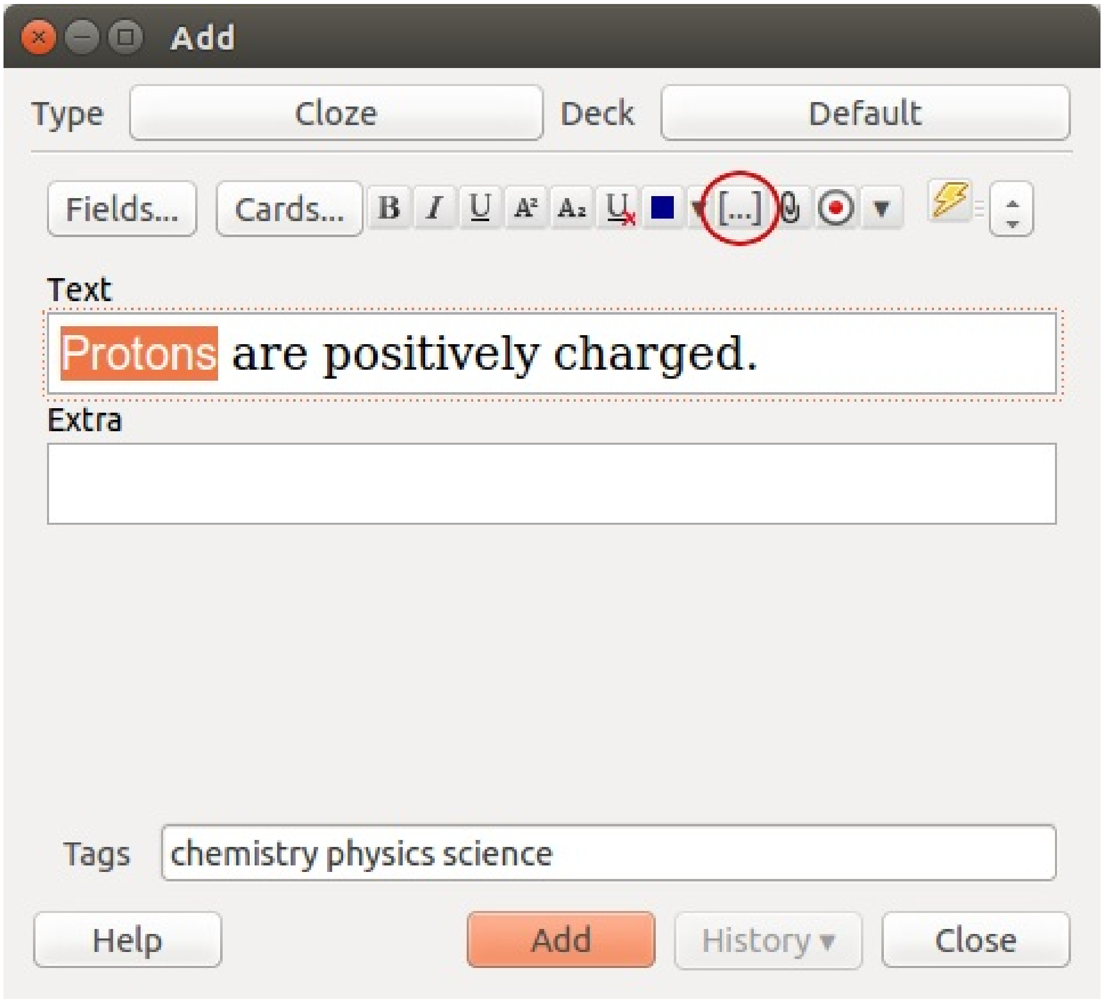
Starting from Anki’s main screen, click on the “Add” button once again. If you aren’t sure of the location of this button, look at the very beginning of this chapter (there’s a screenshot with the add button highlighted).

Once there, click on the button next to the “Type” field. Again, there’s another screenshot earlier in the chapter if you’re confused about this. This time, instead of adding a new note type, simply select the “Cloze” note type that’s already there. Cloze notes come as a default feature of Anki and many other flashcard programs, so you don’t have to worry about going through the process of making a custom note type again.

You should now be looking at a note entry window with two fields: “Text” and “Extra.” In the “Text” field, enter the following:

Protons are positively charged.

Now I want you to highlight the word “Protons” and click the button that looks like this: **[...]**. If you’re having a hard time finding it, take a look at this screenshot:



Type: Cloze
Deck: Default

Text: Protons are positively charged.

Extra:

Tags: chemistry physics science

Cloze note entry screen with the cloze button highlighted

You can alternatively press **Shift + Ctrl + C** (**Shift + Cmd + C** if you're on a Mac) to achieve the same effect. The word "Protons" should now look like this:

{{c1::Protons}} are positively charged.

So what does this mean? To see for yourself, click on the "Cards" button above the "Text" field (for future reference, you can use always use this button to preview cards). If you look at the front preview window of the following screen, you'll notice that the generated card now has the word you highlighted hidden. This is done so that you are made to use your memory to determine what is missing from the card whenever you review it. Press “Close” to go back to the original cloze note entry screen.

Now highlight “positively” and press the button again. Presto, now you have 2 cloze cards that are being generated by this cloze note. Do the same thing with “charged” and you suddenly have 3. Your “Text” field should now look like this:

{{c1::Protons}} are {{c2::positively}} {{c3::charged}}.

The resulting cards will each look like this when you review them:

Card 1: **[...] are positively charged**.
Card 2: **Protons are [...] charged**.
Card 3: **Protons are positively [...]**.

When you press the “Show Answer” button during reviews, the blank spaces will fill with the correct text, and you can judge how well you recalled the information.

My personal policy is to make at least four cloze spaces, although I’ll make exceptions with smaller cards like this where four wouldn’t really make sense. Make an effort to highlight the most meaningful parts of the card, and don’t highlight non-relevant words (such as the “are” in this sentence).

To give you an example of how *not* to format a cloze note, take a look at this:

{{c1::The}} {{c2::quick}} {{c3::brown}} {{c4::fox}} {{c5::jumps}} {{c6::over}} {{c7::the}} {{c8::lazy}} {{c9::dog}}.

The person making this cloze note has gone completely overboard. The way to make this effective is not to create cloze cards that hide every bit of information, but to create cloze cards that hide *significant* information. Highlighting words like "The" really doesn't do anything, as it has no bearing on the rest of the text.

You could generate retention of this sentence with far fewer cards by doing it like this:

The **{{c1::quick}}** brown **{{c2::fox}} {{c3::jumps}}** over the lazy **{{c4::dog}}.**

How to Use Flashcard Types

While it is a bit of a time investment to go through the process of creating appropriate note types, using them is much easier. You'll find that, with enough practice, you'll be able to add dozens of new cards a day without much issue. Adjustments will certainly need to be made as you go, but for the most part it's smooth sailing after you've made the note templates.

So now that you've (hopefully) set yourself up with at least one note type and understand how to use object, cloze and basic notes, let's talk about when to use them. The way I recommend starting is by taking a top-down approach. What I mean by this is to start with the concept (in the form of an object note), then use trivia and cloze notes to complement it.

Let's walk through an example so you can clearly understand this idea. Suppose you want to learn about human memory [60]. Let's look at how you could use the model of object-and-supplement flashcards in this scenario.

I'll use the concept of ***procedural memory*** (a type of ***implicit memory***) as a testbed for this model.

First, you should add an object note for the concept itself. My deck has a “Definitions” note type that is used for such things, and it allows me to create several identifier cards for whatever concept I want to learn. Definition notes also include images and pictures, which takes care of the “vivid” piece of the puzzle. This note type has fields such as the following:

- Name
- Definition
- AKA (if the concept has another name it is commonly known as)
- Simplification (a field for less rigorous, easier to understand definitions)
- Opposite (for any concepts that acts as opposites)

Your object note type may be very different, but the idea should be the same: use the object as a way to create cards with key features of the concept you want to learn.

Second, create a few basic trivia cards, such as:

Front: What type of memory is used to recall “how-to” information about tasks?
Back: Procedural memory

Front: What sort of memory would you be utilizing when riding a bike?
Back: Procedural memory

Front: What category of memory does procedural memory belong to?
Back: Implicit memory

Third, create a few cloze cards as well:

{{c1::Procedural}} memory guides the {{c2::processes}} we perform and most frequently resides {{c3::below}} the level of conscious {{c4::awareness}}.

With this three-pronged approach, you’re creating several chunks that can be used to link to higher concepts. The object card gives you a general idea about what the concept is and what it entails, while the trivia and cloze cards give you more contextual chunks. The trivia cards are especially important in this mix, as the questions you formulate act to test your overall knowledge of the concept in relation to its overall subject. This combination has been, in my experience, a highly effective way to retain both the factual knowledge surrounding a concept and some additional context to aid in recall.

When Plain Old Trivia Cards Are OK

To reiterate, trivia cards are essentially the digital analogue of traditional two-sided flashcards. As mentioned above, they are useful for contextual questions that act as a test of your understanding of the overall subject. But there is another use that I believe deserves some attention: unique information.

Let's look at a recent example from my own deck. I've been reading Ron Chernow's huge biography of John D. Rockefeller, *Titan*, and within it is a section where Rockefeller's role in the near eradication of hookworm in the southern United States is discussed. I thought the fact that his large ($1 million in 1909 dollars) gift improved life for so many people was incredibly interesting, especially considering how poor his public image was (and still is).

For a small piece of very unique information like this, it really doesn't make sense to create a whole note type. So instead, I created a card like this:

Front: What parasite was nearly wiped out in the South as a result of a $1 million gift from John D. Rockefeller?

Back: Hookworm

Simple and effective. If I wanted to study hookworms in detail, I could create a "Parasites" note type or something to that effect, but since this is just an interesting detail I wanted to remember, there's no need to do such a thing. A trivia card takes care of that perfectly well [61].

Mnemonics

If you’ve ever used some sort of wordplay to remember a concept, you’ve probably used mnemonics. Mnemonic devices generally come in the form of rhymes or acronyms that can be used as an aid for recalling information. For example, if you’ve ever used “PEMDAS” (or “Please Excuse My Dear Aunt Sally”) to remember the order of operations (Parentheses, Exponents, Multiplication, Division, Addition, Subtraction) in algebra, or SOH CAH TOA for trigonometric ratios (Sine - Opposite/Hypotenuse, Cosine - Adjacent/Hypotenuse, Tangent - Opposite/Adjacent), then you’ve utilized mnemonics.

In recent years, mnemonics has become a sort of obsession for a class of academic “athletes” who use mnemonic devices to do things like remember the order of a deck of cards they’ve only had a minute to memorize. These people are utilizing techniques such as the so-called “memory palace”, in which each item they want to recall is placed into an imaginary structure which they “walk” through in order to remember. Such techniques are beyond the scope of this book, but you should take some time to make your own mnemonics as you go and/or use some that are already around.

For example, when I was learning about the different paradigms of programming languages, I created a small mnemonic for myself to remember the most popular ones: FOIL (not to be confused with the mnemonic for how to multiply binomials) - Functional, Object-oriented, Imperative and Logic. Whenever you're learning a new subject, try to find a way to create something similar that you can easily remember.

I don't personally rely on mnemonics for retention, as spaced repetition accomplishes the same effect without nearly the same level of effort. With a spaced repetition program, all you need to do is review your cards at automatically spaced intervals and you'll get an effective transfer to long-term memory. Where I do see mnemonics coming in handy is for situations where a high-tech spaced repetition program simply isn't an option. For example, if you find yourself out in remote areas for long periods of time, mnemonics can be used to keep information fresh until you can use flashcards again.

Mnemonics is a fairly deep subject with many different schools of thought and techniques, so I'm going to cut off our conversation about them here. For those of you who are interested in more advanced mnemonic techniques, such as the aforementioned memory palace, take a look at the reading list at the end of the book. Joshua Foer's *Moonwalking with Einstein*, in which the author becomes the reigning memory champion after a short time perfecting mnemonic techniques, is an especially good read.

Part Three: Bringing It All Together

At this point, we’ve covered just about every tool we’re going to need to start building the final pieces of a framework Factory. You should now be able to:

1. Gradually build new habits without much of an issue
2. Create funnels that provide a constant stream of relevant information
3. Work efficiently using systems such as the Pomodoro technique
4. Create flashcards that will allow you to retain the information you take in

If you’re still struggling with any of these things, take a little more time to refine your understanding of whatever it is you’re having trouble with. I know that using a flashcard program and reviewing it every day is particularly alien to most people, so don’t feel bad if you’re having a hard time with that at first. It’s also not easy to jump into making flashcards like the ones I described if you aren’t particularly good with computers. Don’t worry - I promise it all gets easier with time.

From this point forward, I’m going to assume that you now understand how to use the tools I’ve laid out for you. Now we can walk through the process of combining all of these things together to create a fully functional Learning Factory.

Processing Information

Reading

Reading books is something that many people do on a regular basis, but very few do it in a way that will stimulate their memories. Sure, you'll probably remember a few points from each book you read, but unless you're given a reason to think deeply about that material on a regular basis, it will fade rather quickly.

For some, this is on purpose. If you're a regular reader of science fiction, for example, you're not trying to focus on complex subject matter. Readers of science fiction are reading that material because it's something they generally get pleasure from, and reading fiction is an experience. We aren't going to focus on people that read in that manner, although I suppose if you really want to remember every detail of a novel you can certainly use the methods I'm about to outline.

