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# Learning How to Learn: Powerful mental tools to help you master tough subjects

This Gitbook contains my notes on the course [Learning How to Learn: Powerful mental tools to help you master tough subjects](#).

A tutorial I wrote on how to host this gitbook on github pages is written [here](#).

## How to locally serve this repository

1. Open your terminal and run
  - `git clone https://github.com/richdayandnight/tutorial-gitbook-learning-how-to-learn.git`
2. Install dependencies (this is assuming that you already have npm and yarn installed)
  - `npm install -g gitbook-cli`
  - `yarn add gulp gulp-gh-pages gulp-load-plugins --save-dev`
  - `gitbook install`
3. On the root folder of this repository ( `cd tutorial-gitbook-learning-how-to-learn` ) run
  - `gitbook serve`
4. To deploy changes to github, run
  - `gulp publish`

## What a gitbook can contain

### Some code

```
# This program adds two numbers

num1 = 1.5
num2 = 0.3

# Add two numbers
sum = num1 + num2

# Display the sum
print('The sum of {0} and {1} is {2}'.format(num1, num2, sum))
```

### Some formula

$$\int_{-\infty}^{\infty} g(x) dx$$

Block math with (tag):

$$x + y^{2x} \tag{a.1}$$

Block math with tag:

$$x + y^{2x}$$

(a.2)

# Learning How to Learn - Week 1

## 2 Thinking Modes

1. Focused
2. Diffused

Simple pinball analogy

- Focused
  - tight spacing rubber bumpers
  - prefrontal cortex
- Diffused mode
  - wide spaced rubber bumpers
  - walking, exercising, etc.

## Procrastination

When preparing for a weight-lifting competition, one does not slack off and wait till the day before the competition to work out. Building muscles does not work that way. To gain muscular structure, you need to do a little work every day, gradually allowing your muscles to grow. Similarly, to build neural structure, you need to do a **little work every day**, gradually allowing yourself to grow a neuro-scaffold to hang your thinking on a little bit, every day, and that's the trick

Practice makes Permanent

## Brain

- A 3-pound organ that consumes 10 times more energy by weight than the rest of the body
- There's constant turnover in the single connections between neurons called synapses (We're a new person when we sleep and wake up)
- Q: According to the video, what happens on the dendrites of neurons when you learn something new?

A; Many new synapses (connections) are formed on the dendrites.

1. Working Memory
  - There's as many as 4 chunks of information
  - Working memory is the part of memory that has to do with what you're immediately and consciously processing in your mind.
2. Long-term memory
  - long term memory is wide a storage warehouse, and just like a warehouse, it's distributed over a big area. Different kinds of long-term memories are stored in different regions of the brain.

## Sleep

- allows the brain to wash away metabolic toxins
- allows your brain to strengthen important parts of memories even as it erases less important memories
- allows your brain a chance to rehearse difficult material--going over and over the tougher aspects of what you are trying to learn
- makes a remarkable difference in your ability to figure out difficult problems and to understand what you are trying to learn
- **Dreaming** - about something helps your ability to understand it

## Tip

- Pomodoro, 25 minutes, no interruptions, focus
- **Practice makes permanent** - 4 slots of memory -> with practice -> move to long-term memory
- Spaced repetition - is good because it builds stronger neural structures by repeating them over a number of days
- 2 top methods of learning:
  - Learning by doing
  - Learning by osmosis
- Success in life reached through passion and persistence

# Learning How to Learn - Week 2

## Chunking

- conceptual chunks
- chunk means a network of neurons that are used to firing together
  - focused practice and repetition helps you to create chunks
  - after being given out a sample solution, don't focus too much on how an individual step works, but you should also focus on the connection between the steps (why this particular step is the next thing you should do)
- How to make a chunk
  - finding a pattern
  - only doing it yourself
  - understanding context
  - context is where bottom up (learning chunking) and top down learning (big picture) means
    - 1. focused attention
    - 1. understanding of the basic idea
    - 1. practice to gain master and sense of big picture context
  - recall than reread
    - after learning a material, just recall (Karpicke research)
    - by simply practicing and recalling the material -> learn far more and at a much deeper level than just rereading only

## Illusion of Competence

- seeing a solution and thinking you understand it yourself
- only doing it yourself and recalling
- underlining and adding notes is better than highlighting (highlighting provides the illusion that you know the material)
- learning outside your usual study place helps (since you get subliminal cues from your study place)

## What motivates you?

- Neuromodulators
  - Acetylcholine
  - dopamine
    - drugs
  - serotonin

- closely link to risk taking behavior
- emotions is intertwined with learning

## library of neural patterns

- consulting people
- Chunks can help you understand new concepts through a process called **transfer**
- Law of Serendipity

## Overlearning

- 70 hours practice for a 20 minute test
- overfitting, illusion of competence, mastering the easy stuff
- deliberately focusing on the difficult material
- Einstellung - phenomenon
  - your initial intuition about what's happening or what you need to be doing is misleading

Philosopher of science Thomas Kuhn discovered that most paradigm shifts in science are brought about either by young people or people who were originally trained in a different discipline. They're not so easily trapped by *einstellung*, blocked thoughts due to their preceding training. And of course there's the old saying that science progresses one funeral at a time as people entrenched in the old ways of looking at things die off.

