LAS VEGAS ACADEMY

The Art and Science of Learning

And the power of music to teach it.

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". . .optimizing instruction will require unintuitive innovations in how the conditions of instruction are structured."

-Drs. Bjork and Bjork

THE CAMBRIDGE HANDBOOK OF EXPERTISE AND EXPERT PERFORMANCE

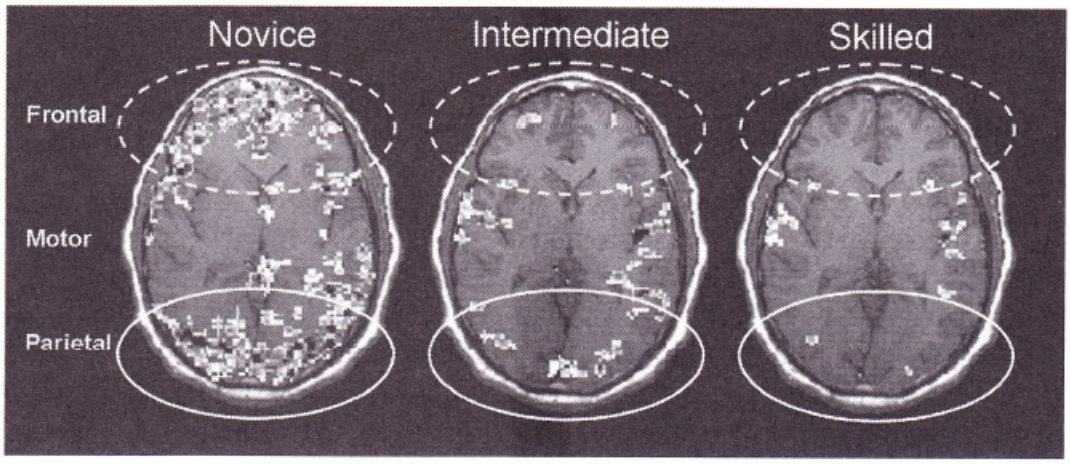


Figure 37.1. Activation of the brain, as a function of practice, in three periods of learning a motor tracking task. This is a maximum projection image, with white areas showing the activation of any cortical area either above or below the illustrated brain slice. The image is an axial (aerial) view of the head, where the top of the image corresponds to the front (nose) of the head and the bottom corresponds to the back of the head. The frontal areas (dashed ellipse) and parietal attention control areas (solid ellipse) show dramatic reductions in activation. The motor areas (middle of images) shares fairly preserved activation.

"Use learning to chase content, not content to chase learning."

What are Your Goals?

- College acceptance.
- You've made a wise choice to study music seriously and intently in preparation.
    - Don't be well rounded, be pointy.
    - What are they really looking for?
        - The generic process of skill acquisition and development.
- Does music really make you smarter?
    - Serious, long-term music study will.
- There are no B+'s in music.
    - Is 89% really good? Not if you are a music teacher.
    - Process vs. content.
- Academic grade stratification.
    - Gaming the system is not learning.
    - Those that figure out, or are taught, the unintuitive process of true learning are called gifted.
        - Music teaches this layered and multifaceted process, so let's take a look at what it is.

Learning Happens in Your Brain

- Neuroscience has improved dramatically over the last 30 years. The advent, and more importantly improvement, of fMRI (Functional Magnetic Resonance Imaging) as well as other diagnostic tools have pushed the field forward at an astonishing rate.
- How do you get to Carnegie Hall? It may be more of a joke than we realize.
    - What exactly is practice?
    - What is 'try'?
    - Will everyone do it?
- Everybody has some of this, the great teachers have most of it, but few know the terms and how these concepts are organized as part of a larger model. This is because the research has only recently been disseminated and those of us who teach music are, understandably, very far removed from the field of cognitive neuroscience.
- So, if skill development is a process, then what qualities need to be present for it to occur? And guess what. . .

Talent is Overrated

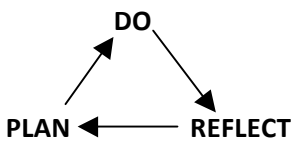
- Consider how important, or not, this concept is to you.
- I know this may sound unusual to some of you. However, I ask you to read, "Talent is Overrated," consider the evidence, consider your teaching and see if you come to the same conclusion, as this is very important. As Colvin writes, "If it turns out that we're all wrong about talent, and I will offer a lot more evidence that we are, that's a big problem. If we believe that people without a particular natural talent for some activity will never be very good at it, or at least will never be competitive with those who possess that talent, then we'll direct them away from that activity. We'll tell them they shouldn't even think about it. We'll steer our kids away

from particular studies whether they're art, tennis, economics or Chinese because we think we've seen signs that they have no talent in those realms . . . most insidiously, in our own lives, we will try something new, and finding that it isn't easy for us conclude that we have no talent for it, and so we never pursue it. Thus, our views about talent, which are extremely deeply held, are extraordinarily important for the future of our lives, our children's lives, our companies and the people in them. Understanding the reality of talent is worth a great deal."

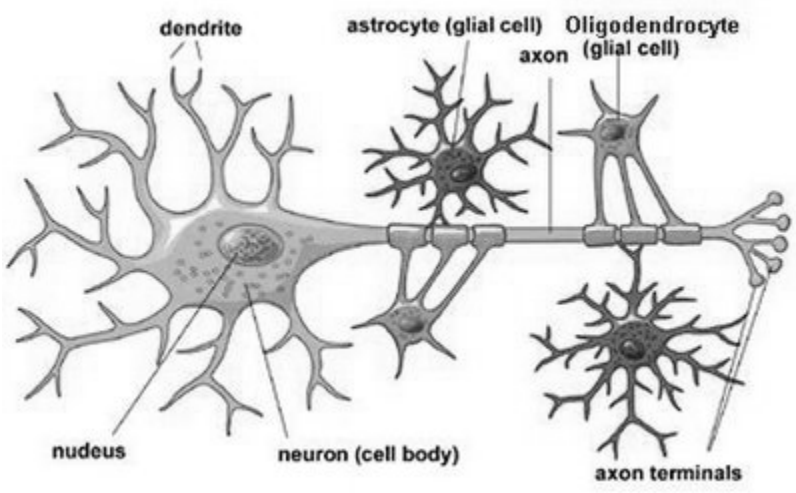
- Mozart and Tiger Woods explained (Colvin 25-30).
    - Children of motivated master teachers.
    - Put in thousands of hours of guided practice starting at a very early age.
    - There is no magic here other than the unusually young age they started focused, guided, serious work with excellent coaching.
- James Flynn and his population IQ research. IQ , short of developmental disability, does not seem to matter.
    - High achieving populations were studied and their IQ scores were similar to lesser achieving populations. What is more is that the high acheiving populations studied actually show up slightly lower on average, though they do show up more at both the upper and lower extremes (Baumeister and Tierney 195). Many elite jobs held by the high achievers hold a minimum threshold of an IQ of 110, while those in lower achieving populations that threshold is 103. (Baumeister and Tierney 195).
    - How can IQ across populations reliably rise whenever an area becomes industrialized if it is a fixed factor?
- Are kids encouraged because they are talented or talented because they are encouraged?
- 10 years 10,000 hours to become world class in any complex domain, and that number is rising.
- The point is not to do 10 years 10,000, but to take the same steps as one would if one were to follow that process however many hours they may work to improve.
- And that process is. . .