The people I'd like to address are those who are reading primarily non-fiction, and are reading such books for the purpose of learning about something. Many of you are using techniques that I've already discussed, such as highlighting and passive note taking, and I hope that you took my advice and stopped doing those things. Of course, if you did stop doing those things, you were probably left wondering, “What should I do then?”

Reading effectively is fairly straightforward, but it does require more time and effort on your part. If you pride yourself on blowing through 20 books per week, I’d say that this is probably not going to be a comfortable experience for you at first. However, if you really are that voracious of a reader, I’d like to humbly suggest that perhaps you aren’t getting very much out of the books that you’re mowing down so easily. You clearly aren’t taking steps to remember the material, and chances are you aren’t giving your mind much time to think about and consolidate what you’re reading.

Instead, what you should be doing is reading carefully, taking the time to soak up what’s being said, and creating flashcards about relevant snippets of information you come across. If the subject is brand new to you, reading will almost certainly be slow-going at first. If you’re normally into devouring books at breakneck speed, you’re likely not going to be happy about this at first. For those of you who fit this description, you should realize one thing: by going slow, your progress will be much faster and last much longer.

At the crucial early stages of learning a subject, using this method provides an efficient and effective method of building a foundational library of factual knowledge. With this library, you'll be able to pick up and understand more advanced subjects much more easily. As we've discussed before, this is due to the fact that, by using these techniques, you're building a sort of custom autopilot for yourself and conjuring up important concepts will start to become second-nature to you. Doesn't the idea of bringing up complex ideas as easily as you would walk down the street or eat a sandwich sound nice?

So now the big question: how do we go about doing this? There are a variety of ways to accomplish it, and I'll walk through some methods you can use. Although they all achieve the same result (transfer to long-term memory), you should pick the ones that fit your style and temperament best. If you aren't sure which one would work best for you (and I'm assuming that is the most probable case here), then you should give them all a shot to see which one gives you the best results. I personally use all of these in one way or another, depending on where I am and what resources I have at my disposal.

Parsing Written Information

We've previously explored how passive note taking is a giant waste of time and I want to emphasize again that just taking notes is counter-productive. The practice of writing in the margins of a book, a practice known as *marginalia*, is equally wasteful. Instead, what you should be doing is taking notes with the express intention of converting them into flashcards.

There are several routes you can take for this, and, again, it depends on your preferences. One option (which is my most-used) is to simply write short email messages to yourself and send them into your article funnel. The way I normally format these is to write the passage(s) I want to use for flashcards in the body, and the title of the book in the header. This method is straightforward and provides a way to linearly progress through your notes. It also provides some motivation to get through your notes, as you'll find it piles up quickly if you don't take care of them.

I don't know about you, but I absolutely detest having a cluttered inbox, and that's part of how I motivate myself to go through learning material in a timely manner.

Another is to simply write the information you want to remember down with paper and a pen. I personally find this a little cumbersome, as I prefer being able to copy and paste information directly into new flashcards, but it works well if you're somewhere without internet access. It also might be a good way to start out if you're a habitual note writer anyways, as this will provide for a fairly painless transition.

Let's walk through how you should be parsing information from notes or highlights as you're reading. Since I don't want to step on anybody's toes with copyrights and such, I’ll use the Wikipedia article about neurons [62] instead of a book or an article from somewhere else on the web.

The first thing to check out is any information that potentially gives you a summary of the material or at least a large section of it. Wikipedia articles generally have a summary at the very top, with finer details emerging as you scroll down. This works out excellently for someone like you that’s looking to make flashcards, as you can make a very natural transition from general to specific as you go through it.

Here’s the top paragraph of this article:

> A **neuron** (/ ˈnjʊərɒn / ***nyewr*** *-on* or / ˈnʊərɒn / ***newr*** *-on*; also known as a **neurone** or **nerve cell**) is an electrically excitable cell that processes and transmits information through electrical and chemical signals. These signals between neurons occur via synapses, specialized connections with other cells. Neurons can connect to each other to form neural networks. Neurons are the core components of the nervous system, which includes the brain, spinal cord and the ganglia of the peripheral nervous system (PNS) which comprises the central nervous system (CNS). Specialized types of neurons include: sensory neurons which respond to touch, sound, light and all other stimuli affecting the cells of the sensory organs that then send signals to the spinal cord and brain, motor neurons that receive signals from the brain and spinal cord to cause muscle contractions and affect glandular outputs, and interneurons which connect neurons to other neurons within the same region of the brain or spinal cord in neural networks.

There are tons of opportunities for creating flashcards in just this one paragraph. First, you need to group the information into small chunks. This is where previous note taking or highlighting habits come into play. But rather than just highlighting or writing down whatever it is you want to remember, start converting that information into flashcards.

The first step is to identify key concepts and create object notes out of them (in this case, “neuron” would be the first one to tackle). This gives you the factual foundation you need to recognize it in the future and build contextual knowledge as you go. I have a pretty in-depth object note type, the aforementioned “Definitions” note, that is used for tasks like this. You can create one like mine, or you can make a more specialized note type if you like.

The fields for my “Definitions” object note type look a little like this:

Object Note Fields and Content for “Neuron”

Field	***Content for “neuron”***
Name	Neuron
AKA [63]	Nerve cell
Definition	An electrically excitable cell that processes and transmits information through electrical and chemical signals.
Simplification	The fundamental unit of the brain, spinal cord and peripheral nerves.

Reference	https://en.wikipedia.org/wiki/Neuron

Each one of these fields should generate a card that reinforces the concept of “neuron” (except “Reference”, which is just there so you can keep track of your sources). Every card made by this note also has a picture of the object and an audio file that states its name to make it even more concrete.

An example of a more specialized object note type would involve breaking down the categories that the object falls into. You want to focus on categories that have lots of useful objects in them. In this case, I’d probably create a “Cells” object note type, since neurons are a type of cell and there are many other cell types that could be processed along with neurons.

To make a more specialized object note, you could break it down like this:

Object Note Fields and Content for “Cells”

Field	***Content for “neuron”***
Cell Type	Neuron
AKA	Nerve cell
Purpose	Transmit and process information
Location	Nervous system
Reference	https://en.wikipedia.org/wiki/Neuron

Object notes on their own are useful, but you should be using them as a basis for more context-focused chunks. In this example, look at the following sentences and think about how each could be turned into useful trivia or cloze flashcards:

A neuron is an electrically excitable cell that processes and transmits information through electrical and chemical signals.

Neurons can connect to each other to form neural networks.

Neurons are the core components of the nervous system, which includes the brain, spinal cord and the ganglia of the peripheral nervous system (PNS) which comprises the central nervous system (CNS).

There are important bits of contextual information surrounding the object in question (neuron) within each of these sentences. Here are some ideas about how you can convert them into cards:

Trivia Cards:

Front: What type of signals do neurons use to process and transmit information?
Back: Electrical and chemical

Front: What can neurons form when they connect to each other?
Back: Neural networks

Front: What are neurons the core components of?
Back: Nervous system

Cloze:

{{c1::Neurons}} are the **{{c2::core}}** **{{c3::components}}** of the **{{c4::nervous}}** system. **{{c1::Neurons}}** can **{{c2::connect}}** to each other to form **{{c3::neural}}** **{{c4::networks}}**.

These paragraphs also have links to other articles that you should add to your article funnel. This is a crucial step, as you shouldn't just be memorizing facts without understanding what they're saying. That would be rote memorization, which we're trying to avoid.

In this example, if you aren't familiar with the concept of a neural network, you should add that to your article funnel and read it. As you're reading that article, use the same process you used here: create flashcards out of the information you come across and read linked articles about things you're unfamiliar with. Doing this takes you further and further down the "rabbit hole," so to speak, and I think you'll be amazed by how much you can learn with this technique alone.

If you're reading an actual book, then the technique is slightly different. Rather than clicking links for things you're unfamiliar with, you simply look them up as you find them. You can accomplish this by either jumping to Wikipedia (which is generally my first stop), or you can try using the list of references included with the book (if there is one). If the book you're reading has a glossary, use that as well.

Either way, the process of converting information into flashcards should be the same. Find relevant concepts you're unfamiliar with, create flashcards, rinse and repeat.

By doing this consistently over time, you bring together separate, but related, chunks into your library of knowledge. Those chunks will eventually form into a top-down understanding of whatever it is that you're studying. It might feel disjointed and strange to be collecting facts in this manner, but as you continue studying you'll find this base of chunks to be invaluable. While others might need to look up concepts they've forgotten, you will recognize and understand them whenever they come up.

Watching Videos or In-Person Presentations

Although I personally view videos and presentations as far less time efficient than written materials, there is certainly value in watching them from time to time. I've had several "a-ha" moments while watching videos, in most cases because the presenter gave a much clearer explanation of a topic I was struggling with than was available in the books I was reading. Some people prefer videos for other reasons, and watching videos might make the transition into regularly studying easier.

However, watching videos is, much like passive reading, not worth much on its own. The additional stimulus you get from audio and imagery helps, but you still need to find a way to ensure that information you want to remember is being sent to your long-term memory. Doing this successfully is very similar to the process required for reading books, but it has a few distinct differences.

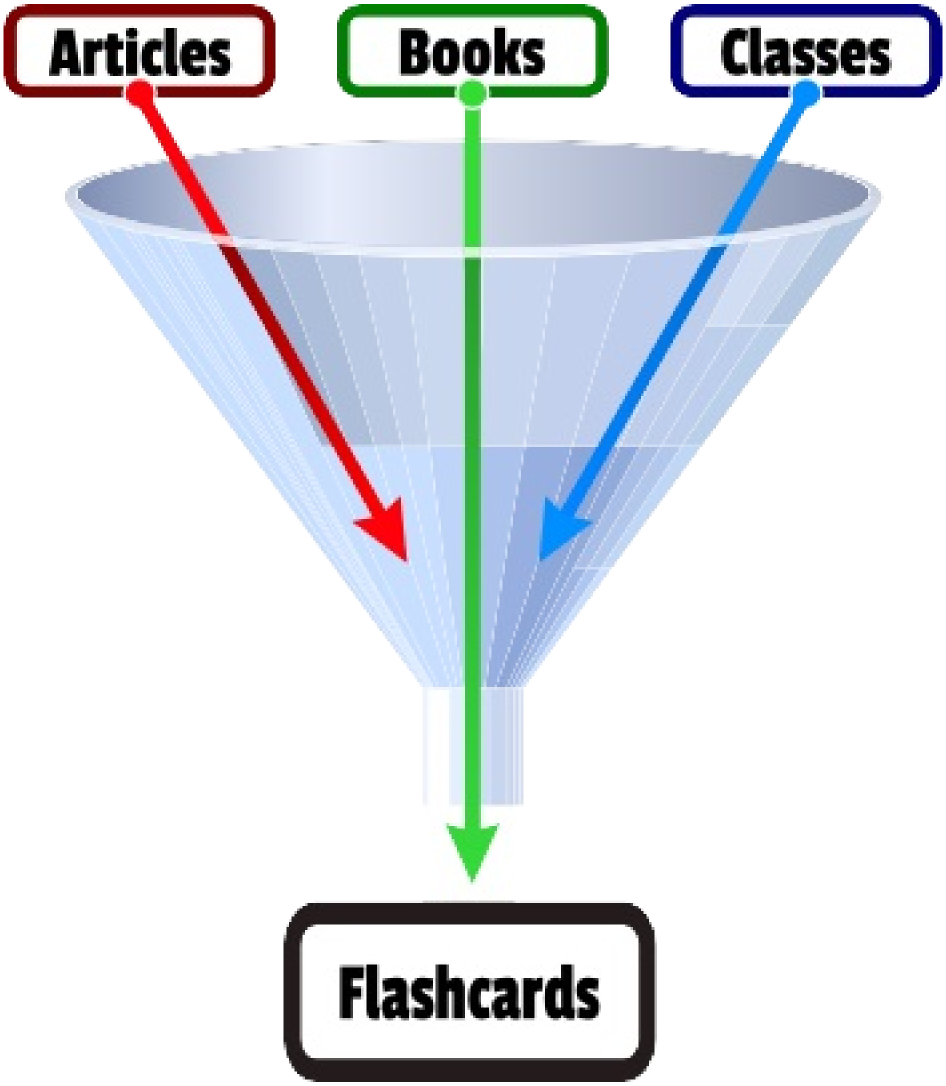
First of all, there are many videos series out there that are designed to provide clear, simplified explanations of difficult topics. I recommend you seek these out whenever you're having problems, and incorporate what they say into your flashcards. I've personally done this many times when filling in the "Simplification" field in my "Definitions" object note type.

Perhaps they used an image or analogy that was really effective, or maybe they provided an interesting bit of trivia. While you're watching the video, pause it and transmit those bits of information into flashcards. You can also take advantage of the presentation by capturing the audio (with sound recording software) or imagery (via screenshots) of the video and using it yourself. There have been multiple instances where I've done this because I just couldn't find a better sound or picture to supplement a concept.