- jumping into the water without knowing how to swim

## Interleaving

- mix up learning
- look ahead

interleaving - building flexibility and creativity practice and repetition - helping to build solid neural patterns

# Learning How to Learn - Week 3

## Procrastination

- a **keystone** habit that influences many aspects of our life
- Arsenic analogy on procrastination

In tiny doses, arsenic doesn't seem harmful. You can even build up an immunity to its effects. This can allow you to take large doses and look healthy even as the poison is slowly increasing your risk of cancer and ravaging your organs. When you procrastinate, you feel better--but only temporarily. In this, procrastination shares common features with addiction.

## Habits

1. Cue
2. Routine
3. Reward
4. Belief

## Focus on Process not Product

- Product is what triggers the pain
- Non-procrastinators tell themselves to just get on with it and quite wasting time whenever they start a task
- Stop judging self with the progress

## The Habit loop

1. Cue
  - i. Categories
    - i. location
    - ii. time
    - iii. how you feel
    - iv. reactions
2. Routine
  - i. Key to rewiring/change
    - i. have a plan
3. Reward
  - i. why are you procrastinating?
  - ii. Remember that habits are powerful because they create neurological cravings. It helps to add a new reward if you want to overcome your previous cravings. Only once your brain starts expecting that reward, will the important rewiring take place that will allow you to create new habits.



#### 4. Belief

- i. belief that your new system works

## Recommended Solutions

- Brief Weekly list of key tasks
- Then each day at night write down a to do list
- Plan your quitting time
- 1 pomodoro as soon as you wake up
- Law of Serendipity
  - lady luck favors the one who tries

## Memory

- outstanding visual and spatial memory system
- 2 things should happen to move things from our working memory to our long-term memory
- must be memorable
- must be repeated

## Hippocampus

- hippos - horse
- campus - sea monster

## Reconsolidation

- occurs during sleep

## Astrocytes

- provide nutrients to neurons
- maintain extracellular ion balance
- involved in repair after injury
- have a role in learning

## Learning Techniques

- Mnemonics
- Memory Palace
-

## Learning How to Learn - Week 4

### Things that make us human

- Learning
- Language
- Planning
- Visual Cortex - matures in childhood
- Prefrontal Cortex - matures in puberty

### Quotes

- We can make significant changes in our brain by changing how we think.
- **Taking responsibility of our own learning is one of the most important things we can do.**
- Virtue of the less brilliant: perseverance
- "The first principle is that you must not fool yourself- and you are the easiest person to fool." - Richard Feynman

### Right hemisphere

- big picture thinking, context-dependent thinking style are significantly more characteristic to result in **right hemisphere dominance**
- Acc to neuroscientist, Vilayanur S. Ramachandran - the right hemisphere serves as a devil's advocate to question the status quo and look for global inconsistencies, while the left hemisphere clings to the way things were

### How to prepare for a test: Test Checklist (developed by Richard Felder)

1. Did you make a serious effort to understand the text?
2. Did you work with classmates on homework problems?
3. Did you attempt to outline every homework problem solution?
4. Did you participate actively in homework group discussions?
5. Did you consult with the instructor?
6. Did you understand all of your homework problem solutions?
7. Did you ask in class for explanations of homework problem solutions that weren't clear to you?
8. A study guide?
9. Did you attempt to outline lots of problem solutions quickly?
10. Did you go over the study guide and problems with classmates and quiz one another?
11. A review session?

