Learning How to Learn

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1.1 The Focused and Diffused mode

- Focused: with the familiar stuff
- Diffused: think more broadly to get to the original place

1.2 A little Dalí will do

- Go back and forth the two modes as learning something difficult
  - To build neural connection (just like building muscle)

1.3 What is learning

- Brain connectivity is dynamic as we know now
- Sleeping "upgrades" the brain
- www.brainfacts.org

1.4 Procrastination

- Because it causes pain
- The Pomodoro:
  - 25 min
  - No interruptions
  - Focus
  - Reward!
  - During the time you are working on the "Pomodoro," you simply want to work intently on whatever you've chosen to work on. Trying to finish a task is NOT the intent of the Pomodoro—such an attitude can actually make your work less fun.

1.5 Practice makes permanent

- Especially with math & science
  - The more abstract, the more practice is important
  - That is, don't cram; cool it off

1.6 Introduction to memory

- Long-term memory & working memory
  - The significance of repetition, revisiting to move what is stored in the short term memory - > long term
- The technic: Spaced repetition
  - Don't haste

1.7 Importance of sleep in learning

- Just being awake creates toxic metabolic substance:
  - Just sleep
- If you want to dream something, it's actually more likely you will
  - And helps you remember it

1.8 Interview

- Ask questions
  - We learn more actively (participation) than passively
- Jogging, outdoor exercising...seems like brain switch to a different mode
  - Take notes while ideas comes up since they tend to evaporate
- Multitasking is more about switching then doing at the same time, since is really not effective
- The hippocampus 海马体
  - New neurons are being born as some of the old ones die
  - Exercise will increase the number of new neurons being born!
  - Recess: the brain needs it
- Being in a creative environment where other people are creative
  - Isolation isn't a must as some stereotype might depict
  - Communication could a boost
- Test are like any other skill
  - Don't get hang up on one problem
    - The answer often might pop up later!
    - Since the brain works in parallel track
- "In the face of the onslaught of routine day by day task"
  - Environment
- A lot of success in life comes from passion and persistence, not being smart
- Francis Crick's model of the brain
  - "Learning from a different perspective"

1.9 Summary Module 1

- Prefrontal cortex: where more familiar thinking takes place
- Activate those dormant neurons on the back
- Take rests for new connections to build
- Exercise

1.10 TA

- A life skill

1.11 Interview: The Polyglot

- (Book) Fluent in 3 months
- Worst of all reason to learn language: for show-off
  - Passion is most important
  - Try to immerse in the culture
- Don't be perfectionists: be like a child
  - A good beginner learner knows to make mistakes
  - Not overanalyzing
  - Laugh at the mistakes
- "Self-fulfilling Prophecies"
  - Whether you think you can or can't, you are right. ——Henry Ford
  - No matter what the challenges, people find their way to go through
- "I have thought of giving up millions of times"
  - Try, try, try again
  - And try different technics - its not your problem yourself
- The Mnemonics 助记法
  - Instead of raw repetition, since its asymmetric: might help with recognizing, but not with invoking
  - And with a scenario, the point is to have the link

1.12 Interview: Creativity and Problem Solving

- Be creative for oneself
- Dealing with criticism :
  - Be willing to accept discomfort
  - That's the nature of change: "No pain, no gain"
- OCEAN
  - Openness, Conscientiousness, Extroversion, Agreeableness, Neuroticism
  - Being willing to disagree sometimes signifies creativity
- "Powers of tens" exercise
  - Zoom out and zoom in

1.13 Interview: Writing

- Mind mapping
  - Also known as clustering
  - Take a piece of paper and turn it sideways
    - Very important, hint that one can go any direction
    - Writes down whatever turns up in map
    - boxes and links
    - The things that are most important/interesting will pop up, in the sense of the idea
- It's wise to not edit while writing
  - It's like cleaning the table while still eating
  - Separate writing from editing
    - Talk back to the noise in our head

2.1 Introduction to chunking

- Effectiveness

2.2 What is a chunk

- The mental leap that helps unite those pieces together through meaning
- Create conceptual chunks
- A set of neurons that are used to fire together
  - The importance of practice once again

2.3&2.4 How to form a chunk

- Pattern
- The best ones: so well ingrained that your brain that you don't need to consciously think about
  - But not a cookie-cutter mindless approach
- Steps:
- Focus
  - Making new neuron connection with the existing ones
- Understanding
  - Is like superglue
  - Especially in math and science:
    - Closing the book and solving it yourself will often speed up the learning process
    - "The first time you actually understand something si the first time when you can actually do it yourself"
- Gaining contexts
  - Going into the bigger picture
    - Namely, when to use it
  - Top down learning(big picture) & Bottom up(chunking)
    - With context is in between
    - Learn the key points first, e.g. before class
- Summary:
  - Focused attention
  - Understanding
  - Practice

