Principles of Effective Studying

Baseado no material de Sven Ligensa

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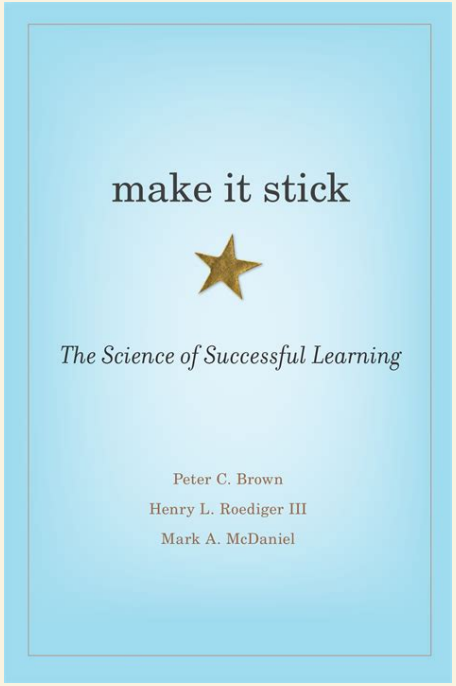
Disclaimer

- Este material foi preparado e cedido por Sven Ligensa
- Sven foi um de meus melhores alunos na Universidade de Münster

Sven ganhou o prêmio de melhor TCC: https://www.wiwi.uni-muenster.de/fakultaet/de/news/4474

Source



Book this material is based on: **Make It Stick: The Science of Successful Learning**

https://www.retrievalpractice.org/make-it-stick

Pergunta inicial

Quais técnicas de estudo você usa normalmente?

- Sumarização
- Anotações
- Highlight
- Mapa Mental
- Exercícios
- Cartões (Anki)
- ...

Motivation: Why Should You Care?

- "If you're good at learning, you have an advantage in life." (Make It Stick, p. 2)
- Most of us don't really know how to learn effectively
  - Striking quote: "Even in studies where the participants have *shown superior results from spaced learning*, they don't perceive the improvement; they *believe they learned better on the material where practice was massed*." (p. 47)
  - Same pattern for other effective study practices
- But why is that so?
  - Effective study strategies are often not intuitive at first glance
  - It is not directly taught in school/university - until now... ;)

Illusions of Knowing

- Fundamental difference: Feeling $\neq$ Reality
- Everyone is affected, often not even aware
- Example of poor *metacognition* (judgement about what one knows)
- Fostered by ineffective learning strategies
- Good metacognition
  - Critical for effective decision making and learning
  - Skill one must acquire

Familiarity Trap

- Feeling that you know something $\longrightarrow$ No longer need to practice it $\longrightarrow$ Bad decisions on what to learn
- *Fluency illusion*: Confuse: Fluency with text $\Leftrightarrow$ Mastery of its content
    - Which learning strategy supports this illusion?

      $\longrightarrow$ Rereading

Mutable Memory

- Two-edged sword
  - Skews our perceptions ($\Rightarrow$ Stay open to the fallibility of your certainties)
  - Essential for learning
- Memory = Reconstruction $\neq$ Reality
- *Hindsight bias*
  - How does that affect our studying?

    $\rightarrow$ Coming into a tutorial session without working on the exercises beforehand $\Rightarrow$ Feeling that the exercises are easier than they actually are

Remedies

- Effective learning strategies like Self-Testing
- *Objective ways* to track progress
- "Practice like you play"
- Seek corrective feedback
- Be aware of what criteria you use to judge what you have learned
    - What are good/bad ones?