Deliberate Practice

- Effortful activity generating constant feedback that guides the refinement of that activity over and over and over. This includes, among other things, task analysis, goal setting, strategy choice, self-monitoring, self-evaluations, and adaptations. (Zimmerman)
- The term was first coined in the 1993 paper, "The Role of Deliberate Practice in the Acquisition of Expert Performance," published in *Psychological Review* by the leading researcher in skill development K. Anders Ericsson and some of his colleagues and (Ericsson, Krampke, and Tesch-Romer).
- The Royal Conservatory and iSCORE (if you teach, check it out, it is free). I borrowed this very basic model of deliberate practice from there:



- Training your brain - Everything we do or think is a neural representation in the brain. Neurons talking to other neurons. We have billions of neurons and each has about 10,000 dendrites (Greek for branches) for receiving signals (in most cases). These signals are sent by axons (1 per neuron) which has its own set of branches at the end called axonal arborization each of which has its own 'transmission' terminal. Each branch is capable of communicating with other neurons. Such communications are neural networks.
    - Synapses are gaps between axons and dendrites across which action potentials (electrochemical nerve impulses) travel.
    - Action potentials travel the axon which is punctuated by little gaps called the nodes of Ranvier.
    - Just as with the electricity we use, if the conduit is not insulated then the action potential leaks out and the signal is not as powerful (does not travel as fast). The more insulated the axon the faster it travels.
    - There are cells attached to axons called oligodendrocytes. Each time an action potential travels through an axon oligodendrocytes are activated to produce an insulating substance called myelin which forms a covering known as the myelin sheath (Araque and Navarrete 1588; Wake, Lee, and Fields 1649-1651).
        - As an example; multiple sclerosis is a breakdown of myelin along pathways governing physical movement. The action potentials are leaking out and the signals can't get to the appropriate places. If a loss of myelin leads to loss of control (speed, accuracy) then what do you think extra myelin might do?



    - The more insulated the axon the faster the action potential travels (i.e. faster cognition, finger movements, etc.). That is why thoughtful repetition over and over creates solid technical foundation and speed *in all domains*.
    - Learning; slow accurate movements/thoughts create accurate neural representations ready for myelination.
    - Speed and facility comes from thoughtful repetition not trying to play fast. When we make mistakes playing fast we are myelinating different neural connections that represent the mistake. Practicing mistakes leads to playing mistakes. Activate the right oligodendrocytes instead of trying to play fast.
    - Violinists left hand representations, London cab drivers Hippocampi.

    - Eventually (it takes some time) enough myelin accumulates for a process called saltatory conduction to take place. This change between the processes has been called the "Lillie Transition" (Young, Castelfranco, and Hartline 533-546). In this process the action potential leaps across the axon at far greater speeds. Specifically it originates on both ends of the axon and meets in the middle instead of linear conduction from one end to the other.
        - Interestingly during the onset of the "Lillie Transition" action potential velocity decreases before the significant increase of saltatory conduction. This may explain plateaus in learning and why sometimes after working a lot on something we can seem to regress. Do not give up, when saltatory conduction occurs you will be much better.
- Cognitive researchers have developed an inclusive model for the Plan-Do-Reflect model calling the three phases Forethought-Performance-Self Reflection, as well as addressing other environmental and psychological factors surrounding the paradigm of skill development (Zimmerman 707-715, 705-719).
    - Record yourself.
    - Keep a journal.
- One characteristic of deliberate practice is that it is not that it is not inherently enjoyable. (Ericsson, Krampke, and Tesch-Romer 368).
    - It is work. Whereas physical work is taxing on the body, this type of intellectual work is taxing on the brain.
    - This state of difficulty is the 'sweet spot of learning'. I, half-jokingly, have called this the 'burn of learning' or the blearn – Feel the Blearn! Of course I later found it has a real name. Two UCLA researchers have described this condition as, "Desirable Difficulty," (Bjork and Bjork 58). Writing about the current state of education professor Bjork states, "optimizing instruction will require unintuitive innovations in how the conditions of instruction are structured (ibid 56)." Or to put it colloquially – learning is not what many people think that it is.
    - During this process the brain is working through confusion to find the perfect efficiency point for that task. This occurrence has been called a process efficiency change. Do you think we only use 10% of our brains and that it would be good if we used more? Not so much. (Hill and Schneider)
- Recovery periods and sleep.
    - Studies show that high achievers take more naps (Ericsson, Krampke, and Tesch-Romer 376-377).
        - Sleep is where memory is consolidated.
        - Recently it has been discovered that a 'sanitation system' called Metabolite Clearance that is not active during waking hours flushes out waste in the brain during sleep (Xie et al.).
        - Leisure activity (Ericsson, Krampke, and Tesch-Romer 377).
    - Recovery Periods.
        - Engaging in deliberate practice is intellectually taxing (mental fatigue) and breaks need to be taken when serious confusion occurs.
        - Current research shows that world class experts cannot engage in more than 4-5 hours of deliberate practice daily (Ericsson 699). 90 continuous minutes of deliberate practice at a time seems to be the limit. Consider this if you want to introduce your students to this concept. Generally 45 minutes on and 15

minutes off works for high level study. For beginners start with five minutes. This is far better than 15 minutes of unfocused practice.
        - When true mental confusion occurs, however long that takes, a recovery period is necessary.
        - Focus is like a muscle. Those new to this type of intense concentration will only be able to lift a little intellectual weight until exhaustion. Start with little bits at a time, it will grow.
    - The amount of time one can engage in deliberate practice without a break (recovery period) increases as one exercises it like a muscle, but do not push through genuine mental fatigue. Take a break and do something that takes little intellectual investment (eat, watch TV, text).
- Repetition – I can't stress enough the importance of massive amounts of <u>thoughtful</u> repetition (did I do it right? If not how do I fix it? If I don't know jot it down and ask my teacher, etc.) tens of thousands of times in the pursuit of effortless enjoyable music performance. Playing is fun, practicing is work; the more work you'll do the more fun you'll have.
    - 100 rep scheme.
    - Getting something 'right' is on only the *first* step. Then repetition can begin with an eye for anything that can be improved for each subsequent repetition. This process can take days, weeks, or months depending on the challenge. We'll address the psychology of the attitude and patience needed for this in the final section.
    - It is fine to make some mistakes, but if you want to learn you must correct it the next rep every time. Pay attention.
    - When you have given a formal performance of a piece you are ready to begin learning it.
    - How most kids do homework is not deliberate practice. No wonder classes seem hard. Kids who do all the assignments *as assigned when assigned* in their homework do not need to study for tests to get A's (rich mental model). I have known plenty of honors students who do this and it has everything to do with how they prepare not 'giftedness'.
- Interestingly there is a way to supercharge the brain's learning potential when doing reps. . .