2.5 Illusions of competence

- Recall
  - The retrieval process itself helps chunking
    - You must have information persisting in your memory if you are to master the material well enough to do well on tests and think creatively with it.
  - Highlighting and underlining must be done carefully
    - Words or noted in a margin that synthesize key concepts are a VERY good idea.
- Illusions of competence
  - Test myself to see if I really understand
    - It's a kind of recalling in some sense
    - Making mistakes are even better
  - Out of (original) context tests works even better
    - Subliminal cues are taken when first studying
    - In this way you can become independent of the location

2.6 What motivates you?

- Acetylcholine 乙酰胆碱
  - Focusing, forming long-term memory
- Dopamine 多巴胺
  - Reward, especially long-term
  - Part of the unconscious
- Serotonin 血清素
  - The active ingredient in Prozac
  - Risk taking
- Emotions
  - Stay happy to learn effectively

2.7 The value of a library of chunks

- Transfer
  - Concepts and methods that can cross disciplines!
    - "the idea that a you've mastered in one area can often help you much more easily learn chunks of information in different areas that can share surprising commonalities"
  - Chunk: compressing information much more compactly
    - Think of it as a collection or a library of neural patterns
- In building a chunked library
  - Different types and classes of concepts need be identified
  - ...soon find that different solution technics are lurking behind your memory
- Sequential / Holistic(global)
  - former one represent focused, latter finding new solutions
  - But inspection is needed since intuition is not always correct
- Law of Serendipity
  - Lady Luck favors the one who tries.

2.8 Overlearning, Choking, Einstellung, and Interleaving

- Overlearning
  - Cure: Deliberate Learning
    - Focus on the difficult part
    - Which is omitted in overlearning, simply repeating what is already mastered
- Einstellung
  - = Mindset
  - Like a roadblock
    - Acquired knowledge might turn out to be misleading when grasping new ideas
- Interleaving
  - Mix up your learning
    - Skipping around through chapters while reviewing
    - Seems to make it more difficult
    - In reality helps learn more deeply
  - Both in one discipline and across disciplines
- Trade-off: 全与专
  - Thomas Kuhn's finding
  - "Science progresses one funeral at a time"

2.9 Summary

- Synthesizing

- Recall
- Transfer
- Interleave
- Illusions of competence in learning:
  - Test yourself!
  - Minimize highlighting
  - Mistakes are good!
  - Use deliberate practice
- Einstellung
- Law of Serendipity

2.10 Interview : Dr. Norman Fortenberry - Learning at MIT

- Studying resources, especially in Engineering
  - It's a team sport
  - Remind self that you didn't suddenly become stupid arriving in MIT
  - The objective is to get the degree
- Handling frustration
  - Talk to 过来人 to clarify your objective
  - Buckle down and study hard
- Important to take a break
  - Redirect your focus to shut my brain down
  - "guilty pleasure"
- Using as many different ways as input modes as possible
  - Notes even mechanicalize help process the knowledge!
  - Discussion, not even necessarily teaching

2.11Interview: Scott Young, a "Marco Polo" of Learning

- Dive into problem asap
  - Feel that grind first so that the solution gained later sticks
- "Self Explanation"
  - Feynman went through meticulously the material he didn't understand at first
    - Combing the development vein
    - "The first rule is not to fool yourself, but you are the easiest person to fool"
  - Take out a piece of paper and write down the idea
    - ...as if I am to teach it to someone else
    - In this way found out the missing part, and come back to relearn
- Creating
  - Analogy & Metaphors
    - e.g. electric circuits - water pipes with water
      - Voltage - pipes that are placed higher
      - Electric potential - Gravitational potential energy
- Motivation
  - Being intelligent in a subject is often just a matter of how much exposure you've had to it
- When best learners fail
  - They just learn from it, and not let it influence them
- Making concrete projects
  - The sole idea could be a motivation
- Online resources
  - MIT open course, recommended
- Learn more, study less
  - Pick specific times to study, doesn't need to be long
    - But intensive

3.1 Introduction to Procrastination and Memory

- Methods demanding less will power to be introduced

3.2 Tackling Procrastination

- Good learning is a bit by bit activity
  - Instead of cramming
- Will power is precious resource
  - But is not necessary in tackling procrastination
- Procrastination shares features with addiction
- Become the master of your habits, "zombies"

