Notes on *A Mind for Numbers*

by Jacob Williams • last updated 2025-02-15

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1. “open the door”

Oakley recounts her own journey from having “simply no interest or seeming talent whatsoever” (Oakley 2) in math, to getting “doctorate in systems engineering” (Oakley 6). She “only

started studying trigonometry—remedial trigonometry—when [she] was twenty-six years old." (Oakley 1)

2. "easy does it"

Oakley says difficult problems often require us to first use the **focused** mode of thinking and then the **diffuse** mode, going "back and forth" (Oakley 22). One problem with procrastination is that it doesn't leave time for this (Oakley 23).

Oakley recommends scanning over a chapter for pictures/headings/etc before reading it, (Oakley 11) something I probably ought to do more often.

Oakley recommends doing pomodoros. A detail: "Don't worry about finishing the task—just worry about working on it." (Oakley 24)

3. "learning is creating"

On switching to diffuse mode: "Unless other tricks are brought into play, this generally takes several hours." (Oakley 30) Dalí and possibly Edison used a waking-themselves-up-from-a-nap-as-they-fell-asleep trick. The book lists various ways to try to switch; some that appeal to me are walking, bathing/showering, listening to instrumental music, "[p]laying songs you know well on a musical instrument" (Oakley 35) (what about improvising?), and sleeping. It mentions certain other activities "are best used briefly" since they "may pull you into a more focused mode" (Oakley 35).

Use spaced repetition for learning; but also, "[a] good rule of thumb, when you are first learning new concepts, is not to let things go untouched for longer than a day." (Oakley 38)

> The next time you are tackling a tough problem, work on it for a few minutes. When you get stuck, move on to another problem. Your diffuse mode can continue working on the tougher problem in the background. When you later return to the tougher problem, you will often be pleasantly surprised by the progress you've made. (Oakley 43)

> It seems that if you go over the material right before taking a nap or going to sleep for the evening, you have an increased chance of dreaming about it. If you go even further and set it in mind that you want to dream about the material, it seems to improve your chances of dreaming about it still further. Dreaming about what you are studying can substantially enhance your ability to understand—it somehow consolidates your memories into easier-to-grasp chunks. (Oakley 45)

Two interesting things on creativity from Robert Bilder (unclear if these are quotes or summaries):

> The best predictor of how many creative works we produce in our lifetime is . . . the number of works we produce. (Oakley 49)

> There is a negative correlation between the level of creativity and "agreeableness," so those who are the most disagreeable tend to be most creative. (Oakley 50)

4. "chunking and avoiding illusions of competence"

Your brain needs to organize information into "chunks"; Oakley gives three steps for this:

1. "*focus your attention* on the information" (Oakley 57)
2. "*understand* the basic idea" (Oakley 58)
3. "gaining context so you see not just how, but also *when* to use this chunk" (Oakley 58)

Memorization and creativity should not be seen as opposed:

> 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. (Oakley 66)

> …a key difference between creative scientists and technically competent but nonimaginative ones is their breadth of interest. (Oakley 66)

Just trying to remember information after you read it is very effective—more effective than even e.g. "drawing diagrams that show the relationship between concepts" (Oakley 71). Going to different physical locations while you recall information can be helpful too.

It's important to **interleave**: "practice by doing a mixture of different kinds of problems requiring different strategies." (Oakley 74) The book suggests making index cards with various problems so you can't tell what section of a textbook they come from.

5. "preventing procrastination"

Apparently you can actually develop a tolerance to arsenic by ingesting increasing amounts? I googled this and found there's even a word for it, Mithridatism.

6. "zombies everywhere"

Oakly lists four elements of a habit: cue, routine, reward, belief.

> The only place you need to apply willpower is to change your reaction to the cue. (Oakley 95)

Oakley says you should "focus on *process*, not *product*." (Oakley 101) This is something I've gone back and forth on a lot—should I set goals of *finish X today* or *spend Y minutes on X today*? Oakley says, "The product is what triggers the pain that causes you to procrastinate." (Oakley 102)

This chapter brings up the pomodoro technique again, and adds an interesting point: the stress the timer causes while learning may help you perform whatever it is you're learning better under stress too.