<u>Strategy Changes</u>

- The Power Law of Practice (Newell, Allen, and Rosenbloom) – What many of us call the '80/20 rule'.
- "The Strategy Specific Nature of Improvement: The Power Law Applies by Strategy in Task," Delaney et al.
- Don't just try these once or twice. Try one or a few and rep them many times in each practice for a week. Don't give up on new ideas too soon. Some of these will work better for you in certain situations. They all work, and you will also begin to find after using them for a while that you will be able to identify the strategy needed for specific circumstances when necessary.
- Heitor Villa-Lobos Etude 7 to explain these concepts:
    - Dots and reverse.
    - Note grouping (3-7, two is dots) with and without a metronome.
    - Pausing before string crossings.
    - Sequences.
    - Add a note.
    - RH only.

    - Planting.
    - Super slow practice.
    - Tremolo scale runs and what I specifically did with i-m-a.
    - Changing strong beat.
- HVL Etude 6; 'tremolo chords' for position shifting.
- HVL Etude 2 for these concepts.
    - Note grouping starting at different points.
    - Continuous note grouping.
    - Duple in triple and triple in duple.
    - Making up rhythms.
    - Groups of 4 and 8 forward and backward.
    - Adding accents.
    - Opposite fingering/bowing.
    - And yes, 100 straight reps – what I spoke to some of the competitors at the festival about – do you keep track of how many reps you do on things or is it just random?
- Now here is one of the most powerful ones: Visualization. It is very, very hard the first time, thus it is hard to get students to do it. It does get easier, but only if it is tried over and over.
- Three times ten and Interleaving.
    - Smith, Glenberg, and Bjork found that ". . . studying the same material in two different rooms rather than twice in the same room leads to increased recall of that material." (Cited in Bjork 58)
- Eyes closed practice.
- In general it seems the harder it is to do for the individual the better it works. Feel the Blearn!
- Warm up with isolated sections super slow. This does not count as practice on those things.
- HVL Etude 10: Constant vigilance (constantly evaluating and adjusting). Breaking things down to the smallest movement that needs work and repping even if it means changing what you are doing after already working for a while.

Strategy change explanations

Dots and Reverse Dots (with and without metronome): If this is not obvious to you see the musical examples herein. Reverse dot is a term I made up until someone brought to my attention that it is a Scotch snap. I should have paid more attention when studying Lully overtures in grad school!

Note Grouping: Playing a set number of notes then stopping and holding the last note for at least twice the value you had been previously playing. I've found groups of 3's (dots are twos) through 7's are enough. For an added challenge start your repetition with 1 or 2 or however many less notes than your target grouping. Now the gaps will be in different places challenging you. For example; after doing some reps with groups of 3 try playing the first note, hold that longer, then do groups of three. Next time play the first two notes and begin groups of 3, etc.

Continuous Grouping: This is a term I use when individual units that are practiced by themselves with groupings are played as part of the larger whole with the same grouping. The example herein is from Villa-Lobos' Etude 2. In this piece each measure (a full arpeggio) can and should be practiced on their own with all sorts of strategy changes. However, when playing the whole piece and applying groupings the location of the long notes will shift each measure giving an added challenge. Take the repeats in the

piece or not, start with less notes than the target grouping as described above. All of these displace the long notes and challenge and focus the brain.

Pausing Before String Crossings: This is obvious. Sometimes this is exactly where the issue is and everything else is fine. Doing this addresses that problem.

Sequences: Rep the passage with 3 note sequences, 4 note, 5 note, whatever.

Add A Note: Play the first note, then the first two, then 1-2-3, 1-2-3-4, 1-2-3-4-5, etc. This is a very powerful tool that is underused because it takes so long to get through. I generally count one time through this exercise, if the passage is not really short, as 10 reps.

Right Hand Only: Self-explanatory. Lefty guitarists adjust as necessary. For bowed strings this obviously only means the bow action on the open strings without the left hand.

Planting: I am not sure how bowed players would do this, but they might want to try it and see if it could work for them perhaps by resting the bow at the start of the next note as quickly as possible, before the first note's duration is over without concern for legato. For guitarists this means playing staccato and using the right hand finger for the next note to quickly plant it on the string. When crossing strings don't worry about staccato, just get the next finger on the string as quickly as possible in readiness for the next note. This trains the fingers to return to the string as quickly as possible helping to train speed. For arpeggios, plant all fingers at once and 'snap' them back as you play the notes.

Make up Rhythms: As you can see note groupings are just specific rhythms applied to your isolated repetitions. Make up your own rhythms, make them more than a measure long, try all sorts of things like triplets to sixteenth notes to a double dotted rhythm. Write down some random rhythms and try them. You can use examples from rhythm teaching texts as well. Each time you have to navigate something new the brain focuses and learns.

Duple in triple and triple in duple: Set your metronome and play straight sixteenth notes as triplets. Take something in 6/8 or in triplets and play four notes to the beat.

Groups of 4 and 8 forward and backward: Play the first four notes of a passage you are trying to master forward and backward (or just forward). Do this at least 4x. Then do the same with the next four. Then do it with the first 8. Continue through the passage like this. A variation would be to do this starting with the first note, then the second, then the third, etc. This would take a long time, but using it sparingly in your rep scheme can be beneficial. Make sure to keep the fingering or bowing true to what it normally is both forward and backward.

Adding Accents: Add accents deliberatively to whatever passage you are trying to master. Really emphasize the accent. Do it on the odd note, the even notes, every third, fourth, whatever note. Try alternating every third then fourth. This is harder than you may think and really forces concentration.

Opposite Right Hand Fingering or Bowing: This is self-explanatory and I only use it sparingly for the obvious reason that there is a fear of undoing a fingering one had to work hard to learn in the first place. I've found this not to be the case, but again, I use it sparingly. It can be effective.