3.3 Zombies everywhere

- Chunking relates with habit
  - It's energy-saving
- Habit
  - The cue
  - The routine
  - The reward
    - Every habit comes with a reward
      - It what keeps it going
  - The belief
    - To change your habit you need to change your underlying belief

3.4 Surf is up: Process Versus Product

- It's perfectly normal to feel negative when starting study
  - Even with subjects you like
- Focus on process rather than product
  - The product is what triggers the pain
  - This way you can relax
    - Rather than judging yourself while studying

3.5 Harnessing your zombies to help you

- Minimizing will power
  - The only point is to change the reaction to the cue
- The cue
  - Location
  - Time
  - How you feel
  - Reactions
- The routine
  - Plan
    - Savor those victory when it finally works after adjustments
- The reward
  - Habits are powerful because it creates neurological cravings
  - When the brain expect the reward, the new habit is starting to work
  - Remember, the better you get at something, the more enjoyable it can become
- The belief
  - The belief that you can do it!
  - Join the community, to help you in moments of weakness

3.6 Juggling life and learning

- Weekly list of key tasks
  - Daily "to do list", the evening before
    - Or else it will take up working memory
- Planning your quitting time is as important as planning the working time
- Maintaining healthy life
- "Eat your frog early in the morning", incredibly useful

3.7 Summing up procrastination

- Keep a planner journal
- Commit yourself to certain routines and tasks each day
- Delay rewards until you finish the task
- Watch for procrastination cues
- Gain trust in your new system
- Have backup plans for when you still procrastinate (no one's perfect :D)
- Eat your frogs first

3.8 Diving deeper into memory

- Visual, spatial memorization abilities
  - The funnier, more provocative, the better
- Repetition
  - People often underestimate the benefits of spaced repetition when learning
  - Index cards
    - Anki!
    - & interleave
  - Auditorial connection, also useful

3.9 What is long term memory

- Hippocampus
  - Memory consolidation
- Memory is dynamic
  - Whenever you recall a memory, it changes, a process called reconsolidation
  - Even possible to plant false memories
- Memories are intertwined
  - Astrocytes - a kind of sell related to providing nutrients, repairing neurons etc.

3.10 Creating meaningful groups and the memory palace technique

- Creating meaningful groups that simplifies the material 创造有意义的意群来简化材料
  - Four plants that ward of vampires:
    - Garlic
    - Rose
    - Hawthorn
    - Masturd
    - Initials: GRHM
      - -> Graham cracker 全麦饼干
- Mnemonics
  - Especially in medicine
- Memory palace technic
  - Imagine a place you are familiar with
  - To place the objects to be remembered
- Your childlike creativity is still there inside you

3.11 Summary

- Long term memory
- Working memory
- Strong visual and spatial memory ability
- Spaced repetition
- Connections
- Grouping, abbr., memory palace

3.12 Interview: Memory Champion Nelson Delis

- Trained rather than natural-born
- Basically every memory technic involves two things:
  - Visualization
  - Attach the image to the palace that you are familiar with
- Names:
  - Not to be embarrassed to ask again at first encounter
  - Even writing down info on the business card
    - Becomes kind of game
- "Memory is all about paying attention"
- General method
  - Come up with the picture
    - Turn what's abstract to what's yours
  - Store it somewhere
    - To be able to access it later
- 4 aspects of brain health
  - Keeping it active
  - Learn a new skill
    - Try
    - Be physically active
  - Be social
  - Diet
- Let go, explore the inner child

3.13 Interview: Keith Devlin, Stanford

- Author of "introduction to mathematical thinking"
- "Don't panic"
  - What are you trying to do
  - What do you want to achieve
  - What information do you have
- The process
  - Understand the problem first e.g. Diagram
  - If recorded method applies, problem solved
  - If not, the journey takes place
  - If stuck too long, take a break
    - Come back to face the problem with a fresh eye
    - "Uh dah, why didn't I think of it before?"
- "Let it take its course"
  - When you get out of the school system
    - Which demands everything to be solved quick under pressure
  - "Three cheers for slow thinking"
- In the field of mathematics, problems
  - are not fundamentally different from any other problem
  - Except that it's completely abstract
    - The hard part is getting that problem familiar on the inside
      - And to do that one need to live inside the problem
- The method of thinking, doing, thinking, doing...
  - The mind is not separate from the body
- Human are not good at multitask
  - Rather, serial task is good
  - Work very intensely and focused for a period of time
  - Switch
  - Procrastination comes when starting something new
    - Once you get into the mood (use willpower for the start), everything flows out
- Switch off all the alerts
  - Rather, find the alerts myself
  - Don't want to be disturbed