Presentations and lectures are little trickier only because you're probably going to have to use a paper notepad or your phone to take notes and then create the cards later. You could use a laptop, but I've personally observed people typing in the middle of a presentation and couldn't help but find that person exceedingly rude. The tapping of the keys while someone is talking is distracting and annoying, to say the least. But if you’re in a situation where your typing won’t affect anybody (or you’re just inconsiderate), go ahead and make your flashcards during the presentation. College lectures are especially accommodating when it comes to taking notes on a computer, so I encourage you to take advantage if you’re a student.

These principles can all be used when using MOOCs as well. I’ve personally found that using MOOCs is a great way to enhance understanding, and many concepts are made clear by the experts who teach them. While watching lectures, take notes and convert those into flashcards. When an exam or quiz comes up, use that material as a basis for flashcards as well - in this case, they often have done all the work for you by defining the questions and answers.

Your Learning Factory’s funnels end up turning inputs from the outside - namely information you want to remember - into easy-to-remember flashcards. Here’s an illustration to drive the point home:



Flashcards are not the end of it, of course. You need to include experience and practice to make sure what you want to learn really sticks [64].

Integrating Experience

Nearly every subject under the sun has some kind of first-hand experience that you can use to assist you in your learning. There are some topics, such as neuroscience or chemistry, where hands-on experience is a little more difficult to come by unless you're already involved somehow (studying or actively working in a field, for example). Others, such as computer programming or language learning are relatively easy to get exposure to, regardless of your situation.

Either way, it's important to find a way to integrate experience into your curriculum. There's quite a bit that can be gleaned from books alone, but actually engaging in something is the only way to sharpen associated skills. For example, you can read dozens of books about programming, but the only way you can actually do it well is by actually programming [65].

As we discussed earlier, the best way to accomplish this is with deliberate practice. How this applies directly to you is impossible for me to know, but here are some guidelines you can use when choosing an activity:

1. **Is it passive or engaging?** *Lean more towards engaging, although having a mix of both can work as well.*

2. **Do you find it challenging?** *Remember, you want to shoot for intermediate difficulty - not too hard, not too easy.*

3. **Are there any potential mentors or teachers involved?** *You'll learn much more if*

> *you have an experienced instructor there with you*.

Ideally, you want to focus on activities that force you to really think about the subject you're interested in. This means you're engaged, you find it somewhat challenging and there's someone else involved that can test your knowledge on a regular basis. The last piece is key, as you'll also get a bit of motivation to do better in the form of peer pressure. Having that person around can also help you overcome hurdles you might be dealing with, as they can provide a more nuanced and experienced viewpoint for you to consider.

If you're engaging in activities that don't meet these criteria, you should start looking for some that do. For example, if you're taking language lessons and your tutor is not challenging you enough (or, alternatively, is pushing you too hard), you should find a new tutor. Or if you're spending most of your time simply watching live presentations, you probably need to think up a more engaging way to expose yourself to that subject.

A word of warning: be careful about what you're thinking about as you're doing these things. One of the primary issues teachers face with this sort of learning (termed *inquiry-based learning* or *discovery learning*) is that students tend to either not think about the subject at hand (because of distractions), or, even worse, draw incorrect conclusions. In a more open learning environment, it's terribly easy for students to wander and not gain useful knowledge from experiences.

You’ll have to stay vigilant while undergoing this segment of your learning. Whenever you believe you’ve come up with a correct conclusion, take a step back and question how you formed it. If you take in information from other people, fact check it before you decide to incorporate it into your library of knowledge. I like to utilize the old Russian proverb that was popularized by Ronald Reagan: “Trust, but verify.”

Don’t be afraid to whip out your phone after a conversation and fact check whoever you were talking to. In fact, I’d say it’s better to do that right away than risk ruminating (and hence starting the memory-forming process) about false information.

Using Handwritten Notes

As we’ve discussed, there are times in which electronic note taking is simply not an option and those are usually related to either reading physical books or experiencing things away from a computer. As such, it’s worth at least briefly discussing how to effectively take hand-written notes.

The way I personally generate notes that I know will be converted into flashcards is by creating compact statements and questions that won't require further refinement. For example, I'm looking at some notes right now that I took while reading a book about the structure of programming languages, and here are some snippets I jotted down:

Garbage: Lost heap-dynamic variables.

Memory leakage is caused by garbage.

C/C++ pointers can point anywhere in memory, whether there is something there or not.

***C/C++ array names without a subscript will always point to the first element*.**

Don't worry about understanding those chunks, as you wouldn't have any reason to unless you're interested in the finer points of programming languages. Instead, focus on how the notes are structured. They're all short, with not a single note exceeding a single sentence. They're also bits of information that can be turned into a variety of different cards effortlessly.

I turned "garbage" into an object note type (after reading more about it in both the book and its Wikipedia article), then created a trivia card like this:

Front: What usually causes memory leakage?

Back: Garbage

By doing this, I combined the factual knowledge of what garbage is with a contextual question that gives me a perspective on its role within the subject. Memory leakage turns out to be a very important problem in programming, and it is worth understanding what creates it.

A cloze note could very easily be made here as well, with the following format:

{{c1::Memory}} {{c2::leakage}} is caused by {{c3::garbage}}.

To use one more example from this small collection of notes, let's look at the snippet about array names. At the time, I already had an object note type about subscripts (aka indices), and didn't need to make anything new there. However, I knew by then that it made sense for me to create a trivia card about what happens when arrays without subscripts are used in C or C++ (which, to those unfamiliar with programming, are programming languages).

Here's how I handled that:

Front: What element is referenced when a C/C++ array is called without a subscript?
Back: First element

This example relied on previous knowledge about what arrays and subscripts are, which allows me to keep this particular trivia card relatively simple. If I didn’t have that understanding ahead of time, this would not make any sense to me.

Another example we could use is an in-person presentation I went to. It was given by Chris Anderson, the former editor of *Wired* magazine and the current CEO of 3D Robotics, a drone company. He discussed the finer points of how drones are being used today, and how 3D Robotics was providing services to a variety of different industries around the world.

One thing he mentioned that I thought was really interesting were the challenges facing drones at certain altitudes. For one, there are laws in US prohibiting drones from flying over 400 feet. This fact by itself can easily be converted into a trivia card:

Front: What is the legal altitude limit for flying drones in the US?
Back: 400 feet

He then went on to explain that the reason drones aren’t allowed to go very high is that it’s very easy to navigate obstacles down low, but incredibly difficult up high. A drone has to be aware of its surroundings and be able to determine if a fast-moving aircraft in the distance is a problem. A simple dot on the horizon can turn into a mid-air collision very quickly, and drones haven’t yet demonstrated that they are capable of managing such situations.

These bits of information can also be parsed and put into flashcards that give context to the first one we created regarding altitude limits. You could, for example, make a trivia card like this:

Front: Why aren't drones allowed above 400 feet?
Back: Sub-par obstacle avoidance

Hopefully this has made it clear how you can take information from nearly anywhere and transform it into chunks that can be placed in long-term memory.

Discipline, Exercise and Rewards

As I've mentioned before, there are many, many books out there about the finer points of exercise, and I won't be adding to that collection. However, exercise plays an important enough role in learning that it does need to be viewed as a non-optional component of your Factory.

First and foremost, no matter what type of shape you're in, you should stop reading this book and go for a quick walk [66]. This will do several things for you:

1. You'll be exercising, which by itself has numerous cognitive and physical benefits.

2. You'll give your brain a chance to switch over to the previously mentioned defuse thinking mode, which allows your mind to wander and explore new avenues of thought.

3. You can say you've officially started your daily habit of exercising (if you don't already have one).

4. If you were feeling down, you'll probably be feeling at least a little better.

Congratulations, you've now given yourself a cognitive and psychological boost. Wasn't terribly difficult, was it?

Now that we've gotten that out of the way, let's explore how to incorporate exercise into your routines. First, consider your daily schedule. What kinds of commitments do you have on a regular basis? Do you have regular, predictable work hours or are you constantly on call? You need to ask yourself these questions so you can create a predictable space in your day specifically for exercising.

I personally prefer to work out at the end of the day, but your schedule might not allow for that. Either way, it doesn't matter - what matters is that you specify a slot for that time on a daily (or near-daily) basis. My own policy is to ensure that, no matter what, I at least go for a walk. I'd like to be able to do more intense workouts (such as weight lifting, Brazilian jiu-jitsu, hiking or sprints) every day, but sometimes that’s just not possible. This is especially true while traveling.

By making the commitment to do at least a small amount of exercise every day, you’re creating and reinforcing a beneficial habit that, with enough time, will become nearly automatic. After doing this simple bit of exercise every day for a couple of months, you’ll find that you forgot what it was like to not have it in your life.

When you’re taking on a large amount of information, it is of the utmost importance to take breaks. Sometimes it helps to use those breaks to exercise, but most breaks should focus on relaxation. Aside from the aforementioned benefit of switching into the task-negative mode thinking mode, you also give yourself a potent psychological boost.

Think of it like this: learning, like most things in life, is a marathon not a sprint. If all you do is shove information down your proverbial gullet, your progress will be short-lived. You’ll end up burning out just like I did, and that will almost certainly make you dislike the learning process.

Here are some tips I suggest you incorporate into your regular learning process:

Define Rewards with Levels (Daily, Weekly, Monthly, etc.)

Think about things you enjoy doing and classify them based on how rewarding they'll be. Then consider what you should do in order to “earn” that reward. For example, I usually have a specific YouTube video I want to watch after each Pomodoro session I take on. It isn't a huge burst of entertainment, but it isn't supposed to be. It's just what I watch for 5 minutes to keep my mind off of my work after I've been working hard for the last half-hour.

I also normally have an event at the end of each week that I look forward to. Last week, I knew that a friend of mine was having a party on Saturday night. By knowing that I would have a solid block of relaxation during the weekend, it became much easier to cope with the stress and strain of the week. My goal in this situation was to ensure that I followed my daily regimen precisely each day of the week. I did that, so when I got to the party I didn't worry at all about missing potentially productive time (something that I struggled with at social events for a long time).

Is there are a trip you were thinking about going on in the near future? Great, book it and now you have a big chunk of guilt-free pleasure you can enjoy down the road. Think about what you need to do in order to allow yourself to embrace the experience completely. For something like this, it should be much bigger than just finishing a period of work. If you've thought about writing a book or putting together a new business, these are the sorts of goals that are worthy of a big reward.

Set an Ending Time Every Day!

This one deserves an exclamation point because of its importance and effectiveness. By defining a stopping point each day, you’re not only giving yourself a period of earned relaxation, but you also create motivation to get your work done. You’ll be amazed at how much you can get done when working under a mild deadline [67].

Setting an end time also prevents overworking and, assuming you work during the day, will help alleviate any kind of work-related sleep problems you may be having. Many people feel the need to work far past their normal hours, but such habits end up being entirely counter-productive. Set a cutoff time and push yourself to get your work done by then. Don’t sacrifice sleep, which is incredibly important for both learning and long-term health, just to get a few more chunks into your mind.

Bonus: What About All My Old Notes?

Now that you know how to properly parse information, some of you may be looking solemnly at your large stacks of notebooks and highlighted books, wishing that the time you spent on them could be restored. I know I certainly feel this way whenever I think about the hundreds of hours I spent doing these things. So what should a person do with these notes to make them useful?

First of all, you should consider if they’re really that important. The manner in which most people take notes is usually pretty counter-productive, and your notes might not be worth the time and energy required to turn them into something useful. Looking back on some of my own old notes and highlights, I can see plenty of instances where I took notes that were, in retrospect, not that important. It was my hope that taking a note on or highlighting every other word would make me that much smarter. Many of my notes are also far too long, and would have to be chopped down into several chunks.

The time and energy expenditure involved in going back and converting these into something useful can be significant, particularly because you can’t copy and paste information from a physical book. So you should begin by first thinking long and hard about whether you want to actually do this. I think it’s especially important to consider whether you want to remember these notes because they’re genuinely useful in your day-to-day life, or if you’re simply feeling bad about having spent so much time creating them.

If you do want to place these old notes into long-term memory, then I recommend you treat them the same way you would any other written information. Look at your notes, break them down into small chunks (if they’re big) and use the techniques we’ve gone through to convert them into flashcards.

Walkthrough: Programming

We’ve covered essentially everything you’ll need to get started with a program, but, as I’ve mentioned before, this book is dedicated to the idea of *practical* knowledge. As such, let’s walk through how you could incorporate everything you’ve gleaned from here into a sample program. We’ll also go through some of the mistakes I’ve made, so that you can be better prepared to deal with speed bumps as they pop up.

I’m going to use programming as a template here, and I have several reasons for doing so:

1. I’ve actually gone through the process of learning to program.
2. It’s a skill that quite a few people are trying to learn, so there is a high probability it will be useful to you.
3. Programming can be done by nearly anybody, anywhere, so if you wanted to use programming as a way to experiment with learning, it’s an excellent subject to start with.

However, if you want to learn something else, you can easily use this template for another subject. You will have to tweak a few things, but the baseline system is essentially the same.

From this point forward, I’m going to assume you have zero experience with programming. If you do have some knowledge of the subject, I imagine you can still pick up on how to structure any further learning you want to engage in. It’s also worth mentioning that you shouldn’t expect to be a world-class expert in a short period of time, learning system or not. What I can do for you here is simply get you past “Beginner” status faster, and give you a far more solid base of fundamentals to work from in the future.