Super Slow: This is obvious, but rarely used. The reason is the self-control it takes to play something that you've got going at a much higher tempo at a painstakingly slow tempo. To stay with that all the way through for many reps can be mentally taxing. This exercise allows one to put the passage 'under the microscope' and magnify small details that may be overlooked in other types of practice.

And Yes, 100 Reps Slowly and Accurately in Time as Written: Some days it is just good to rep as written and slowly enough to be entirely accurate. It works for myelination and can be a welcome change from all of the other strategy changes. In any case it allows one to view the work in the context it will be performed.

Position shifting: Here the idea is to gradually decrease the time between leaving one position and arriving at another in a *systematic way*. Begin by playing the isolated position shift (after it has been generally learned) as slowly as necessary to play each note or chord perfectly. Consider this a quarter note rhythm. Do not worry about having a large gap in sound as you move. The gap does not matter, the accuracy of the shift does (accurate neural representation). After many repetitions (try 25, but no less than 10) play the first note or chord *at the same exact tempo* but play it twice as eighth notes. You have just cut in half the amount of time you spent moving during the shift (the silent space). Again, do not worry about any gap in sound when you shift. As long as you play the rhythms correctly use as much time as you've got to get to the next position *perfectly*. Then play the first in triplets, then sixteenths, then quintuplets, then sextuplets. You get the idea.

For bowed string players tremolo bowing will probably achieve this. For guitarists and pianists it will become too technically difficult to play repeated fingers (such as in block chords) at the smaller note values. For these use arpeggios in the rhythm you desire to apply.

Visualization: The ability to see in your mind's eye, away from the instrument, what your left, right, or both hands (depending on the situation) are supposed to do.

Eyes Closed Practice: This is obvious. It sharpens the sense of proprioception – the brains sense of how limbs are oriented in space. Try it, you may be surprised at how well you can do it the first time.

Three times ten: In, "The Little Book of Talent," Coyle references research by Dr. Douglas Fields at the National Institutes of Health. "He discovered that our brains make stronger connections when they're stimulated three times with a rest period of ten minutes between." Work on something, do something else for ten minutes, work on it again and repeat.

Interleaving: Is essentially what we are doing with strategy changes. This can be applied to larger structures in practice. When learning multiple pieces of music work on one, then go to another, back to the first, then to another, back to the first, etc. Applied to the larger practice structure work on something, then go to something completely different (For instance, moving from learning lines for a play to answering emails for a while) then return to the original task several times a day in this manner.

Sandwich Technique: Do something the right way, then the wrong way, then the right way again.

- This list is not comprehensive. Be open to all possibilities and keep your ears open at masterclasses and workshops.
- So, if all of the previous turns out to be true then what stands in the way of anyone, really everyone, being really great at whatever they choose? It turns out it is. . .

Self-Control

- Also called executive function by neuroscientists and self-regulation by psychologists. Many people call it willpower. This refers to the basic ability to choose "should" over "want".
- This is wired up in the pre-frontal cortex of the brain.
    - The PFC is very underdeveloped in the young and will not finish developing until the age of 25 (ever wonder why your insurance goes down, or you can't rent a car until you are 25?).
    - Self-control is learned just like instrumental skills – we engage in the behavior (create the neural network) and then reinforce it by repeating it over and over (myelination).
    - Because this control of impulse is unpleasant for a young person, and indeed many people, many times they have to be taught, and sometimes structured into these behaviors. It takes a good deal of self-control on the part of parents and teachers to make children do things that appear to make the child uncomfortable in the interest of making them self-reliant adults. That is one of the greatest acts of love we can do for a child: not praising them effusively for doing nothing or being their friend.
    - We have a limited amount of this resource and it while it is governed by the PFC it is fueled by glucose. (Baumeister and Tierney)
    - These glucose fueled neural networks are *generic willpower*, that is to say that they can be used to make yourself do any number of things you may not feel like doing.
- Self-esteem movement of the late 80's
    - Studies show self-esteem correlates with good grades (self-control) (ibid)
    - Educators and others believe that praising children for nothing (everyone gets a first place trophy!) will impart self-esteem thus facilitating better grades.
    - Researchers ran with it, with one in 1994 praising it. It made news, but what did not make news was the end of his report in which he said it was "disappointing" to see the lack of really solid evidence "to date". (ibid)
    - Does anyone see the problem? What is the causal factor? Why believe that self-esteem leads to good grades *when it seems obvious that good grades lead to self-esteem,* and that is indeed what later research found and it seems this movement is coming to an end. But not after a generation was raised to believe they are superstars for doing nothing and expect to be treated that way. They have underdeveloped pre-frontal cortices and many of them are living with their parents as adults *with no intention of accomplishing anything else.* They may expect their parents to treat them a certain way, but that is not going to work with society at large.
    - Google, "You Can do Anything," a Saturday Night Live sketch for a hilarious view of this phenomenon. After you laugh you may cry when you realize how accurate it really is.
- Creating motivation without failure.
    - This world does not exist, however there is much that can be done to reduce the negative and produce lasting positive habit patterns.

Habit Pattern Development

- Practicing, and doing work properly, can be developed incrementally into a habit. (Duhig)
- 30 days to build a solid habit. (Coyle)
    - Let's address practice.
- We are working on two things here: *amount* of work and *type* of work (as discussed earlier). Both can be trained simultaneously. Both are like muscles and can be developed as one would develop a muscle. Start with a little resistance and increase as strength increases.
    1. Amount of practice.
    2. Find 'sacred' practice time.
        - Getting started, assessing time (see attached time inventory sheet), quit without guilt. Identify the smallest details and begin building from there.
        - Start with 10 minutes 5 days a week. After two weeks it will begin to become a habit. That is to say that the act of getting started and going through the first 10 minutes is like tying your shoes. It may not be pleasant, but it is just something you do automatically without any significant discomfort.
        - Go to 15-20 for the next two weeks. The student can quit without guilt at 15. All I ask is that they *try* to push through for another minute. If not right away then eventually they will go past that without even noticing.
    3. Type of practice. Focus; what it is and how to train it
        - What many people think is focus and work toward improvement is not. Thus significant improvement is rare. Getting work off of one's desk is much different than getting the work done right which is the essential concept of skill development.
        - Attention to every detail, the smaller the better – build up from there.
        - Always endeavor to not give answers, ask questions to let students find the answers. This is harder than just giving information and is a mark of master teaching. If you are new to doing this it will be a bit confusing and mentally uncomfortable. You are going through desirable difficulty (Feel the Blearn!), don't abandon it, embrace it.
        - Meta coaching.
        - 10x perfect game.
        - What if. . .
        - I'm going to ask you to play and listen to yourself and everyone else in your group. When you we finish this section be prepared to speak for 2-3 minutes about every aspect of everyone's performance. This brings the student to acute awareness paying attention to as many details as possible in order to fill the time (I usually start by becoming totally silent for 30 seconds. It seems like an eternity and then I tell them I'll want them to fill at least four times that amount with their critique). I do not make them speak, but they always perform better on that attempt and learn what good focus is.