I feel called out: "Procrastination often involves becoming sidetracked on less essential little tasks, such as pencil sharpening, in part because you can still feel the thrill of accomplishment." (Oakley 106)

Nice quote(?) from Oraldo 'Buddy' Saucedo: "We all have a failure rate. You will fail. So control your failures. That is why we do homework—to exhaust our failure rate." (Oakley 111)

7. "chunking versus choking"

This gives advice on building better chunks, including that you should work some problems through in detail multiple times (the same problem repeatedly)—sleeping in between at one point. And also, "[m]entally review key problem steps in your mind while doing something active, such as walking to the library or exercising." (Oakley 115)

Sometimes "knowledge collapse" happens—"periods when you seem to take an exasperating step backward in your understanding." (Oakley 118) It's normal and "when you emerge from these periods of temporary frustration, your knowledge base will take a surprising step forward." (Oakley 118)

> "Research has shown that testing isn't just a means of measuring how much you know. Testing in itself is a powerful learning experience. It changes and adds to what you know, also making dramatic improvements in your ability to retain the material. … Improvement because of the testing effect occurs even when the test performance is bad and no feedback is given." (Oakley 119–20, emphasis removed)

8. "tools, tips, and tricks"

> Research has confirmed that a special place devoted just to working is particularly helpful. (Oakley 126)

This is nuts:

> One of the most extraordinary stories of reframing is that of Roger Bannister, the first person to run a mile in less than four minutes. Bannister was a medical school student who couldn't afford a trainer or a special runner's diet. He didn't even have time to run more than thirty minutes a day, squeezed in around his medical studies. Yet Bannister did not focus on all the reasons why he logically had no chance of reaching his goal. He instead refocused on accomplishing his goal in his own way. On the morning he made world history, he got up, ate his usual breakfast, did his required hospital rounds, and then caught a bus to the track. (Oakley 127)

Writing a task list the day before can help put your subconscious to work while you sleep.

Oakley tries to finish all her tasks by 5pm each day, and notes that Cal Newport "used a 5:00 P.M. quitting time through most of his student career." (Oakley 134)

> It's important to transform distant deadlines into daily ones. Attack them bit by bit. Big tasks need to be translated into smaller ones that show up on your daily task list. (Oakley 134, emphasis removed)

Oakley says "Planning your life for 'playtime' is one of the most important things you can do to prevent procrastination…" (Oakley 139) I think I struggle with this because the boundary between my 'work' and 'play' is so fuzzy/malleable that I don't really know what "playtime" would usually consist of… and also it's hard for me to not feel like I'm wasting time.

9. "procrastination zombie wrap-up"

Here's something I struggle with:

> People who make a habit of getting their work done in binges are much less productive overall than those who generally do their work in reasonable, limited stints. (Oakley 145)

This too (it's a quote from B. F. Skinner!):

> "When I am not working, I must relax—not work on something else!" (Oakley 146)

10. "enhancing your memory"

Oakley advises taking advantage of our "visual and spatial memory systems" (Oakley 157) for memorizing stuff. In particular, memory palaces.

> To use the technique, you might imagine a gigantic bottle of milk just inside your front door, the bread plopped on the couch, and a cracked egg dribbling off the edge of the coffee table. In other words, you'd imagine yourself walking through a

> place you know well, coupled with shockingly memorable images of what you might want to remember. (Oakley 160)

> Top anatomy professor Tracey Magrann applies the memory palace technique to learning the five layers of the epidermis:
>
> "The epidermis has five layers. From deep to superficial, they are the stratum basale, stratum spinosum, stratum granulosum, stratum lucidum, and stratum corneum. To remember which one is the deepest layer, visualize your basement. That is the stratum basale. To get from your basement (deepest layer) to the roof (superficial layer), walk up your basement stairs . . . be careful! They are covered with cactus spines (stratum spinosum). That leads you to the kitchen, where someone has spilled granulated sugar all over the floor (stratum granulosum). Then you go upstairs and stop to put on suntan lotion before you go to the roof. The stratum lucidum is like a layer of suntan lotion because it protects you from UV rays but is present only on the palms and soles, so that's where you picture yourself applying the lotion. Now you are ready to go to the roof and enjoy a nice corn on the cob (stratum corneum)." (Oakley 161)

Songs and weird images can also be used.