I decided to learn to program because I wanted to have a more in-depth understanding of computers. I’ve always been an avid user of computers, and I felt that being ignorant of programming made any knowledge I had of their function overly superficial. Over the course of about six months, I taught myself enough to create and deploy several web apps, as well as build a fairly complex backup program.

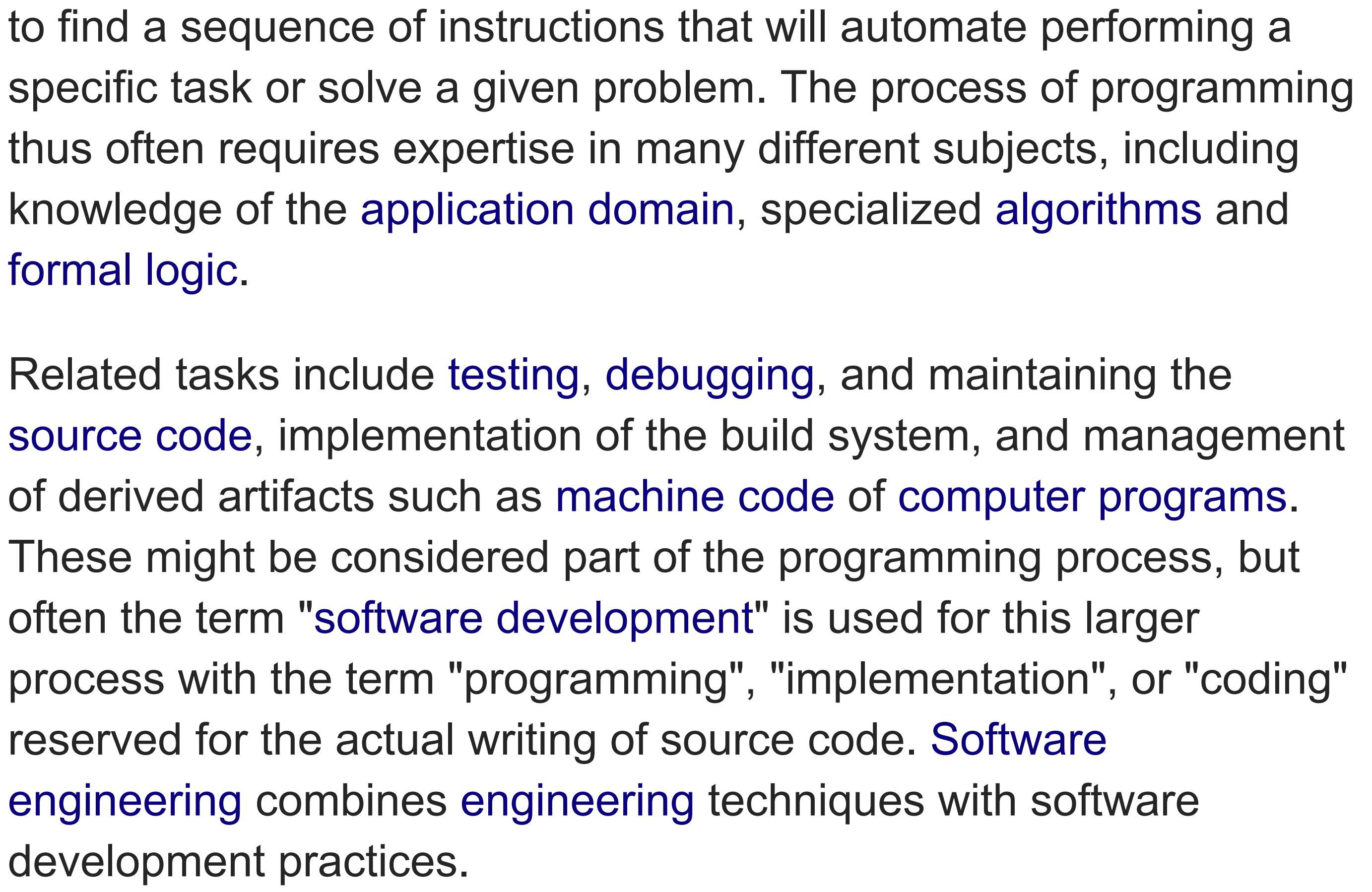
Although I perhaps had a bit of a head start because of my experience with markup (HTML) and style sheet (CSS) languages, I feel that my level of knowledge at the beginning was extremely shallow. By the end of my initial six month period of learning, I was competent enough to create non-trivial projects. I was not (and am still not) an expert, but I learned quite a bit about not only how computers work, but how to effectively structure a learning program.

Starting Out

Start With Wikipedia

The first thing you should do is hop over to the Wikipedia article for computer programming (link here). Whatever your opinion is about Wikipedia's reliability, there's no denying that it has tons of information that can, at the very least, point you in the right direction. Consider it a place to start, not your sole source of information. Let's look at the introductory paragraphs and see what we can pick out of it that will help out a beginner programmer[68]:

> **Computer programming** (often shortened to **programming**) is a process that leads from an original formulation of a computing problem to executable programs. It involves activities such as analysis, understanding, and generically solving such problems resulting in an algorithm, verification of requirements of the algorithm including its correctness and its resource consumption, implementation (commonly referred to as coding [1] [2]) of the algorithm in a target programming language. Source code is written in one or more programming languages (such as C, C++, C#, Java, Python, Smalltalk, JavaScript, etc.). The purpose of programming is



to find a sequence of instructions that will automate performing a specific task or solve a given problem. The process of programming thus often requires expertise in many different subjects, including knowledge of the application domain, specialized algorithms and formal logic.

Related tasks include testing, debugging, and maintaining the source code, implementation of the build system, and management of derived artifacts such as machine code of computer programs. These might be considered part of the programming process, but often the term "software development" is used for this larger process with the term "programming", "implementation", or "coding" reserved for the actual writing of source code. Software engineering combines engineering techniques with software development practices.

That’s quite a bit of information to take in, especially for a beginner, so let’s start taking it apart and passing it through our article funnel. The first item you should send into the funnel is the “algorithm” article, as it would appear to me that algorithms play an important role in programming. Although a beginner won’t know exactly how important each concept is at the start, it’s important to take note of concepts that pop up again and again in a subject. Algorithms are mentioned several times in these introductory paragraphs, so it’s safe to assume that you should know about them.

It looks like there are a few more articles you should send into the funnel as well. Here are the articles that look like they'd be the most useful:

1. Algorithm
2. Programming language
3. Application domain
4. Formal logic
5. Source code
6. Testing
7. Software development
8. Software engineering

Copy each one of the URLs attached to those articles and send them to your funnel (either a dedicated article funnel address or just your regular email). You'll tackle those later on, but for now let's look around in the article for useful information we can convert into flashcards right now.

One sentence stands out to me in the opening paragraph as being an excellent candidate for your first programming-related card:

> The purpose of programming is to find a sequence of instructions that will automate performing a specific task or solve a given problem.

This is a concise and useful way to describe why someone would program a computer. You're essentially automating tasks to solve problems, and every programmer should have that idea ingrained in his or her mind. Let's break this down into cards so that this incredibly important foundational idea can be transferred to your long-term memory.

First, we should create a trivia card:

Front: What is the purpose of programming?
Back: Automated problem solving

Simple, to-the-point and easy to remember. Now let's make a few cloze cards:

The purpose of {{c1::programming}} is to find a sequence of {{c2::instructions}} that will {{c3::automate}} performing a specific {{c4::task}} or solve a given {{c5::problem}}.

Now we have five cloze cards, each of which highlights the most relevant pieces of information within that sentence. Since the rest of the paragraph lays out information in a way that isn't necessarily conducive to a beginner's understanding of programming, move on to other sections in the article.

I suggest you read the entirety of this article, as it is jam-packed with useful information and links to other articles that will deepen your understanding of programming. The section (and accompanying article) about the history of programming languages is highly recommended, as you should have a concept of how the subject you're learning evolved. History isn't of the utmost importance at the beginning, but it does assist in giving you context about how we arrived at our current place in that subject. It's especially fascinating to see how far we’ve come in computing.

You should also make a point of reading the “Computer science” article that is listed in the “See Also” section. Programming is really just putting computer science into practice, and you should begin learning about it right at the beginning.

Since this is your first day, don’t try to tackle everything at once. Read the article, Make a few cards out of it, add a bunch of links to your article funnel, then move on to the next step. As you progress, make a point of doing this every day. With each session that you complete, you will have added at least one new chunk of useful, foundational information to your memory bank. The more consistently you do this, the faster your understanding of the subject will expand.

Books

Now we should think about what kinds of books we’re going to read on our path to expertise. As we’ve talked about before, your first books should not be the massive tomes used by experts. Instead, we should find a few books that are going to introduce the most important concepts to us and then move up in difficulty once those foundational ideas are firmly in our minds.

The topic of programming books is a hotly debated one, so you’ll have to take a bit of a risk at first. There are lots of expert programmers out there who have serious attitude problems, and it’s been my experience that they feel beginners should be put through an incredibly difficult gauntlet to see if they have the “right stuff.” As such, they’ll often recommend the difficult and obscure books to people who will probably not understand what they’re reading.

Several outcomes are possible if you take this track. One is that you’ll immediately get frustrated and decide learning how to program is either beyond your capabilities or isn’t worth your time. Another is that you’ll get through a book and, because you don’t have the experience to contextualize the content, you won’t get very much out of it. Yet another outcome is that you read it and immediately understand it, no experience required. This third option is nearly impossible, so don’t expect it to happen.

Some experts will claim they did in fact experience that third possibility (mastery at first glance). They’re either lying or they had far more background than they’re willing to admit. For example, they might have been math fanatics before picking up programming, which would be a huge advantage early on.

Bottom line: keeping it simple is the best way to go about it. So let’s look around for some books that will ease us into programming and computer science. Whenever you’re looking at a subject, it’s wise to consider what it might be derived from, particularly if the subject has scientific underpinnings. For example, languages are studied as a whole in linguistics, so you should at least consider buying a book on linguistics to compliment any books on your specific language. Since programming is basically just applied computer science, we’re going to include at least one book about that as well.

At this point, you should be looking in places like Reddit for some ideas about recommendations. You could alternatively just hop over to Amazon and start searching with terms like “beginning programming” and “beginning computer science.” If you’re coming up short or are feeling overwhelmed by selection, here are two books I would personally recommend:

1. ***Think Python*** by Alan Downey - An excellent introduction to programming that focuses mostly on the Python language and how it can be used. It’s only about 300 pages, but it’s chock full of information that will guide you towards being a great programmer later on.

2. ***Introduction to Computation and Programming Using Python*** by John Guttag - A book that is designed for people who have some basic programming experience (which you’ll get in *Think Python*) that lays out computer science principles using Python. This

one is the basis for MIT's introductory course for computer science, so that alone should speak volumes about its quality.

While you read these books, do exactly what you were doing with the Wikipedia articles. When you see a chunk of information that will deepen your understanding, turn it into some kind of card or note. You'll inevitably come across concepts that you don't understand, and those are the ones you should be focusing on.

These books also provide the added benefit of being full of exercises, so you can integrate your reading with practice that will solidify the concepts you're being taught.

Each subject you learn is going to require specialized note types. As an added bonus, I'll give you an object note type that has helped me tremendously in my own programming education. Since programming revolves around feeding computers specific commands, it makes sense to create a note type that revolves around those commands. It's a simple, but effective, way to speed up the process of getting those commands planted firmly in your long-term memory.

Just like with the chess experts who could quickly remember board positions, you can become an excellent programmer if you can effortlessly recall commands and when they are most relevant. This is accomplished by generating notes that associate meaning with the commands, and providing examples of their function.

Here’s how you can format the note type (which I call “Syntax” notes in my own flashcard deck) with some examples from the Python language:

Command*	***Meaning***	***Input***	***Output***	***Lang***
sum(Δ)	Add elements of list	sum(4,2,3)	9	Python
print(Δ)	Print text	print(‘Hello!’)	‘Hello!’	Python
.upper()	Capitalize text	‘Hello’.upper()	‘HELLO’	Python

* *The delta symbol, Δ, is used to indicate where inputs should be placed*

***I use a language field because I have cards from many languages, not just Python. You may only want to use it for one language, making this field unnecessary.*

Using this format will make remembering commands much, much easier. Many programmers keep desk references around specifically so they can look up commands as needed. With this system in place, the number of times you’ll need to refer to an external source to remember a command will be drastically reduced.

It’s worth noting that this note type doesn’t utilize images or sounds, but I do use a syntax highlighter plugin for Anki that highlights text [69]. This makes the commands sufficiently vivid, and works as a fairly powerful substitute for sights and sounds.

Experience & Discipline

Getting experience with programming is pretty simple: write code and build things. However, you must constantly be pushing yourself to ensure you’re staying in that intermediate difficulty level that your brain is so fond of. You don’t want to dive into extremely challenging programming problems right away, as the complexity will only frustrate and deter you. On the other hand, you don’t want to tread water for too long by only solving problems that are easy for you.

There are loads of online courses for beginning programmers now, and I recommend you pick one to use on a daily basis; it doesn’t really matter which, they’re almost all focused on the same concepts. You should also be making the most of the exercises being offered in the books you’ve picked up. If you’re going through books without exercises, then just stick with the online courses.