Mindset

- Researcher Carol Dweck and growth vs. fixed mindset.
    - Her three decades plus of research has addressed why, to put it colloquially, most of us can't get out of our own way when it comes to learning.
    - See attached handout
    - Praise the work, not the 'talent'. This is simply the truth and not a manufactured motivational strategy.
    - Perseverance/patience.
        - Setting goals is good, setting deadlines may not be.
- Don't believe the road signs that nature puts up along your quest for skill development.
    - Research shows that there is no fast track to improvement. Level of accomplishment always correlates with amount of practice.
    - Don't measure yourself against where you want to be, measure yourself against where you have been and how you have improved over the course of months, at least.
    - Setting goals is great, setting deadlines may not be.
    - Adults thinking they should learn music, or other brand new concepts, as they do in science and math and reading (All things they've had a massive amount of practice in over the years). They will not be able to assimilate a brand new skill like playing an instrument the way they acquire higher level knowledge in those fields.
    - Don't compare yourself to others by age. Compare by hours put in and, more specifically, the type of work done during those hours.
    - How progress is measured. Days vs. weeks or months. The long arc of performance development.
- Perseverance and patience.
- Skill acquisition is set up backward to what most people perceive it should be. Many perceive that because something is hard at first and little progress is made with great effort that they do not have talent. In reality it is pushing through this initial phase and getting to a level of competence in which higher level accomplishment can be trained *is itself* 'talent'. Many tend to think that being really good at something right away (which never happens, the research is overwhelming on this) reveals a 'talent' and then hard work to reach one's potential can begin. This is part of the misunderstanding of talent.
- Accountability/assessment.
    - ASTA article 8/2012. Christopher Selby. "10 Strategies for Developing a Strong Student Practice Ethic"

Real Accomplishment as Motivator

- We cannot get there without pushing through the initial learning (Blearn, motivation, allocation of time, acquisition of instruction, etc.) just like your muscles would be sore and you would hurt for a while if you started working out, the brain will 'hurt' as one engages in meaningful skill acquisition. It is a myth that any given individual begins learning a skill *with no previous exposure or participation in that domain* significantly faster than anyone else.
- Development and Adaptation of Expertise: The Role of Self-Regulatory Processes and Beliefs by Barry J. Zimmerman.

    - Using several domains this research showed that genuinely getting better (good) at something through proper training created a genuine interest in participating in *and improving* in a given domain. "Because successful learners view strategic processes as effective means to an end, they are motivated more by the attraction of positive outcomes of these processes than by the fear of adverse outcomes (Pintrich 2000),"
    - This is the source of real self-esteem and efficacy.
    - Passion can be developed and nurtured. Could all passion for life pursuits come from here?
- Flow (Csikszentmihalyi)
    - This researcher has devoted his career to explaining that state of losing ourselves in a challenge, time melting off the clock, and much being accomplished. This is what some people refer to as the 'zone'.
    - It is a real psychological phenomenon, and it appears that this is the highest state of efficiency at which we can function.
    - This occurs when developed ability meets a higher challenge. This is the most efficient way to coach and design lessons.
        - When it happens write it down!!
        - Keep asking questions and redirecting focus – every second (though don't forget about the importance of recovery periods. A little silliness for a minute will usually do the trick. After some intense work I might say, "Now would you please recite the Gettysburg Address . . . backwards . . . and in Latin." Clear the mind, reset, and begin again).
    - He makes a distinction between enjoyment (when the brain is stimulated and we are in flow) and pleasure (lying on the beach, watching TV, etc.).
    - This is the state we all strive for, but we do not know that as beginners. This applies to everything we do (general learning theory).

I could talk about this all day. If you have any questions, comments, whatever please email or visit my website www.ggoodhart.com.

". . .learning how to learn is the ultimate survival tool."

-Drs. Bjork and Bjork

Recommended Reading

Start with the first three, they are the jumping off point for everything you need to know and research.

Talent is Overrated: What *Really* Separates World-Class Performers from Everybody Else
Geoff Colvin

For my money the single best reference on the nuanced overarching idea of talent, how we wrongly perceive it, and how these implications inform teaching and learning. Unlike Outliers Colvin describes the things that you need to do to be successful. He also points to research you can review on your own. It is scholarly, but also it is an entertaining read.

Willpower: Rediscovering the Greatest Human Strength
Baumeister and Tierny

These researchers have done some amazing work on what happens in the brain with regard to self control and how it is been trained. They also cite other relevant research and weave together a compelling take on how discipline is learned. Another scholarly entertaining read. This, TIO, and Mindset are the fundamental must-reads of this list.

Mindset: The New Psychology of Success
Carol Dweck

Professor Dweck has spent over three decades researching the *psychology* of learning. Since learning is different than what most people think it is things like failure and mistakes seem to indicate a lack of ability to them. In an attempt to appear competent they cover this by not participating in learning. It is, of course, more complex than that and her work is fascinating. You will recognize it all around you and likely, as did I, in yourself to some extent.

The Little Book of Talent
Daniel Coyle

An owner's manual containing specific things great coaches and teachers use to maximize skill development. I am amazed that an investigative journalist could figure this out so well. I thought one would have to do thousands of hours of teaching. This is an invaluable resource.

The Talent Code: Greatness isn't born. It's grown. Here's how.
Daniel Coyle

Mr. Coyle elucidates an exciting theory at the time (2009), and proposes that all human improvement can be traced to a single biological process. This process is myelination. Myelin is an insulating sheath around axons in the brain. The more insulation the faster the nerve impulse travels. Thus faster cognition, motor skills, etc.

Since 2009 important research has been published showing evidence that the underpinning process Mr. Coyle writes about is indeed accurate. As you read it keep in mind that starting in 2011 it has been shown scientifically that sending an impulse through an axon does cause an oligodendrocyte to produce myelin.

The Genius in All of Us: New Insights into Genetics, Talent and IQ
David Shenk

Another take on the same theme. He identifies a new paradigm for nature vs. nurture (nature *times* nurture) and explains how much of what we think about genetics is not correct. This is partly an introduction to epigenetics which is a very active field now.

The Power of Habit: Why We do What We do in Life and Business
Charles Duhigg

How hard is self control really? It can be developed into a habit. This is a well-researched, practical and interesting look into how our brains ingrain and act on habits and what we can do about them for ourselves and in teaching others.