      → Good: *Explaining* a text well using own words

      → Bad: *Familiarity* with text

Brain

- Circuitry: *Neurons* communicating via *synapses*
  - Enables: Senses, cognition, motor skills, learning, memory, ...
  - Forms possibilities and limits of persons intellectual capacity
- *Neuroplasticity*: Brain is remarkably mutable
  - Learning $\Leftrightarrow$ Changing the brain
  - Genes $\rightarrow$ Brain architecture (Initialization point)
  - Experience $\rightarrow$ Modification of fine structure
- Knowledge and memory = Neural processes
  - Maturation of connections = Gradual thickening of myelin coating of axons
    - Practice $\Rightarrow$ Myelin $\uparrow \Rightarrow$ Strength and speed of electrical signals $\uparrow \Rightarrow$ Performance $\uparrow$

Learning

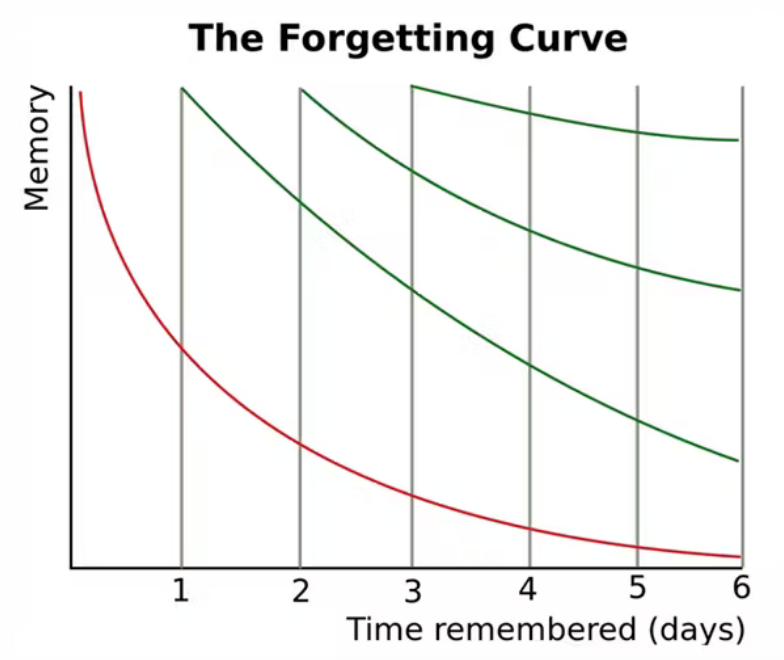
- "**Acquiring knowledge** and skills and having them readily available from **memory** so you can make sense of **future** problems and opportunities"
- *Iterative* Process: Revisiting knowledge like a spiral and understanding more and more every time
  - Can you think of an example?

    → Reading a dense paper multiple times (Some aspects are immediately clear, others are not. The second time reading, you can work with the information you already understood and build up on that...)

    → As Information Systems student: Building up on knowledge about *data* or *processes* in subsequent modules (It would not make sense to learn all the details in one module)
- On neurological level: Strengthening neural pathways
- Steps: Encoding, Consolidation, Retrieval

Forgetting

- Learning requires *memory*
  - *Forgetting* = Unability to recall something (easily)
- Central goal: Interrupt the *forgetting curve*
  - We (exponentially) forget most information we consume after short amount of time



The Role of Failure

- Source of useful information
- Not desirable itself, but unavoidable $\rightarrow$ Effort despite risks
- Fear of failure $\Rightarrow$ Worse learning (aversion to experimentation and risk taking, diminishes performance under pressure)
- Important: *Positive attitude* towards mistakes
- Few settings where failure not optimal learning strategy
  - Can you think of an example?
    $\rightarrow$ Parachuting

Desirable Difficulties

- Desirable difficulties $\Rightarrow$ More effort during learning $\Rightarrow$ Deeper, more durable learning
- Can be overcome through increased effort
- Learning is **not** better when it's easier!
  - "When learning is hard, you do important work." (p. 7)
  - On the other hand: When it's easy, you could probably let it be
- Feature of many effective learning strategies (Spacing, Interleaving, Variation, ...)
- Have you already experienced them in your own life?
  $\rightarrow$ In nearly every kind of sport training: varying the kind of shot/throw/hit; Not practicing only few days before a match, but throughout the whole season