This is where discipline needs to be part of your program. Start by seeing how comfortable you are with a very simple programming task. For example, create a simple loop or maybe print out a message. Walk through what you’re doing and see how much of it you can explain. On your first day, this probably won’t be very much. This doesn’t matter - what matters is that you’re making the first step.

Now make a commitment to, at the bare minimum, a task of this complexity every day. Just as we discussed doing something basic like five pushups to begin building up your discipline, you should do the programming equivalent. It isn’t time consuming or terribly challenging at first, but it gets you into the daily habit of hands-on engagement with the subject.

At some point in this beginner phase, you should start creating at least one simple, repeatable exercise for yourself. When I started programming, I noticed that loops were very, very important. After I noticed that my ability to write loops was limited, I made a point of writing loops for at least 10 minutes every day. This was my first exercise, and I did it until I could write loops (in Python, at least) in my sleep. Once I’d become comfortable writing loops, I created another exercise - and the process continued until I had mastered several different skills.

On day one, make reviewing your flashcards a daily priority. Find a time of day you can set aside specifically for reviews and stick with it. If your schedule is highly variable, just make a promise to yourself that you’ll do your reviews. As we’ve discussed, the reviews will be pretty minimal at first. While your deck only has a few cards your reviews will only take a minute or two. But once you build up a larger deck, you’ll see that it requires a block of time each day.

Most flashcard programs come with a feature that allows you to limit the number of cards you review as well. I personally keep my limit at 650, but if you find you’re absolutely hating reviews past a certain number, it might be worth lowering the max for a while. Take a look at the manual for your program to find out how.

This same sort of daily commitment should also be used with reading. At first, you should avoid bingeing on the books you’ve just purchased. Instead, ease into them by reading small blocks at a time, absorbing chunks and turning them into flashcards as you go. Make sure you’re understanding the material that you’re reading, and pause as needed in order to get the fundamentals firmly in your mind.

To help you ease into this, you might also want to start simply reading internet articles from sources related to your subject. In programming, this is pretty easy since there are many, many tech-focused news outlets. *Wired*, *Ars Technica*, *IGN* - the list goes on. Pick a source and start reading. One thing I think you’ll enjoy quite a bit is reading articles that might have previously seemed filled with intimidating terms and ideas that you can now understand.

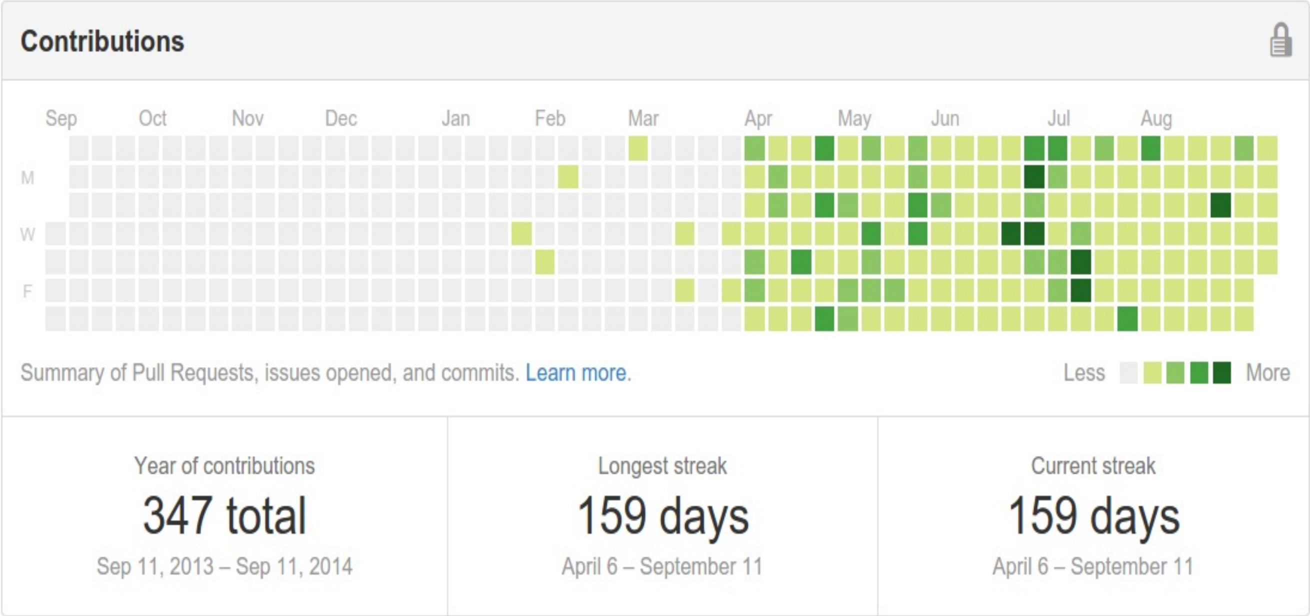
Once you’ve done that for a while, start to ease into longer periods of book and article reading and taking notes (for making flashcards, of course). But after a month or two of doing it every day, you'll find that reading and making flashcards is a painless, enjoyable process.

Tracking

Start tracking what you're doing. As time progresses, you won't need to do this nearly as much, but it's crucial at the early stages. Tracking your daily work is an excellent way to keep an eye on how far you've come, and will provide a visual reminder of your hard work. With programming, there's a fairly straightforward way to do this: Github repositories (or "repos").

Github is a place where you can keep your code and create different "versions" of each app that you're working on. I made a commitment a while back to make at least one Github "commit" every day. A commit is just an addition to a repo, and each time you make one a square gets highlighted on a grid. It also keeps track of "streaks," so you can know how long you've been consistently added code.

Here's what my Github grid looks like right now:



Contributions

Summary of Pull Requests, issues opened, and commits. Learn more.

Year of contributions
347 total
Sep 11, 2013 – Sep 11, 2014

Longest streak
159 days
April 6 – September 11

Current streak
159 days
April 6 – September 11

I started using Github in January, but I didn't make the commitment to use it every day until April 6. As you can see, I've maintained my streak ever since then. Some days my commits are not particularly impressive, but I always (without exception, even on vacation), make at least one commit daily [70].

I mentioned this earlier, but it ends up feeling completely wrong to break a habit like that. The idea of missing my commits for my day is downright repulsive at this point, and I'm quite proud of my own consistency. If you make a commitment and stick to it, you may eventually start to feel the same way. **It feels good to be disciplined.**

Post-Beginner Stage

As you move forward in your learning, you need to begin ratcheting up the complexity of what you're doing. This means reading deeper books, increasing the difficulty of your practice sessions and creating more flashcards.

This book is designed to give you more of a baseline to work with, which can then get ratcheted up as time goes on. Everything in here is designed to provide a framework that will allow you to get through the beginner stage quickly and with far more foundational knowledge than you normally would. Becoming an expert is not a quick or simple process, and is beyond the scope of this text. However, I think it's worth reviewing how you can start heading towards expert status once you've overcome the initial hurdles in your learning.

Books

After you finish your initial "beginner" volumes (I recommend you use at least one more book than the two I listed before at that stage), you need to start reading more difficult material. You may not feel ready for them yet, but that's the whole point. It is natural to feel intimidated by unfamiliar levels of complexity, but it is key to growth.

If you’re at the intermediate stage of your learning, you should start reading books that deal with specialized areas of the subject you’re studying. Although there may be some exceptions I’m unaware of, just about every major field has at least one subfield that you can dive into. Computer science is incredibly deep, so it’s not difficult to find a subfield you can try out.

It’s also worth noting that computer science is actually considered a subfield of mathematics, so if you’ve been looking for a real-world reason to brush up on math, this is a great opportunity. Here are some suggestions for someone transitioning into the intermediate or advanced stages of their learning in programming:

1. Algorithms
2. Data structures
3. Discrete math
4. Cryptography
5. Information theory
6. Linear algebra
7. Networking

When you want to dive into a subfield, do it in the same way you dove into the very first piece of material. Start with a Wikipedia page, figure out the foundational facts you’ll need to remember, and go from there. Make flashcards out of what you read, and start with introductory texts before getting into the finer details.

You’ll find that getting into subfields is often far more satisfying, as you’ll be able to make connections between the base subject and the subfield that broaden your overall understanding.

Experience & Discipline

The transition from beginning to novice is relatively straightforward and surprisingly easy to conquer through experience. However, once you start to approach intermediate and expert levels, you’ll find that it becomes tougher and tougher to push through and make progress. That’s why you needed to create the habits you did early in the game - by doing so, it makes ratcheting up the difficulty much easier. The work itself might not be easy, but starting a practice session and avoiding procrastination will be less of a struggle.

Once you’re ready to start moving up, it’s time to take on a larger mental load. This means dedicating yourself to longer, more difficult practice sessions. Rather than just doing a simple task every day, you should instead focus on spending set periods of time that deal with your weakest skills. As mentioned before, the Pomodoro technique is an excellent way to do this and still maintain your sanity.

Start doing at least a couple 25/5 Pomodoros per day of programming once you've got enough knowledge under your belt to actually do that. An beginner probably doesn't have the library of underlying factual knowledge to do that, but an intermediate level programmer absolutely should.

Another component you need to be bringing into the fold at this stage of your learning is peer interaction. Although a beginning programmer isn't going to have anything of real complexity to offer other programmers, an intermediate level programmer will. Start adding code to a Github repository and find a way to get better programmers to look at it. Go to events and discuss the finer points of your programs with professionals who can give you insights (and maybe even a job offer, if that's what you're looking for).

From my own experience, I can tell you that one of the most encouraging moments of my programming journey came after describing my first nontrivial program to a guy who I knew was an excellent coder. I laid out how it functioned, how I'd built it and why I made it in the first place. He raised his eyebrows and said "Wow, that's pretty impressive." At the time, I was feeling a little skeptical of my own abilities, and it was a big psychological boost to hear that from someone I knew was at a much higher level than me.

You should also start incorporating physical exercise into your daily routine, with increasing amounts of difficulty. By the time you reach intermediate level, you should be doing something you find physically challenging at least a few times per week. I personally do sprints at least twice a week, lift weights at least three times per week, and take a walk at least daily. Hiking is also part of the equation, although that happens less frequently.

The intermediate stage is also where your projects need to start getting more complicated. While you're a beginner, your projects should primarily be simple toys that allow you to comprehend a piece of something. When you want to start being taken seriously, you need to make things that will actually be useful to somebody.

My first big project was building a Python version of an old batch file I'd hacked together. It was getting pretty bloated, and I was running into problems I wasn't sure I could solve with a batch file. Since I was learning Python, I decided I'd try making it with that instead. It ended up as a program that has a fairly high level of complexity, and can now be used by anyone that wants to efficiently sync their backups across a variety of sources.

If you aren't sure where to start here, I'd suggest you try making a web app of some kind. The systems in place for doing this are, in many instances, easy for intermediate-level programmers to take advantage of. One of my first challenging web apps was a Morse code translator. It presented a bunch of problems that I had no clue how to solve at the time, but by then I'd accumulated enough experience that they turned out to be in that sweet spot just outside of my current abilities.

Keep Improving

There's a phenomenon in psychology called the *Einstellung effect*. When someone is in the grasp of the Einstellung effect, they are essentially sticking with old habits - even if they're aware of newer, better ways of doing things. For example, many older people still read the newspaper, even though up-to-the-minute information is available on the internet 24/7. They're simply comfortable getting their information the old way, and don't care to do it more efficiently even if it would save them valuable time and effort.

Einstellung is the German word for "installation" and you can think of it as "installing" a barrier in your habits. Don't get stuck doing things the same way in your Factory - always look for a way to improve upon what you have. This gets particularly tricky when you're past the beginner stage, because you start to feel like you don't need to (or can't) make your Factory better. This is nonsense, of course. You can always make it better, and you should always be aware of the Einstellung effect creeping just around the corner.

Setting Goals

When you’re first starting out, your goals are pretty simple. You say things like “I want to learn to program” or “I want to build apps.” These are all well and good, but they’re very general and hard to quantify. At what point does one “know” how to program? What sort of apps do you want to build? It’s fine to have these sorts of goals to begin with, as they’ll initially provide some much-needed motivation. However, as time goes on you need to be creating new goals that reflect your new-found understanding.

For example, rather than saying “I want to learn how to program” or “I want to learn how to build apps,” you should start setting goals like “I want to build an app that uses Amazon S3 storage and is deployed on Heroku.” This goal is focused on learning specific technologies, and will give you clear exit points. Once you have an app that is storing data on Amazon S3 and is running on a Heroku instance, you can say you’ve accomplished your goal. Even this is a bit simplified, but it should give you an idea of where your goals should be by this stage.

Learning Bloopers

You already read about the painfully inefficient process I created to learn the ins and outs of finance, but there have been plenty of other areas where I've struggled as well. My learning has gone through a variety of rough spots, and I believe there's quite a bit of value in sharing my difficulties with you so you can hopefully avoid some of them. My pain can be your gain.

Languages (French and Spanish)

I didn't leave the country for the first time until I was 24, so I wasn't sure how I'd react to being in Europe (specifically the UK and France). My girlfriend and I had spent quite a bit of time getting ready for it, but we had no idea what it was going to be like staying in a place where English was not everyone's first language.