Outliers: The Story of Success
Malcom Gladwell

Gladwell uses good storytelling to show how the environment we create influences success and that it is not innately limited. It is probably the most interesting read, but the least scientific, and he does not explain *how* the process works. I describe it as *Entertainment Tonight* to Colvin's *60 Minutes.* In any case it is a worthwhile read. The information on Canadian hockey players and how that speaks to the talent myth is worth the price alone

Good Business Leadership: Flow, and the Making of Meaning.
Mihaly Csikszentmihalyi

Csikszentmihalyi (pronounced 'Csikszentmihalyi') first described the concept of flow in the late 1990's. This is the state experienced when time melts away as you are working on a task. You've worked hard, done a lot, but it feels like hours have passed in moments. In Good Business, one of his several books on flow, he describes the concept on its own and relates to business structures. In any case the application of flow in any group setting has benefit and this book is quite illuminating. Don't dismiss it upon first read, it took a while for this to sink in, but when it did it had a profound effect.

The Willpower Instinct: How Self-Control Works, Why It Matters, and What You Can Do To Get More of It
Kelly McGonigal

A great companion to the Baumeister/Tierny book. Suggests exercises you can try for a week at a time and looks at some of the issues from a different angle.

Addendum:

The Cambridge Handbook of Expertise and Expert Performance
Edited by K. Anders Ericsson et a.
Ericsson has established himself and his team as the leading research authority on skill acquisition and expertise over the last 30 years. This is not a book per se but a collection of peer reviewed studies on all aspects of performance development including how it is done in specific fields, how motivation works, the specific process of skill acquisition (deliberate practice) and more. It is not a light read, very clinical, and at 900+ pages I myself have not read it all. I have read much of it and its organization makes it easy to pick which studies one wishes to read (I have found no need as of yet to read how one becomes an expert in software design, for instance).

The Role of Deliberate Practice in the Acquisition of Expert Performance. 1993
Anders Ericsson et al.
The seminal paper that first described the path to world class performance. It is available online. He updated it in the Cambridge Handbook as, "The Influence of Experience and Deliberate Practice on the Development of Superior Expert Performance," but what he wrote in 1993 is still accurate. If you like the 1993 paper then spend the $60 on the book.

The Strategy Specific Nature of Improvement: The Power Law Applies by Strategy in Task
Delaney et al.
The paper that first studied and identified the efficacy of strategy changes.

Whether you think you can, or you think you can't – you're right.

-attributed to Henry Ford

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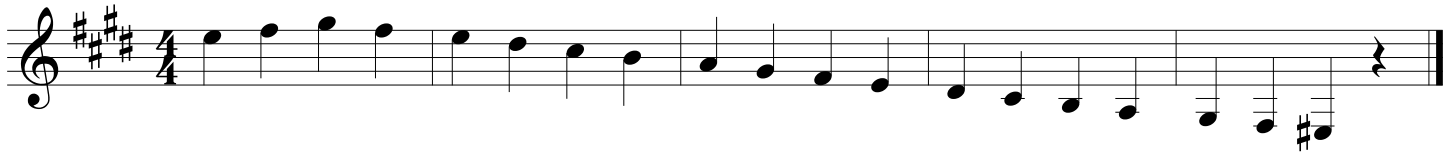
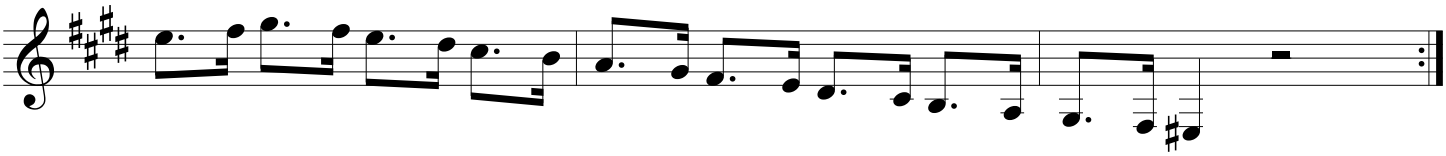
Strategy Shifts

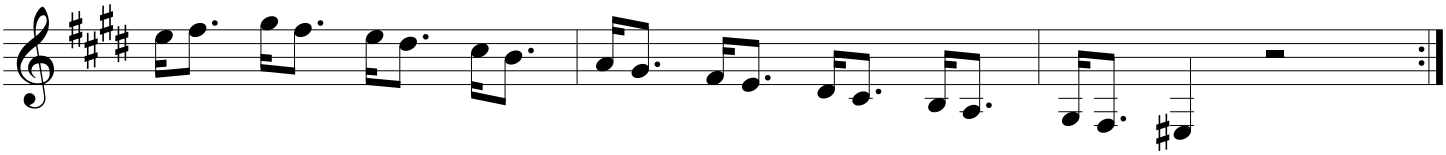
Opening of Villa-Lobos Etude 7 (originally in 16th notes, pick up on the and of 4)