Advantages and Disadvantage

- Advantages
  - Trigger encoding and retrieval processes
  - Help creating mental models ($\rightarrow$ Concepts, transfer)
  - Mimics challenges of practical experiences ($\rightarrow$ Practice like you play)
- Disadvantage: Feel less productive ($\rightarrow$ Illusions of Knowing)
- Undesirable difficulties: Cannot be overcome through increased effort

Retrieval

- **Recalling from memory**
- Doesn't need to be initiated by instructor $\rightarrow$ *Self-testing*
- Check answers $\rightarrow$ Combat Illusions of Knowing
  - Important: Really *answer* the question before reviewing the solution
- Versatile implementation possibilities
  - Physical flashcards, Anki, Writing down questions and answers (Physical, Notion, Obsidian, ...)
- Restudying after failed retrieval $>$ Not attempting retrieval

Advantages

- Advantages
  - Strengthens memory
  - Shows gaps in knowledge ($\rightarrow$ Combats Illusions of Knowing)
- Should be *primary study strategy*
  - In combination with the other strategies we will see in a minute...

- What would you write on a simple flashcard to test yourself on the topic of retrieval?
  → Front: What is **Retrieval**?
  → Back: A very effective learning strategy where you answer a question instead of simply reading the solution.
- Have you already implemented retrieval in one form or another? If yes: Show me your hand.

Spacing

- **Letting time pass between study sessions**
  - Leads to forgetting ($\rightarrow$ Forgetting Curve) = Desirable difficulty
- Anything you want to remember must be periodically recalled from memory
- Crucial aspect of everyday experiences
- Study schedule
  - Interval depends on material
  - E.g. 1 day $\rightarrow$ 1 week $\rightarrow$ 1 month

- Combine with Retrieval
- Reach back to retrieve prior material → See how knowledge relates to what you learned later
- Advantages
  - Learning has time to consolidate into cohesive representation in the brain for long-term memory
  - Interrupts forgetting
- How can spacing be implemented?
  → Flashcards with "manual" implementation of spacing (Leitner system), Anki, Phase 6, ...

Variation

- Vary the exercises, shuffle your flashcards
- Advantage: Versatility of learning
  - Finding commonalities/differences between different problems
  - Broader understanding
  - Better assessment of context + Selecting right solution
  - Transfer of learning between situations
- What is an example?

  $\rightarrow$ Mock exams (different kind of exercises)

Interleaving

- Interleave practice of multiple topics/subjects/skills
- Switch *before* each practice is complete
- Alternate between different problems that need different solutions
- Implements Spacing
- Have to recognize problem type first, then select right solution
- Advantages
  - Retrieval is harder
  - Same advantages as Variation

Implementation

- Test yourself on key concept
  - Be able to *define* it (in own words) and *use* it
- Distill information into "big picture"

Memory Cues

- Something with familiar structure to link information to
- Mental framework to store and later recall (large amounts of) information
- Organize what is already learned: *Understanding* first, *remembering* second!
- After repeated usage not needed anymore
- Can you think of an example?
  → **P**lease **D**o **N**ot **T**hrow **S**ausage **P**izza **A**way (Seven layers of ISO OSI model)

Implementation

- Mnemonic device
- Memory palace
- Rhyme schemes
- ...

Concluding Words

- Less effective study techniques *feel better* than effective ones
  - But learning is *less* effective, when it is *easier*
  - Results stem from short-term instead of long-term memory
- The most effective study technique is Retrieval, which should be combined with Spacing, Variation, Interleaving, ...
- Have faith in your implementation of effective strategies and don't abandon them too quickly

Muito obrigado pela presença e participação!

Agora, gostaríamos de ouvir você.
Sua opinião é essencial para podermos crescer, melhorar e criar experiências ainda mais significativas no futuro.

Preparamos um formulário de avaliação simples e rápido, mas que fará toda a diferença para nós.