When we stepped off the chunnel train in France, we were immediately confronted with language issues. All of the signs were in French (obviously), and we had no idea how to get where we needed to go. I ended up haggling with an old Frenchman (via sign language, since he didn't speak English) for a ticket on the Metro and then headed into downtown Paris.

It was borderline intoxicating to be in a non-English speaking place. I was not expecting to enjoy it so much, especially after the initial issues we had when we first arrived in France. It was a beautiful place with a ton to do, but all I knew how to do was say basics - “Please,” “Thank you,” “Do you speak English?”

As someone that was only monolingual, I felt like a stereotypical “ugly American,” and I resolved to change that when I got back home. I was going to learn not one, but two different languages (French *and* Spanish) - at the same time. No longer would I wallow in cultural inferiority, someday I would be a triumphant citizen of the world capable of speaking many languages effortlessly!

This is where I made my first mistake. Rather than focusing on one language, which would have given me the ability to truly soak up its many nuances and learn at a much faster rate, I decided to bog myself down in multitasking. I even read forum posts from polyglots (people who speak many languages) who said it wasn’t a good idea. Unfortunately, I saw myself as an exception to the rule.

I naively dove in headfirst to learning both languages. My first step was building vocabulary, so I built up some very complex note types for identifying foreign words and their meanings. I became obsessed with learning as many words as possible, and I was averaging upwards of 25 new words per day.

There is the second problem: taking on too much information at once. It certainly felt like I was making progress, but in reality I would have been much better off taking on a smaller number of words each day. The fact that I was doing this with two languages meant that it became fairly easy to get vocabulary mixed up.

I stuck almost exclusively with vocabulary for a while, which I will say was my third mistake. I wasn't taking in anything except the words themselves, and my understanding of things like grammar and situational usage was nonexistent. At the beginning stages, I should have been reading and absorbing information about the structure of the languages, but instead I was simply learning how to identify objects.

This method showed itself to be a problem as soon as I started to take lessons online. I signed up with a service that allowed me to connect with tutors all over the world, and I was taking several per week. Each teacher expected a certain level of competence, and I never did meet it. It would usually start off OK, as my vocabulary was unusually strong for a beginner. I could tell the teachers had high hopes for me because of this, but that hope generally faded when it came to actually comprehending or speaking the language.

What made this even worse was that I was starting to learn little phrases as well, so some teachers *really* thought I had some parts of the language down because I could say somewhat complex things. The problem was that I didn't actually form those sentences, I had just memorized them. Remember what I said earlier about not just memorizing things at random? Yeah, I completely violated that rule here for the second time.

Some of that was a bit of insecurity, as I desperately wanted to become better but felt like I should have been making greater progress. My methods were actually hurting me more than helping me, but I couldn't see that at the time. Don't make that mistake: your current level does not reflect your intelligence - it only reflects your current level.

Inevitably, I dropped out of tutoring and pretty much dropped the language learning altogether for a while. It was a frustrating experience at the time, but I simply didn't understand learning the way I do now. I still have my language cards, and as a result my vocabulary in both Spanish and French remains fairly strong, but my ability to speak those languages is pretty slim. I'm planning on seriously tackling French once I'm done with this book, and this time I'll do it correctly.

To recap:

1. Don't take on too much at once. My desire to rapidly become a polyglot was far too ambitious

for someone without any language learning experience, and I would have gone much further if I had instead focused on French first. After reaching a comfortable level of competency, I could then move on to Spanish.

2. Take the time to understand the foundational underpinnings of the subject at hand. By skipping grammar and the various cultural nuances of each language, I became good only at identifying things. This has limited use, and didn’t grant me conversational abilities.

3. Don’t become emotionally invested in how other people will perceive your abilities. If you do, you’ll end up trying to take shortcuts and compromise future gains. I did this to myself when I decided to start memorizing phrases, rather than learn the underlying grammar. Take a deep breath and realize that your progress is more important than other people’s opinions.

Programming

My path to programming competence has also been filled with speedbumps. As I mentioned before, I had a limited amount of experience with code - primarily with CSS and

HTML, which are not programming languages - so I figured I should be able to pick it up fairly easily. That was my first mistake: assuming that my previous experience automatically transferred to this new field. This can be said for most worthwhile topics, but computer science in particular has a breathtaking amount of depth that I simply didn’t (and couldn’t) see before getting into it.

Because it is so deep, there are also a seemingly endless number of information sources related to it. There are thousands (if not millions) of guides, courses and books available online for teaching every piece of the programming puzzle. On top of that, there are an equally large number of people with loud opinions about what the best languages are and how beginning programmers should go about learning the craft.

After my initial foray into coding via Code Academy (a popular, free online course), I suffered an acute case of “analysis paralysis.” The sheer number of sources overwhelmed me, and I spent an unreasonable amount of time just floating around, trying to decide what language to use and what sources to learn from. I eventually settled on some sources and a starting language (Python), but not before wasting far too much valuable time dabbling and second-guessing my decisions.

This also generated another problem that was similar to my experience with learning languages: I wasn’t focusing on foundational concepts. I would dabble in computer science classes, but I’d read an article or something talking about how I should learn A, B or C technology *right now* and I'd go after that instead. At the end of the day, I realized that most of those technologies are fads, and all of them rely on the fundamentals. If I had stayed with the fundamentals, I would have been able to pick up new technology rather easily.

I also didn't spend nearly enough time having my work reviewed and getting feedback. Again, I was emotionally invested in not looking stupid, which is a really, really bad idea. My code would have almost certainly been much better if I had started to get critiques from other programmers once I entered my intermediate stage.

It all came to a head when I had a technical interview several months after starting my learning program. You could say I bluffed a bit about my level of experience, but I felt like I had strong enough skills that they wouldn't question me at the end of the interview. The guy interviewing me was highly experienced and had put together a fairly complex app on his own. He needed some additional help and thought I might be able to lend a hand.

The interview was a disaster. Although I will say that the problems he presented were more on the abstract side and not necessarily something that a programmer would tackle on a regular basis, I should have known how to deal with them. There was one problem in particular that required an understanding of recursion (which I did not have) where I really had no idea where to start. In the middle of watching me drown in my own code, he cut off the interview, politely told me I wasn't who he was looking for, and ended the interview.

I sat in my chair for a good 10 minutes, trying to come to terms with what had just happened. The world had just dealt me a harsh, but valuable lesson: **learn the right way, or pay the price.** Up to that point, I was essentially just someone that could hack away at a program until it worked. Although it is my understanding that there are some career programmers who work like this, it clearly put me in at a disadvantage. If I had taken the time to really grasp the underlying principles of computer science, the interview would have been far less difficult.

Had I also gone out of my way to get honest feedback on my work, I would have known where I stood and worked on my weaknesses accordingly. I like to think I've progressed quite a bit since then, but from that point on I realized it was not a good idea to call yourself an expert. You're not an expert until an expert calls you one.

In addition to similar lessons learned from my foray into languages (such as learning foundational principles first), there were some unique insights gained here as well:

1. Decide on a starting point and run with it. Don't sit around worrying about whether you've started at the "right" place. You will learn something no matter where you begin, and whether you've made the right choice or not will

become apparent before too long.

2. Don’t assume your previous knowledge provides an advantage. I made this mistake when I thought that knowing HTML and CSS would give me a leg up. If you’re new to a subject, you have no way of knowing how your previous knowledge will connect with unfamiliar concepts. The best way to deal with this is to be humble and work under the assumption that you don’t know anything. View your mind as a blank slate and you’ll be surprised how much progress you make.

Taking Inventory

Here are some guidelines and checklists you can use to ensure that you’re getting the most of your learning system and not veering away from what makes it so effective. I suggest you print these out (or even convert them to Google Forms you can fill out every day) and use them every day until you’re doing it all automatically.

Discipline

My daily activities (check each that apply):

1. Are simple and easy for me to manage at this stage □
2. Are being tracked with ______________________________ □
3. Are not being done past my cutoff time □
4. Include reviewing my flashcards □
5. Include at least a small amount of exercise □

I'm sleeping at least 8 hours per night: True/False (circle one)

Activities

Remember, start simple with a single task, then work your way up

Daily activity 1:

____

Daily activity 2:

____

Daily activity 3:

____

Daily activity 4:

____

Daily activity 5:

____

Physical exercises:

____

Current practice exercise:

____

Daily cutoff time: _________ AM/PM (circle one)

Problems

Use the space below to describe issues you're having with discipline.

Rewards

Daily reward:

____

Weekly reward:

____

Monthly reward:

____

Projects

Current project:

____

Next project:

____

Current goal:

____

Flashcard Creation

When converting a concept into a series of flashcards, follow these steps:

1. Create object note from definition in Wikipedia article (if available)
2. Create contextual trivia and/or cloze notes from article and/or external sources (such as a book)
3. Look for another, connected concept
4. Rinse and repeat

Guidelines for new notes:

1. Short, easy to digest questions and answers
2. Vivid pictures and sounds
3. Information properly divided into fields
4. Relevant to what you're learning
5. Tagged
6. Has references
7. In single, randomized collection

Before considering a new note type, ask yourself these questions:

1. Is it worth creating a whole note type or can another, existing type do the job?

2. Are there wider applications than just what you’re considering? For example, a “People” note can be used for all kinds of people, but a “Scientists” note would be far more narrow.
3. Are these new notes going to enhance your understanding of the subject?

The 10 Commandments of Learning

When learning anything new, keep this list of principles handy:

1. Learn fundamental concepts first.
2. Don’t move forward until you feel you truly understanding the fundamentals.
3. Work towards putting the most important concepts in long-term memory.
4. Focus intensely when it’s time to study or work.
5. Exercise regularly.
6. Don’t cram.
7. Make sure you’re sleeping enough.
8. Take time for relaxation.
9. Make at least a small contribution to your knowledge library every day.
10. Get feedback from those more experienced than you.

Starter Flashcards

If you’re looking to create a few flashcards right now, but aren’t sure where to start, here are some that use key concepts from this book:

Object Notes

These are grouped under a simplified version of a note type that I named “Definitions.”

Term	Working memory
Definition	The system that actively holds multiple pieces of transitory information in the mind, where they can be manipulated.
Example	The system that is used when you need to think about your next chess move.
Simplification	Memory where information can be both held and

	manipulated.
Wikipedia	Working_memory

Term	Long-term memory
Definition	The final stage of the dual memory model, in which data can be stored for extended periods of time.
Example	The system that is used to bring up your understanding of addition.
Simplification	The section of your mind where information is stored indefinitely.
Wikipedia	Long-term_memory

Term	Chunking
Definition	A phenomenon whereby individuals group responses when performing a memory task.
Example	Tying together the letters “M-E-M-O-R-Y” into the word “memory.”

Simplification	Compressing information into small bits so it is more easily learned and recalled.
Wikipedia	[Chunking]()

Trivia

Front	***Back***
What type of memory is used to retrieve well-understood information?	Long-term memory
What type of memory is used for thinking?	Working memory
What type of practice is the most effective way to improve your skills?	Deliberate practice
How often should you review your flashcards?	Daily
	Procedural memory

What type of memory is being used when you do something automatically, such as riding a bike?	
What process involves transferring information from working to long-term memory?	Consolidation
What is the simplest way to give yourself a cognitive boost?	Exercising
What must you absolutely, positively get enough of every night?	Sleep
What method can you use to compress information in your working memory?	Chunking
What does your brain try to avoid doing at all costs?	Thinking
Why does your brain try to avoid thinking?	Energy preservation
What will your brain utilize whenever possible?	Memory

What thinking mode is your mind in when you are taking a leisurely walk?	Task-negative mode
What thinking mode is your mind in when you are intensely studying material?	Task-positive mode
What productivity technique can you use to ensure you focus for at least a short period of time?	Pomodoro

Cloze

{{c1::Consolidation}} is the process of {{c2::transferring}} bits of information from {{c3::working}} to {{c4::long-term}} memory.

Define a {{c1::stopping}} {{c2::time}} every day to avoid {{c3::burnout}}.

Your {{c1::brain}} is designed for the {{c2::avoidance}} of {{c3::thought}}, and will use {{c4::memory}} whenever possible.

{{c1::Working}} {{c2::memory}} is where your {{c3::mind}} does all of its {{c4::thinking}}.

An {{c1::expert}} not only {{c2::understands}} a subject, but can {{c3::contribute}} to it as well.

Conclusion

Sadly, this is the end of our journey. But from this ending, hopefully you can find many new beginnings. From here on out, you should have all the tools you need to create a Learning Factory you can use for the rest of your life. There are a million possible uses for it, and I sincerely hope that you use it to get wherever it is you want to go. Whether you're trying to land the job of your dreams or you're just intellectually curious, there's something to be gained by using what I've laid before you.

It is my greatest hope that you end up creating something above and beyond what I have. I'd love to hear about your progress and how you've morphed this system into something powerful and useful, so feel free to go to my website (www.52aces.com) and let me know how you've used it. Testimonials and feedback are always appreciated.

If you've successfully used this book to broaden your learning horizons, please tell your friends about it. Leave a review on Goodreads (good or bad) or any other forum where opinions about books are expressed. The more active learners we have in this world, the better.