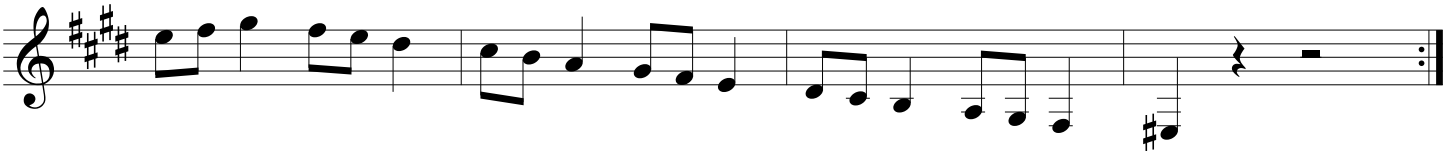
Dotted Rhythms



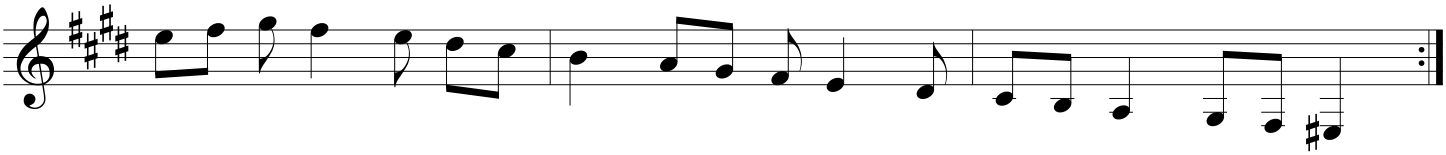
Reverse Dots



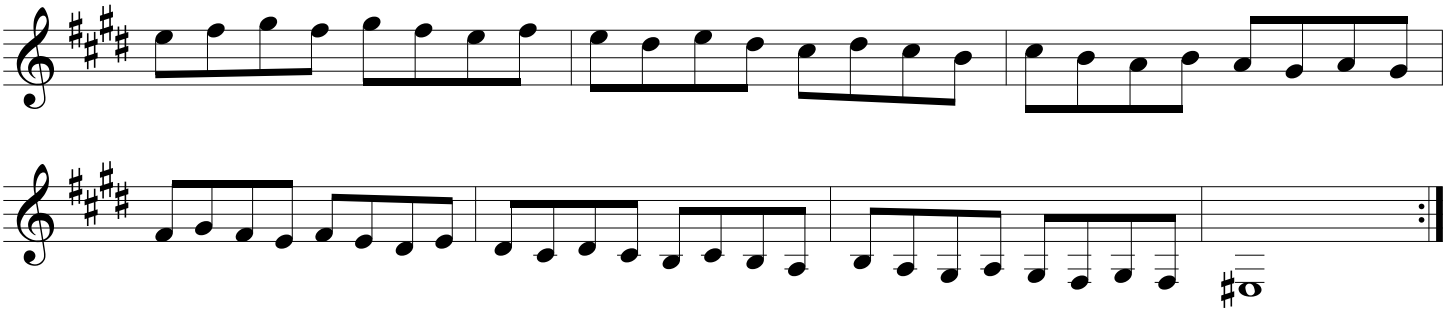
Note Grouping 3's



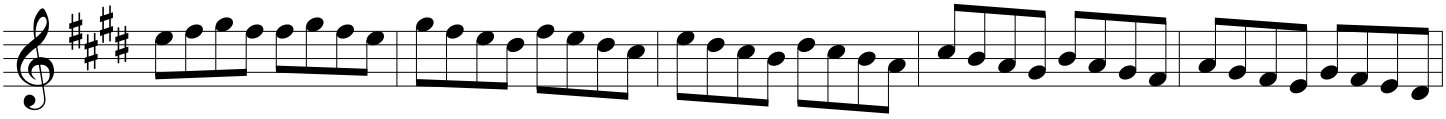
Note Grouping 4's (etc.)

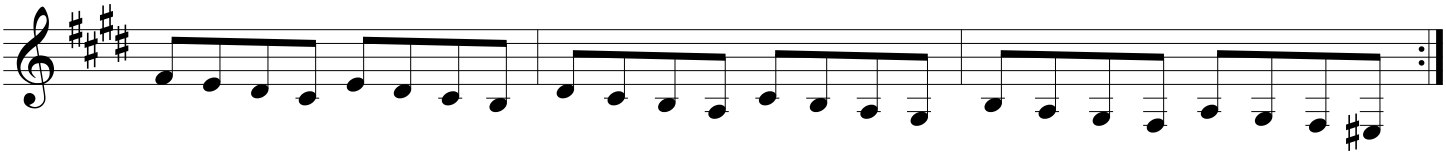


3 Note Sequence

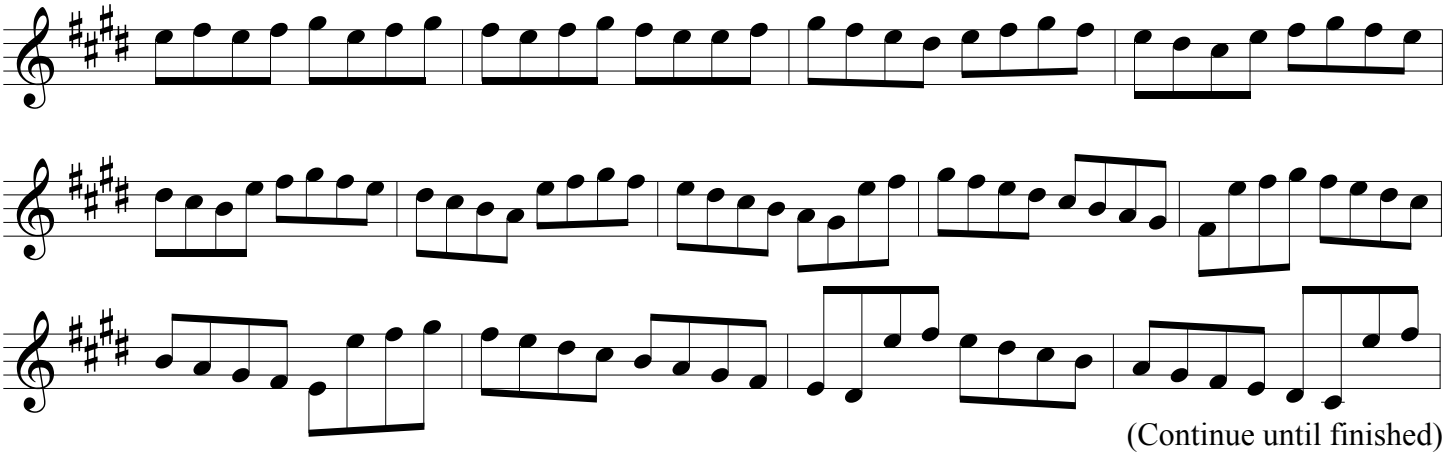


4 Note Sequence (etc.)



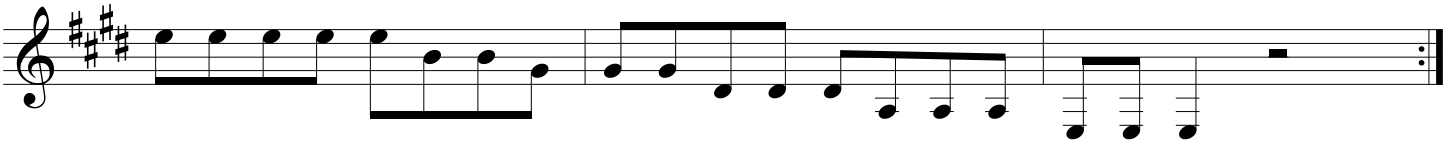


Add a Note (Feel free to pause before each iteration if you wish)

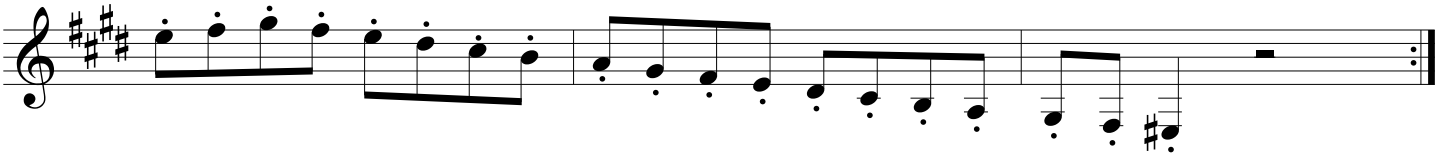


(Continue until finished)