3.14 Interview: Dr. Robert Gamache

- Bilingual (English & French with Dyslexia 失读症)
  - Studying French enforces English
  - Should study every subject everyday
    - Not about the time length, but the using
    - "拳不离手，曲不离口"

            - 学不离手，曲不离口

- Repetition hardwires your brain
    - Practicing continuously
    - The example used is studying physical chemistry\
    - Applies to other subjects as well
- When stuck
    - The discovery was serendipitous
    - The gears is always turning in the background
- Balancing family and work
    - As a scientist in research you are sort of like a professional athlete
        - Everyday you have to get up and do something that's gonna make you a little bit better than the competition
        - "Publish or perish"
    - This is tremendous pressure
        - But if you work all the time, it tends not to be productive
        - Downtime is very beneficial "the gears is akways turning in the background"
- Advise for students in different stages of life:
    - The prof was doing two majors
        - Basically a study machine
        - Downtime let me "get the steam off"
    - Choose a career where you do something you love
        - When you love something, it's always easier to learn
    - Refresh yourself periodically
- Examples that makes the subject easy
    - Science is compounded by the fact that human is not comfortable with numbers

3.15 Interview: The Imposter Syndrome and Dealing with Procrastination

- Imposter Syndrome
    - Is like a tape that plays inside the students' head
    - Is more common than you think
    - Realize the problem is the most important step
- Tackling procrastination
    - Schedule
    - To do list
        - Break the task down into doable small pieces
            - Then is not that formidable
    - Once you get started, is much more easier
        - Make appointment with myself
        - Use the most productive hour to do the most difficult problem
        - Steady progress
            - Half-hour chunk
                - Even if just half-hour, everyday, then it gets done

4.1 How to become a better learner

- The best gift to give to the brain
    - Exercise
        - Helps newly generated neurons to survive
- Practice makes perfect - when the brain is ready

4.2 Renaissance learning and unlocking your potential

- Learn using metaphor and analogy
- Work profitably with teammates
- Perform well on tests
- After the exasperation, the leap will come

4.3 Create a lively visual metaphor or analogy

- Often the more visual, the better
- e.g.
    - cation - positive -> cat - "paw"sitive
    - anion - negative -> onion - negative
- Interestingly, it also helps with breaking "Einstellung"
    - & metaphors help us at least get a sense of what is going on

4.4 No need for genius envy - the imposter syndrome

- Both the how and why is known
    - After the chunk is formed
- Well-trained intuition
    - Chess masters, surgeons, fighter pilots etc.
- Deliberate practice on the toughest parts
- Imposter syndrome
    - Every person has different gifts
    - "Keep your chin up & your eye on the open door"

4.5 Change your thoughts, change your life

- "Not only because he was extraordinary, but also because he was so ordinary"
    - Santiago Ramón y Cajal
    - 11 yrs old in jail, climbing up the medical study until 20s
    - Became the father of modern neuron science
    - "The virtue of the less brilliant" - preserverance
    - Coupled with flexibility to change his mind and admit errors
- When you use the neural circuits
    - You help build the myelin sheaths 髓鞘 around them
- Taking responsibility for your own learning!

- Taking responsibility for your own learning!

- It's important to switch on into cool dispassion
    - Not only to focus, but also to tune people out whose interest lies in undercutting you
        - The greater your achievement, the more sometimes other people will attack and diminish your efforts
        - On the other hand, if you funk a test, you may encounter critics that throws more bar, saying you don't have what it takes
    - Take pride in who you are, especially the qualities that makes you "different" 择善固执
        - Use them, your natural contrarians, as your secret talisman to success, to defy the always-present prejudices about what you can't accomplish

4.6 The value of teamwork - Avoiding overconfidence

- Righthemisphere
    - The "aha" feeling
        - Taking a step back in finding the big picture
        - The importance full cognition
    - E.g. if you refuse to revisit wized-through hw/test questions, acting like refusing to fully act the ability of the brain (the above function)
- "Question the status quo and look for global inconsistencies"
    - While the lefthemisphere focus on interpreting
        - Which at times results in overconfidence, yielding mistakes eventually
- Friends and teamwork can act as diffused mode
    - Caveat: turning into social events