-Ace

Appendix A: Reading List

I've purposefully made this a fairly compact list, and the titles I chose are the most accessible ones for a layman to pick up. The first two on the list, *A Mind for Numbers* and *Why Don't Students Like School?*, are written by professional academics and are absolutely chock-full of reference studies if you're looking for scientific rigor. At the very least, read these two books; even if you don't want to read through the science they're referencing, they're full of great information about many of the methods I've outlined in my book.

These should be enough to whet your appetite, and reading each of them will lay out one more important piece of the puzzle. I've included books about habits, sleep and language learning because they each hold relevant information for those who are truly interested in being top-notch learners.

Anyway, here's the list:

A Mind for Numbers by Barbara Oakley

This fairly compact book is packed with information about how the mind works, with a focus on improving your learning capabilities. Reading this book actually inspired me to write my own, primarily because there wasn't much in the way of instruction about how to integrate the concepts into my own learning. It was also interesting to see that many of the findings of neuroscientists in the last few years matched up with techniques I'd been using in my own learning system.

Why Don't Students Like School? by Daniel T. Willingham

This text is designed, as the title suggests, primarily for educators dealing with students on a day to day basis. However, it has an absolute treasure trove of information about how the mind works and how one can utilize its mechanisms to aid in learning. There are also a large number of book and study recommendations contained within it that you can use to branch out and learn more about learning.

Anki Essentials by Alex Vermeer

A small, free (as of this writing) book about the finer points of Anki. Whether you use Anki or not, there are many useful chunks of information about how flashcards should be formatted, along with some quality insights about memory.

The Power of Habit: Why We Do What We Do in Life and Business by Charles Duhigg

An excellent analysis of how habits are formed, I recommend you read this if you're struggling with poor discipline. Charles Duhigg walks step by step through how to identify and fix bad habits, and build good ones from the ground up.

The Willpower Instinct: How Self-Control Works, Why It Matters, and What You Can Do to Get More of It by Kelly McGonigal

This book is based on Dr. McGonigal's wildly popular course at Stanford, "The Science of Willpower." It walks through, in very approachable language, the forces at work whenever you want to make better decisions. She also has a great section about how sleep affects willpower that I think every sleep-deprived person should read.

Moonwalking with Einstein by Joshua Foer

Josh Foer started out just wanting to learn more about memory athletes and ended up as a world champion. *Moonwalking with Einstein* is his exploration of mnemonics and how he, as a chronic forgetter, utilized them to accomplish truly incredible feats of memory. Highly recommended for anyone who wants to learn memory and/or mnemonics.

Dreamland: Adventures in the Strange Science of Sleep by David K. Randall

Sleep is an integral part of learning, and *Dreamland* does a good job of exploring the vastly underappreciated role of sleep in our lives. If you're not getting enough sleep every night, this book should provide you with some reasons to consider a lifestyle change.

Babel No More: The Search for the World's Most Extraordinary Language Learners by Michael Erard

Learning a foreign language is a difficult task and there are a seemingly endless supply of people who offer advice about how to do it. This book does a good job of surveying some of the world's most prolific polyglots (people who can speak a large number of languages), and there's some potentially useful information in here for learning enhancement. I think it was particularly interesting that Cardinal Mezzofanti - the man who was supposedly the world's greatest language learner - used a large, rudimentary set of flashcards.

Learning and Memory: From Brain to Behavior by Mark A. Gluck, Eduardo Mercado and Catherine E. Myers

This is a textbook, but if you're really interested in how memory works it is truly *the* book to read. Inside its pages you'll find in-depth discussions about the body of knowledge surrounding memory, including sections on both experiments and neural substrates. It's expensive and large so I wouldn't recommend buying it unless you're serious about the subject.

Appendix B: Some Additional Anki Tricks

For those of you who are curious about how to make your notes more comprehensive and/or vivid, here are some tricks you can use. I’m not going to go into great detail about how to do each one, but if you get stuck you can refer to the manual for Anki (or whatever other program you use) to figure out its implementation.

Again, I must stress that not only are these designed for users of a specific piece of software (Anki), but that software may change at any time. These tricks may or may not apply to other programs, and by the time you read this they may not even work for the current version of Anki.

Conditional Replacement

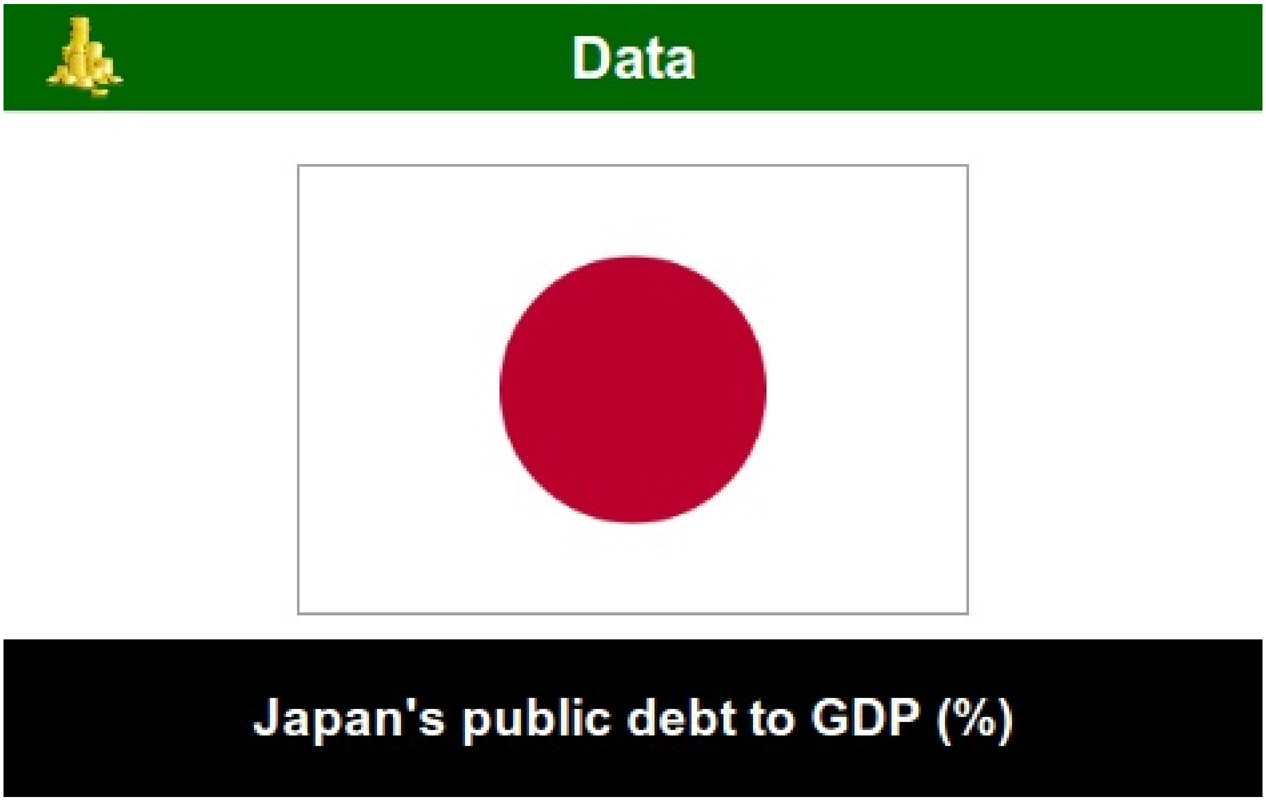
What if you want information from fields to be shown in some instances, and hidden in others? Conditional replacement is what you’re looking for. It works by encapsulating an element on your template with either one of these:

To ***hide****information* ***unless*** *a specific field has information in it:*
{{#Field Name}}
<information>
{{/Field Name}}

*To***show***information* ***only*** *if a specific field has information in it:*
{{^Field Name}}
<information>
{{/Field Name}}

One way I personally do this is with something called the “Borders?” field. If I have an image that has soft white edges, it often looks strange in the middle of my flashcards. As such, I’ll put a “y” in the “Borders?” field if I want the image(s) to have a dark border around them.

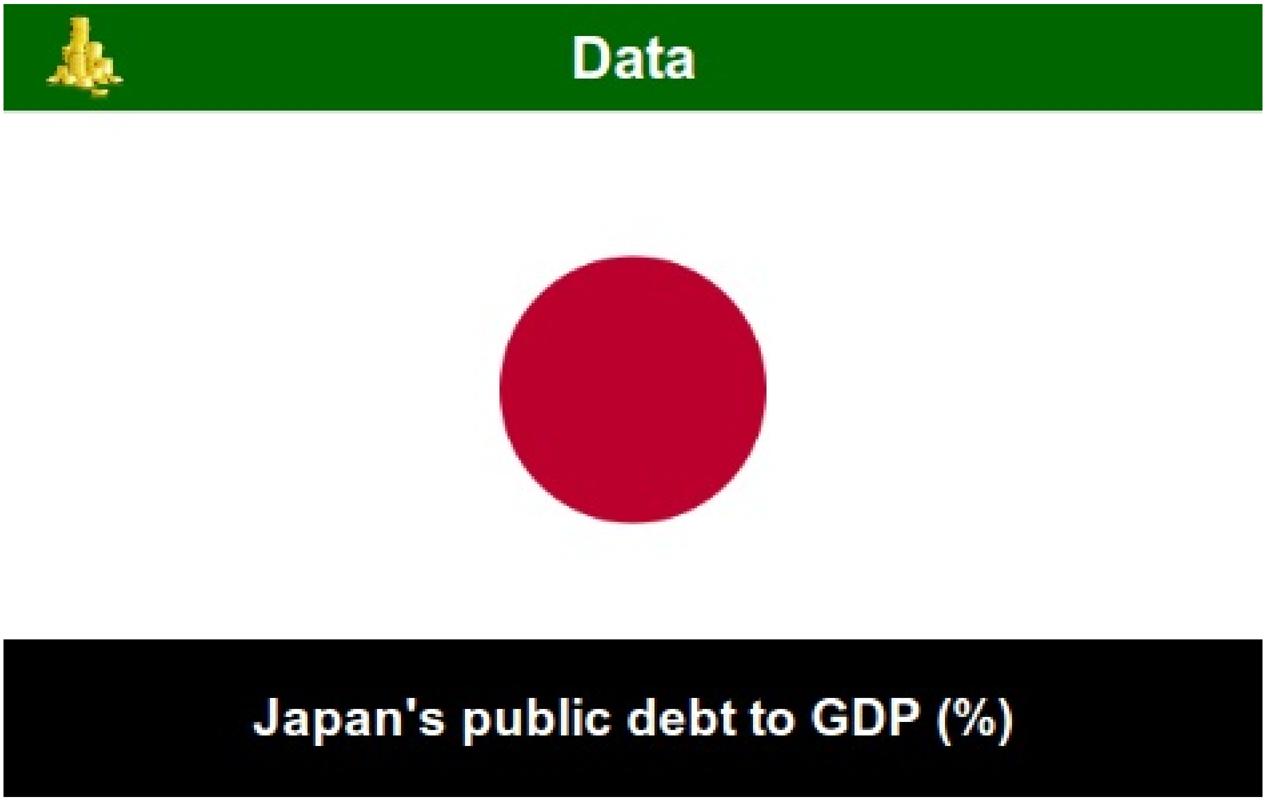
An example of this is a card I made about the public debt to GDP in Japan. The Japanese flag has a white background, and my cards do as well. In order to address this potential color blend, I added a “y” to its “Borders?” field:



Data

Japan's public debt to GDP (%)

If I were to ignore the “Borders?” field, the end result is a red circle floating in whitespace:



Data

Japan's public debt to GDP (%)

Another handy feature of conditional replacements is in hiding entire cards. Some of my note types have a large number of fields, and often times the notes I’m making don’t necessarily have information for each one. In those cases, I use conditional replacement to hide cards connected to a field unless there’s input.

For example, in my “Definitions” object note type, I have an “Etymology” field that generates a card by the same name. I made this so I could remember where certain terms came from. Unfortunately, this just doesn’t apply in some situations - the term’s origin is unclear or flat out unknown, and I can’t put anything in there. Without conditional replacements, a blank card would be generated because the template wants to make a card but doesn’t have anything to put in it.

The way to accomplish this is very straightforward: put the first half of the conditional statement at the very top of the “Front Template” window of a card, and the second half at the bottom of that same window. Here’s an example from my “People” object note type:

```
{{#Name}}

<header id="People">
<images class="icons"><img src="_Icons-People.png"></images>
<h2>Name</h2></header>

<images class="portraits">
<img src="_EE-People-{{Name}}.jpg">
</images>

{{/Name}}
```

Notice how {{#Name}} and {{/Name}} are at the top and bottom? This tells Anki that there ***must*** be input in the “Name” field before a card will be created.

There are a wide number of additional uses for this feature, and you’ll have to experiment to see where it might benefit you.

External Stylesheets

Since I have experience with creating websites using HTML and CSS, I’ve made my CSS rules for Anki pretty sophisticated. Not only that, but I like the idea of being able to change the styling rules for my entire collection by making a single change in a CSS file. The way that Anki is set up by default is to have each note type individually styled via the “Styling” window.

This is easy to implement and highly recommended if you’re well versed in CSS. You simply cut all the styling information in the “Styling” window, paste it into a file called “_CSS.css”, place that in your collection.media folder and then replace it with the following:

@import “_CSS.css”

The major downside of this is that you don’t get immediate feedback when you make changes. Anki will only load your stylesheet once when it first opens, and you’ll have to reload to see any changes you’ve made on the external sheet. I generally overcome this by placing changes I’m thinking about making into the “Styling” window before placing them into the external file.