12. Did you get a reasonable night's sleep before the test?

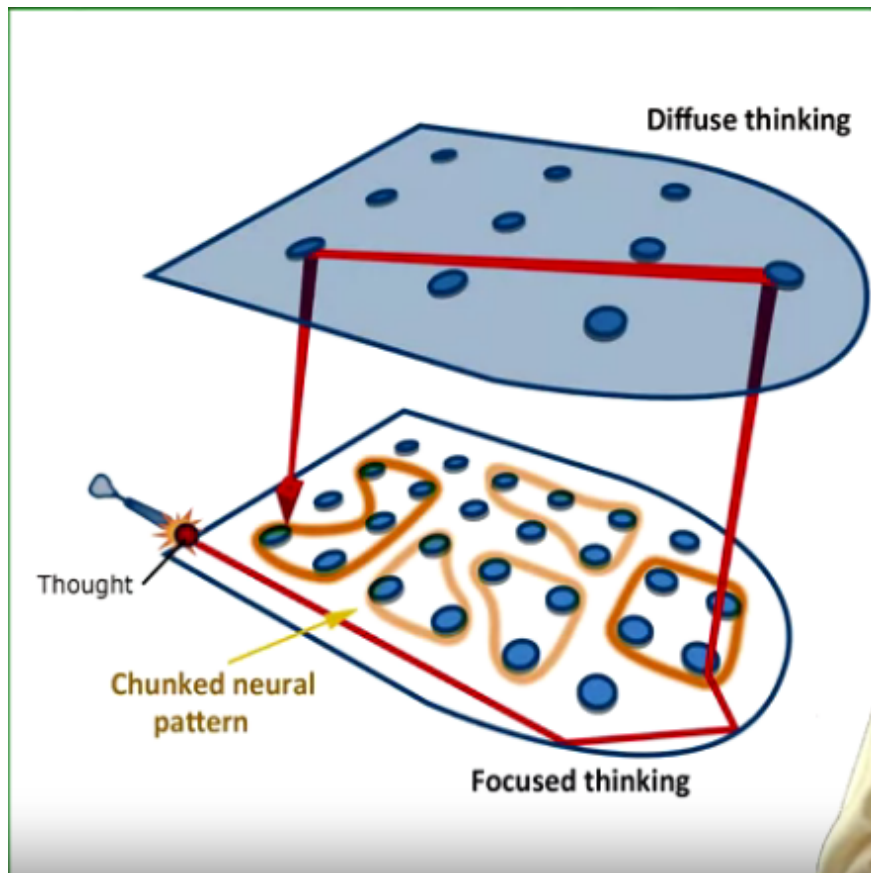
## Notes

- Consulting with your peers/ talking to them about what you're studying helps build your understanding and can help you in catching where your thinking has gone astray.
- When you receive a test paper:
  1. Skim the test paper
  2. Work on the difficult problem
    - if stuck for at least 1 minute, move on to easier problems
  3. Answer easy problems
  4. Get back to difficult problems
- Cortisol is produced when you're under stress while taking an exam (sweaty palms, racing heart)
  - It's how you view/interpret the stress that matters
    - Stress -> "This test makes me afraid" -> You'll be afraid
    - Stress -> "This test makes me excited" -> You'll be more fired up to take on the exam
- Practice deep breathing
- Always recheck your work, even after you're "done" with it. Through **overconfidence**, it might be that you fool yourself that what you've done is correct even if it isn't. Pause. Shift your attention and ask yourself a question "Does this really make sense?"

## Summary

- Santiago Ramón y Cajal (Noble prize winner, neuroscientist) - If you change your thoughts, you can really truly change your life.

## Diffused-Focused thinking analogy pic



## Questions

1. What are the different modes of thinking?
  - Focused and diffused mode of thinking are the two modes of thinking.
2. How much energy does the brain use?
  - The brain is a 3-pound organ (accounting to about 2% of our whole weight) that consumes 10 times more energy than expected based on weight alone. For the average adult in a resting state, the brain consumes about 20 percent of the body's energy.
3. What is a chunk and how it is formed?
  - A chunk is set of interconnected neurons that are used to firing together. It is formed by following the steps stated below: (FUP)
  - with Focused attention, Find a pattern
  - Understand the basic idea through Recalling it by yourself only
  - Practice to gain mastery with the concept (make sure to understand the context - (details) and the big picture of things)
4. What is illusion of competence? How to we avoid these?
  - Illusion of competence is when you believe you know the material when you really don't. Some examples of actions that lead to us having the illusion of competence is when we reread the text over and over, highlight too much text, and seeing a solution to a problem and thinking that you understand it yourself. We can avoid this by recalling the ideas you've just learned, adding personal notes (instead of highlighting), and learning outside your usual place.
5. What is einstellung?
  - Einstellung is a phenomenon of somebody getting used to doing things in a certain way such it prevents him to think fresh ideas in solving problems.
6. What key stone bad habit affects influences many aspects of our life? What are some sample recommended methods to change this habit?
  - Procrastination is the keystone habit that influences many aspects of our life. Methods that are recommended to change this habit are: 1) using Pomodoro to help ease the uncomfortable feeling when starting a task 2) planning the quitting time 3) creating a daily planner, one where you write your plans/todos the night before so your brain subconsciously prepares yourself to allocate proper resources/time the next day
7. What is the virtue of the less brilliant?
  - perseverance
8. How do you prepare for a test?
  - According to Richard Felder, you need to at least do the following to get a "measurement" of [how well-prepared you are](#) for an upcoming test.
  - Did you make a serious effort to understand the text?
  - Did you work with classmates on homework problems?
  - Did you attempt to outline every homework problem solution?
  - Did you participate actively in homework group discussions?
  - Did you consult with the instructor?

- Did you understand all of your homework problem solutions?
  - Did you ask in class for explanations of homework problem solutions that weren't clear to you?
  - Did you follow your study guide?
  - Did you attempt to outline lots of problem solutions quickly?
  - Did you go over the study guide and problems with classmates and quiz one another?
  - If there was a review session before the test, did you attend and asked questions about anything you weren't sure about?
  - Did you get a reasonable night's sleep before the test?
9. What is the law of serendipity?
- Lady luck favors the one who tries.
10. Does changing your thoughts change the way you perceive life?
- Yes. If you change your thoughts, you can really truly change your life (non-verbatim) - Santiago Ramón y Cajal. This is related to neuroplasticity.