More interesting advice quoted from Magrann:

> By using more areas of the brain while learning, we build stronger memory patterns, weaving a tighter web that is less likely to be forgotten during the stress of an exam. For example, in anatomy lab, students should pick up the anatomy models, close their eyes, feel each structure, and say the name of each part out loud. (Oakley 164)

11. "more memory tips"

> One of the best things you can do to not only remember but understand concepts in math and science is to create a metaphor or analogy for it—often, the more visual, the better. (Oakley 168)

> Writing appears to help you to more deeply encode (that is, convert into neural memory structures) what you are trying to learn. (Oakley 173)

This is an interesting warning:

> …be careful about what you decide to skip when reviewing for tests. Your memory for related but nonreviewed material can become impaired. (Oakley 174)

The chapter doubles down on memory tricks: "research has shown that students who use these types of tricks outperform those who don't." (Oakley 179) It insists you'll get faster at using

them, with practice.

12. “learning to appreciate your talent”

This chapter tries to encourage people who are less naturally gifted by emphasizing how much you can improve by practice. “Chess, that bastion of intellectuals, has some elite players with roughly average IQs.” (Oakley 188) A footnote says Richard Feynman had (or claimed to have?) an IQ of 125.

It mentions Klingberg 2008 finding you can actually increase your working memory—I wonder what the current research on that is.

13. “sculpting your brain”

Santiago Ramón y Cajal is presented as another inspirational story of overcoming early difficulties to have a good intellectual career.

Cajal would spend a lot of time hand-drawing cells even though he also had photographs of them; this is given as an example of the value of abstraction.

> Metaphors and physical analogies form chunks that can allow ideas from very different areas to influence one another. (Oakley 198)

This chapter says some stuff about brains maturing in our twenties, which I think I’ve heard elsewhere is an oversimplification?

14. “developing the mind’s eye through equation poems”

> If you are a novice looking at an equation in physics, and you’re not taught how to see the life underlying the symbols, the lines will look dead to you. It is when you begin to learn and supply the hidden text that the meaning slips, slides, then finally leaps to life. (Oakley 203)

Oakley thinks it’s a good idea “to stage a play in your mind’s eye and imagine the elements and mechanisms you are studying as living creatures…” (Oakley 207) Cajal, Einstein and Barbara McClintock are given as examples of successful scientists who used similar feats of imagination in their process.

15. “renaissance learning”

> Neurosurgeon Ben Carson, winner of the Presidential Medal of Freedom for his pioneering surgical innovations, was initially flunking and gently urged to leave medical school. Carson knew he learned best through books, not in-class lectures. He took a counterintuitive step and *stopped* attending lectures to give himself time to focus on learning through books. His grades soared and the rest is history. (Oakley 214)

> We're often told that empathy is universally beneficial, but it's not. It's important to learn to switch on an occasional cool dispassion that helps you to not only focus on what you are trying to learn, but also to tune people out if you discover their interests lie in undercutting you. (Oakley 220)

16. "avoiding overconfidence"

This chapter starts with an anecdote about "Fred", although a footnote tells us he's just "a hypothetical amalgam".

When in "the focused, left-hemisphere-leaning mode of analysis" (Oakley 228) we're vulnerable to overconfidence and being oblivious to mistakes:

> As leading neuroscientist V. S. Ramachandran has noted, the right hemisphere serves as a sort of "'Devil's Advocate,' to question the status quo and look for global inconsistencies," while "the left hemisphere always tries to cling tenaciously to the way things were." (Oakley 228)

This is interesting, wonder if it has held up:

> One of the most-cited papers in sociology, "The Strength of Weak Ties," by sociologist Mark Granovetter, describes how the number of acquaintances you have—not the number of good friends—predicts your access to the latest ideas as well as your success on the job market. (Oakley 231)

Oakley emphasizes the importance of discussing/brainstorming/checking your ideas with others, and includes an anecdote about Niels Bohr spending time with Feynman because the latter was not prone to being a yes-man.

17. "test taking"

Oakley speaks highly of Richard Felder's STEM-education resources—https://engr.ncsu.edu/stem-resources/ — and includes his test-preparation checklist. One surprising item for me was "attempt to outline lots of problem solutions quickly, without spending time on the algebra and calculations" (Oakley 241).

To take advantage of diffuse mode processing, when taking tests, try to spend just a little time on each hard problem before switching to easy problems.

This quote from Sian Beilock is intriguing:

> “My research team has found that if you write about your thoughts and feelings about an upcoming test immediately before you take the test, it can lessen the negative impact of pressure on performance. We think that writing helps to release negative thoughts from mind, making them less likely to pop up and distract you in the heat of the moment. (Oakley 250)

References

Oakley, Barbara A. *A mind for numbers: how to excel at math and science (even if you flunked algebra)*. Jeremy P. Tarcher/Penguin, 2014.