If you’re interested in seeing how I’ve structured my Anki stylesheets, I’ve placed them into a GitHub repository for all to see. You can find that at github.com/acecodes/AnkiCSS.

Backup Syncing

This isn’t really a hidden gem of Anki or anything, but I highly recommend you start using it every day. Not only does it provide you with a free cloud backup of your files, it also gives you the ability to easily share decks between devices.

The process of doing this is pretty simple. All you need to do is create an account on AnkiWeb and then enter your login credentials on all the Anki installations you want to backup. Then every time you review or make changes to your deck, press the sync button (it looks like the recycle sign in the current version of Anki) to back everything up to the cloud. Check out this section of the Anki manual for more in-depth instructions.

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- Zac Singer, for providing some great feedback - particularly about my gnarly first intro.

About Me

Originally from Northern California, I currently live and work in San Diego, CA. I've worked as a software engineer, sales engineer and option trader/financial advisor, among other things. Although I don't have a degree, I think I do a good job of making up for it by

working extremely hard to learn and improve myself on a daily basis. In my free time, I enjoy training Brazilian jiu-jitsu, hiking, reading voraciously and exploring as much as I possibly can.

Want more? Check out my website, www.52aces.com, for more content that revolves around learning, memory and living a better life.

Footnotes

[1] Dr. Danielle S. McNamara (January 2000). "Preliminary Analysis of Photoreading"

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[3] "Inside the Mind of a Savant" Darold A. Treffert and Daniel D. Christensen. Scientific American. December 23, 2009.

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Practice. In Brumfit, C.J. (ed) (1983). Language Teaching Projects For The Third
World. ELT Documents 116. British Council English Teaching Information Centre.

[6] Rawson, Katherine A., John Dunlosky, and Keith W. Thiede. "The rereading effect: Metacomprehension accuracy improves across reading trials." *Memory & Cognition* 28.6 (2000): 1004-1010.

[7] Rohrer, D., & Pashler, H. (2007). Increasing retention without increasing study time. Current Directions in Psychological Science, 16, 183-186.

[8] http://psycnet.apa.org/journals/apl/59/3/358/

[9] Redick, T. S.; Shipstead, Z.; Harrison, T. L.; Hicks, K. L.; Fried, D. E.; Hambrick, D. Z.; Kane, M. J.; Engle, R. W. (2012). "No Evidence of Intelligence Improvement After Working Memory Training: A Randomized, Placebo-Controlled Study". *Journal of Experimental Psychology: General* .

[10] Jaeggi, S. M., Buschkuehl, M., Jonides, J., Perrig, W. J. (2008), Improving fluid intelligence with training on working memory, Proceedings of the National Academy of Sciences, vol. 105 no. 19

[11] Redick, T. S.; Shipstead, Z.; Harrison, T. L.; Hicks, K. L.; Fried, D. E.; Hambrick, D. Z.; Kane, M. J.; Engle, R. W. (2012). "No Evidence of Intelligence Improvement After Working Memory Training: A Randomized, Placebo-Controlled Study". *Journal of Experimental Psychology: General* .

[12] Chooi, W. T.; Thompson, L. A. (2012). "Working memory training does not improve intelligence in healthy young adults". *Intelligence* **40** (6): 531

[13] Pashler, H.; McDaniel, M.; Rohrer, D.; Bjork, R. (2008). "Learning styles: Concepts and evidence" . *Psychological Science in the Public Interest* **9** : 105–119. doi : 10.1111/j.1539-6053.2009.01038.x

[14] This may not apply to those with legitimate learning disabilities, such as dyslexia.

[15] Nielsen, Jared A., Brandon A. Zielinski, Michael A. Ferguson, Janet E. Lainhart, and Jeffrey S. Anderson. "An Evaluation of the Left-Brain vs. Right-Brain Hypothesis with Resting State Functional Connectivity Magnetic Resonance Imaging." PLOS ONE, 14 Aug. 2013. Web. 30 Aug. 2013.

[16] Yohan John, who has a PhD in neuroscience, wrote an excellent article about this: https://neurologism.com/2014/02/27/is-the-right-brainleft-brain-emotionalrational-distinction-still-useful-2/

[17] Raichle, Marcus E., and Debra A. Gusnard. "Appraising the brain's energy budget." *Proceedings of the National Academy of Sciences* 99.16 (2002): 10237-10239.

[18] I wrote about this in more detail on my blog: http://52aces.com/blog/how-to-remember-your-keys/

[19] Willingham, Daniel T. *Why Don't Students Like School?* . Wiley, 2009. Print.

[20] This is a process called *encoding* , and it is what allows you to turn information from your surroundings into useful constructs you can recall later on.

[21] Whenever you encode something unintentionally, you are engaging in *implicit learning* . Although intention to learn is helpful, how much you think about something ends up affecting how well you encode it.

[22] LaBar, K. S.; Phelps, E. A. (1998). "Arousal-mediated memory consolidation: Role of the medial temporal lobe in humans". Psychological Science 9 (6): 490–493

[23] Source: http://www.indiana.edu/~p1013447/dictionary/penny.htm

[24] Or you're not American...

[25] It should be noted that in the first edition of the book I used the traditional technique of "katas" as a guidepost for studying. Since then, I've taken up Brazilian jiu-jitsu as a hobby and have discovered that the sparring-driven culture provides a far more effective framework.

[26] Kim, S-i. (1999). Causal bridging inference: A cause of story interestingness. British Journal of Psychology, 90, 57-71

[27] Ericsson, K. A., Krampe, R. T. h. & Tesch-Ro¨mer, C. (1993) The role of deliberate practice in the acquisition of expert performance, Psychological Review, 100, 363–406

[28] My explanation of working memory is a simplification of *Baddeley's model of working memory* .

[29] Gobet, Fernand, and Herbert A. Simon. "Expert chess memory: Revisiting the chunking hypothesis." *Memory* 6.3 (1998): 225-255. *Author's Note: This is a study that replicated results from a study originally done in 1973.*

[30] As I mentioned, this is a very simplified model of how researchers view memory. For example, I’m using the term “thinking” as a stand-in for the *levels-of-processing effect* and I’m not laying out the finer points of the dominant four-register *Baddeley-Hitch working memory model* . This is intentional, as I don’t want to end up writing a textbook and confusing my (layperson) readers. However, if you want to dive deeper into the specifics of memory, I recommend your check out the books listed in the appendix.

[31] Creativity researchers refer to this as *conceptual combination* .

[32] Fox, M. D.; Snyder, A. Z.; Vincent, J. L.; Corbetta, M.; Van Essen, D. C.; Raichle, M. E. (2005). "From The Cover: The human brain is intrinsically organized into dynamic, anticorrelated functional networks". *Proceedings of the National Academy of Sciences* **102** (27): 9673–9678.

[33] As the story goes, King Hiero II had supplied gold to a smith in order to make a crown of 100% pure gold. Hiero wanted to figure out if the smith had cheated by putting some silver in the crown and pocketing the leftover silver for himself. Archimedes worked tirelessly on the problem but couldn’t come up with a method - until he got into the bathtub. It probably didn’t happen, but the story still illustrates an important, real-world aspect of how our brains come up with insights.

[34] Rechtschaffen A, Bergmann B (1995). "Sleep deprivation in the rat by the disk-over-water method". *Behavioural Brain Research* **69** (1–2): 55–63

[35] Thomas, M., Sing, H., Belenky, G., Holcomb, H., Mayberg, H. Dannals, R., Wagner JR., H., Thorne, D., Popp, K., Rowland, L., Welsh, A., Balwinski, S. and Redmond, D. (2000). "Neural basis of alertness and cognitive performance impairments during sleepiness. I. Effects of 24 h of sleep deprivation on waking human regional brain activity". *Journal of Sleep Research* **9** (4): 335–52.

[36] Taheri S, Lin L, Austin D, Young T, Mignot E (December 2004). "Short Sleep Duration Is Associated with Reduced Leptin, Elevated Ghrelin, and Increased Body Mass Index" . *PLoS Med.* **1** (3): e62.

[37] As of this writing (2016), there is still some debate about whether sleep debt is a measurable phenomenon. Regardless, the consensus amongst sleep researchers is that sleep deprivation for any period of time is damaging.

[38] Sleep plays a crucial role in the process of *consolidation* , a concept we reviewed earlier.

[39] Brisswalter, Jeanick, Maya Collardeau, and Arcelin René. "Effects of acute physical exercise characteristics on cognitive performance." *Sports Medicine* 32.9 (2002): 555-566.

[40] Ströhle, Andreas. "Physical activity, exercise, depression and anxiety disorders." *Journal of neural transmission* 116.6 (2009): 777-784.

[41] Tangney, J. P., Baumeister, R. F. and Boone, A. L. (2004), High Self-Control Predicts Good Adjustment, Less Pathology, Better Grades, and Interpersonal Success. Journal of Personality, 72: 271–324.

[42] http://www.apa.org/monitor/2011/12/exercise.aspx

[43] This cycle stems from what psychologists call *self-licensing* , which occurs when you give yourself permission to do the wrong thing purely because you’ve done a good thing.

[44] This is embracing *Premack’s principle* , which I recommend you read about: https://en.wikipedia.org/wiki/Premack%27s_principle

[45] Unless you’re reading something along the lines of a college textbook, which may very well offer a great deal of depth in a single volume.

[46] Remember that the default mode network needs time to work in order for you to make progress.

[47] Sam Harris, a philosopher with a PhD in neuroscience, wrote a devastating critique that I highly recommend checking out: https://www.samharris.org/blog/item/this-must-be-heaven

[48] Bloom, B. (1984). "The 2 Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring" , Educational Researcher, 13:6(4-16).

[49] Karpicke, J.D. & Roedinger III, H.L. (2008). "The critical importance of retrieval for learning" . *Science* , 319, 966-968.

[50] Karpicke, J.D. & Blunt, Janell R. "Retrieval Practice Produces More Learning than Elaborative Studying with Concept Mapping" Science. 2011 Feb 11;331(6018):772-5. Epub 2011 Jan 20.

[51] Butler, Andrew C. "Repeated Testing Produces Superior Transfer of Learning Relative to Repeated Studying" J *ournal of Experimental Psychology* : Learning, Memory, and Cognition. 2010, Vol. 36, No. 5, 1118–1133.

[52] Reading a *Wired* article from 2008 about the eccentric Mr. Woźniak is what first got me interested in memory and I highly recommend that you take some time to sit down and read the online version of the article yourself: http://archive.wired.com/medtech/health/magazine/16-05/ff_wozniak?currentPage=all

[53] This is part of what is known as " Transfer-appropriate processing ," which states that recall is easiest when the *retrieval cues* (in this case, images and sounds) used for recall are the same as the ones used for learning.

[54] Tomlinson, T. D.; Huber, D. E.; Rieth, C. A.; Davelaar, E. J. (26 August 2009). "An interference account of cue-independent forgetting in the no-think paradigm". *Proceedings of the National Academy of Sciences* **106** (37): 15588–15593 .

[55] Anki was built in such a way that it expects media files to be used directly in fields, which is not an efficient way to use media. Additionally, Anki has a built-in function that checks the media folder for files that aren't found in any fields. Since the files themselves are not being placed in fields, files without the underscore in front of their name will get deleted.

[56] My preference is JPG as it usually results in much smaller files - an important concept to keep in mind when you have thousands of media files!

[57] We are only going to explore one type of conditional replacement here. Check out the Anki manual link earlier in the paragraph and the appendix at the end to learn more.

[58] Short for **em** phasis.

[59] Technically, the "correct" way to do this is by styling elements using CSS since <br /> tags can cause design issues, but this is a simple hack you can use right away.

[60] Since you're reading this book, I'm assuming this to be the case and truly hope you dive deeper after you're done reading this.

[61] If you would like to get started with some trivia cards related to the content of this book, check out the " Starter Flashcards " section of the book. There you will find a variety of trivia and cloze cards, as well as worksheets for all aspects of a Learning Factory.

[62] The content of this article may have changed (significantly) by the time you read this.

[63] I highly recommend you incorporate an "AKA" field, as many objects you'll want to remember have multiple names.

[64] This is a core idea in the *levels-of-processing model* of memory, as experiments have shown that pure rote rehearsal is usually not enough to solidify knowledge in long-term memory.

[65] Prolific coder Eric S. Raymond once famously expressed this same thought: *“Computer science education cannot make anybody an expert programmer any more than studying brushes and pigment can make somebody an expert painter.”*

[66] If you’re physically incapable of going for a walk, substitute this for something vigorous that you can do.

[67] You should also be aware that working on deadlines only works under certain conditions. If you have a daily deadline that isn’t insane, such as finishing some work by 5 PM, that works well. However, you slip into counter-productive territory when you tell yourself that you need to get a gargantuan amount of work done by 5 PM .

[68] They may have changed by the time you read this.

[69] Which reminds me: don’t be afraid to experiment with plugins for Anki or any other flashcard program. I use several plugins myself and they make my life much easier.

[70] This was written in the 1st edition, and my Github profile is much less impressive now.