

Your Brain on Practice

Riley Braase, DMA

rbraase@gmail.com



Context and Key Concepts

- **Nervous system:** The network of neurons in the brain, spinal cord, and nerves that sends and receives messages throughout the body. Chemical/electrical signals travel along **neural pathways**, which can be compared to trails in a forest: they get stronger with use and fade with disuse.
- **Neuroplasticity:** the ability of the nervous system to change, especially in response to learning, aging, and injury recovery. Focus, repetition, and rest can increase neuroplasticity, especially for adult learners.
- **Deliberate Practice:** Effortful practice qualities needed to develop expertise, defined through research by Anders Ericsson. Conditions for deliberate practice include clear goals, motivation, feedback, repetition, and intense focus
- **Working Memory:** Short-term memory and executive control. Limited to about 7 “chunks” at a time (maybe just 4)



Focus: Attention, mindfulness, physical and mental arousal, executive functions e.g. planning and emotional regulation

- **Yerkes-Dodson Law:** Optimal performance happens when physiological arousal (heart rate, blood pressure, etc.) is not too high and not too low. Like tuning a violin string, with not too much or too little tension.
- **Breathing strategies:** Raise/lower arousal. *Box breathing* for calm: in for 4 counts, hold for 4, out for 4, hold for 4. *Wim Hoff breathing* for alertness/relaxation (if done mindfully): 30 deep breaths, hold until uncomfortable, 15 second recovery breath in. Repeat three or more cycles.
- **Self-Regulated Learning:** A process of self-directed learning involving forethought, performance, and self-reflection. Forethought skills include *goal setting, self-motivation, audiation, and task analysis*. Performance skills include *execution of the task, attentional monitoring, and internal dialogue*. Self-reflection includes *evaluation of outcomes* and *causal attribution* – determining why something worked or didn’t work. Using practice journal and self-recording can help practice with effective self-regulated learning.



Repetition: Improve or notice something new on each rep. Think “iteration,” not robotic replication. *Quantity x Quality*

- **Myelin:** A membrane that wraps in layers around neural pathways to speed up electrical signals like the insulation on a wire. **Myelination:** the growth of myelin caused by stimuli including repetition.
- **Cerebellum:** Brain region that coordinates movement and timing. “Nonjudgemental automatizer” of repeated signals
- **Habituation:** Decreased brain response to a constant or repeated stimulus. Avoid excessive or mindless repetition
- **The Mastery Illusion:** A misconception that a skill or information has been stored in long term memory after experiences relying on short-term memory. Some strategies lead to less short-term progress but better long-term retention: varied practice, distributed practice, randomly ordered/interleaved practice.
- **Varied repetition:** Reduce habituation and improve generalization by varying the task. Target technical/musical challenges: rhythm (reinforce fast even technique), articulation (slur for tone/phrasing, staccato for rhythm) style (creativity, new perspectives), attention/mindfulness. Tool for varied repetition: 3 consecutive reps, 3 different ways.
- **Active retrieval:** Retrieve information from long-term memory rather than holding it in short-term memory. Also called the testing effect, similar to *generation*. E.g. flashcards rather than re-reading notes. Music examples for performance prep: mock performances and self-recording, case-to-face (test performance without a warmup), and simulating performance anxiety in practice, e.g., heart rate with exercise, introducing distractions, cooling hands with ice, etc.
- **Interleaving:** Cycling between multiple short sessions on a set of skills rather than practicing each area for a continuous block. **Random practice** = a random order of topics. Applies distributed practice and discriminative contrast.



Rest and Spacing

- **Memory consolidation:** the transfer of short-term memory to long-term memory that takes place over time.
 - Improve memory consolidation through *spaced practice, sleep* (7-10 hours), *deep rest* like meditation or a nap after learning (10-30 min.), and *micro breaks* during practice (about 10 sec. every 2 min).
- **Spaced Practice/Distributed Practice:** Practicing in multiple sessions spaced throughout the day or distributed over weeks/months, which is generally better fewer longer sessions on a skill (**massed practice**).

Strategies checklist:

Only aim for 1-2 new strategies in a practice session to avoid cognitive overload.

- Focus
 - Goals: Write practice journal plan/reflection
 - Find your focus: Breath/stretch/exercise
 - Session duration: 25-90 minutes – Shorter for new/hard tasks
- Repetition
 - Break it down, build it up: slow/small chunks
 - Active retrieval
 - flash-cards/self quizzing for cognitive skills
 - Self-recording, mock performance, simulate anxiety for performance-oriented skills (speaking, music, sports, etc)
 - Interleaving/random ordered practice
 - Varied repetition, e.g. 3x3
- Rest
 - Spaced repetition: multiple sessions per day, or spaced over weeks/months

Practice journal example for Self-Regulated Learning

Before Practice:	After Practice/during breaks:
Date/time: What do I want to accomplish?	Why was I successful?
How will I do it?	What are the remaining challenges, how will I address them?

Resources

Books:

Learn Faster, Perform Better: A Musician's Guide to the Neuroscience of Practicing, Molly Gebrian (2024)

The Musical Brain: What Students, Teachers and Performers need to Know, Louis Svanrd (2023)

Music and the Brain for Musicians: Understanding the Research and Getting Involved, Laura Stambaugh (2022)

PracticeMind: The Complete Practice Model, Hans Jørgen Jensen and Oleksander Mycyk (2022)

The Musician's Mind: Teaching, Learning, and Performance in the Age of Brain Science. Lynn Holding (2020)

Peak: Secrets from the New Science of Expertise. Anders Ericsson (2016)

Make It Stick: The Science of Successful Learning. Peter Brown, Henry Roediger, Mark McDaniel (2014)

The Talent Code, Daniel Coyle (2009). Also, *The Little Book of Talent*

Digital:

[The Bulletproof Musician](#) by Noa Kageyama, PhD.

- Blog, podcast, newsletter, and courses available featuring research on performance psychology and strategies for practice/performance. Many interviews with top performers and researchers.

["How to Practice Effectively for Just About Anything"](#) TEDed video by Annie Bosler and Don Greene.

- Concise 5 minute summary of practice tips, great for a quick introduction or review

[Music and The Brain](#), Dr. Molly Gebrian. Videos and articles that cover many of the topics in *Learn Faster, Perform Better*

[University of Texas at Austin Center for Music Learning, Online Resources](#)

- Many research-based resources including intelligent music practice, video essays and interviews, embouchure demonstrations designed for students, disabilities information

The Huberman Lab

["Teach and Learn Better with a 'Neuroplasticity Super Protocol.'"](#)

["Toolkit for Sleep - Huberman Lab."](#)

Huberman Lab Podcast episode recommendations: Ep. 1 "How Your Brain Works and Changes," Ep. 2-3, Covering sleep, Ep. 6-8, Covering focus and learning, Ep. 20 "How to Learn Skills Faster"

[Tips for Better Sleep](#) – Center for Disease Control and Prevention

Guided deep rest:

[Yoga Nidra - Guided Meditation to Relax](#) | 10 minutes

[Non-Sleep Deep Rest \(NSDR\)](#): A Science Supported Tool for De-Stress and Relaxation | 23 minutes

Apps: Headspace, Reverie

[Guided Wim Hof Breathing](#)

[Box Breathing](#)

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