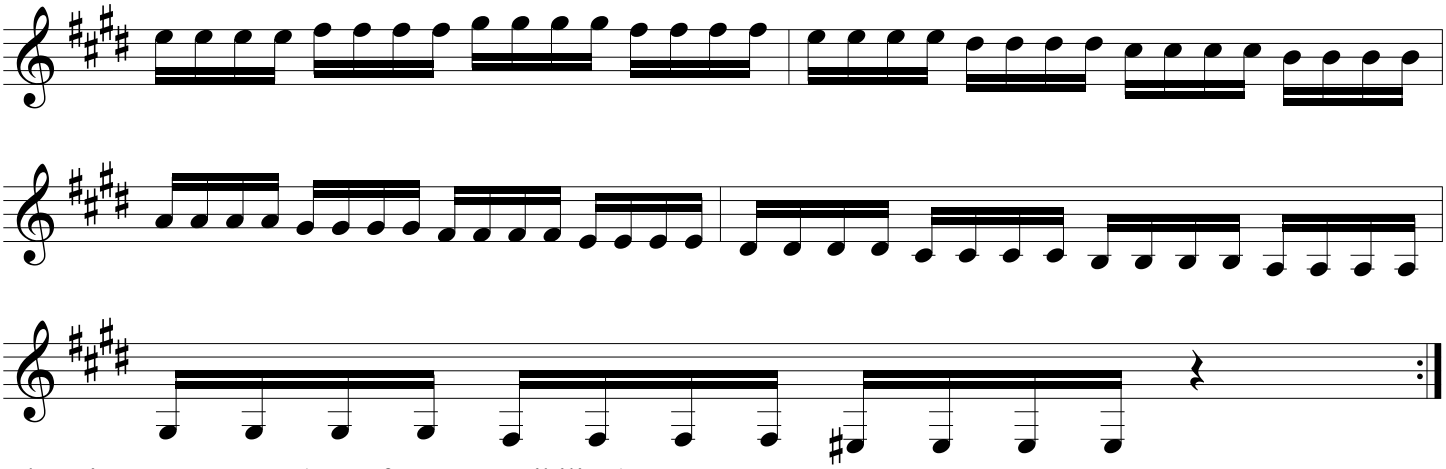
Right Hand Only



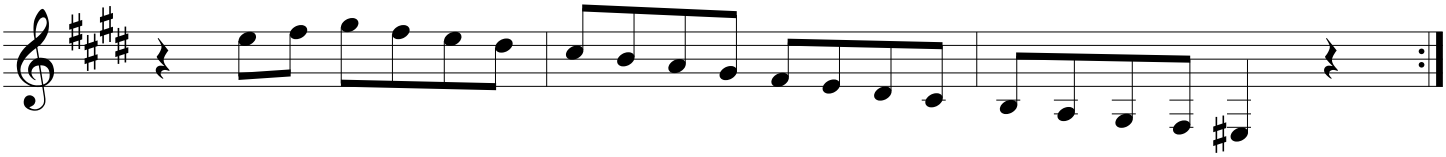
Planting (when crossing strings bring the finger to the new note instead of back to the string for the staccato)



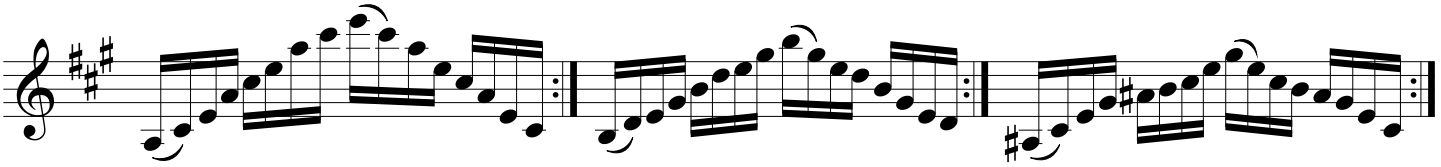
Tremolo Scale Runs



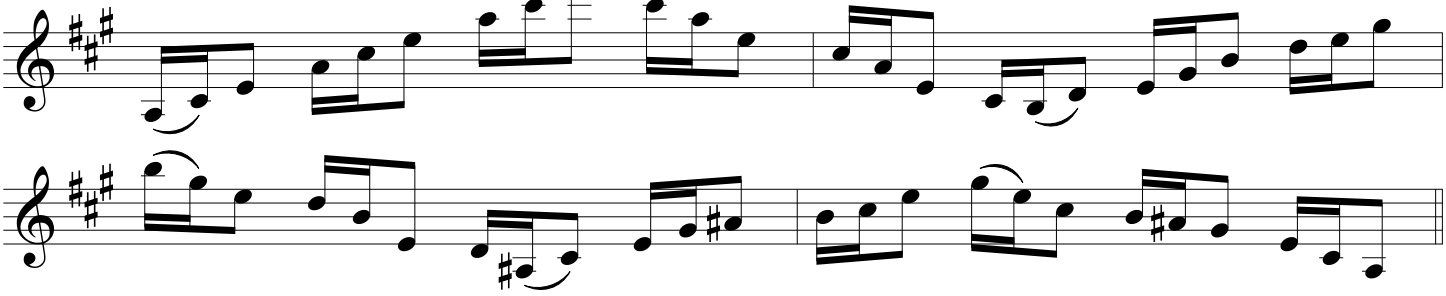
Changing Strong Beat (one of many possibilites)



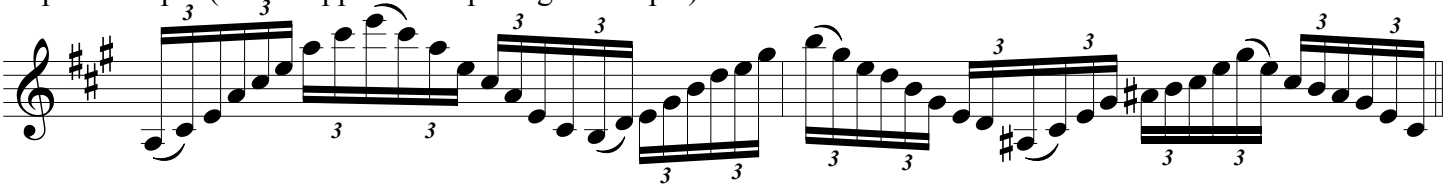
First two measures of HVL Etude 2



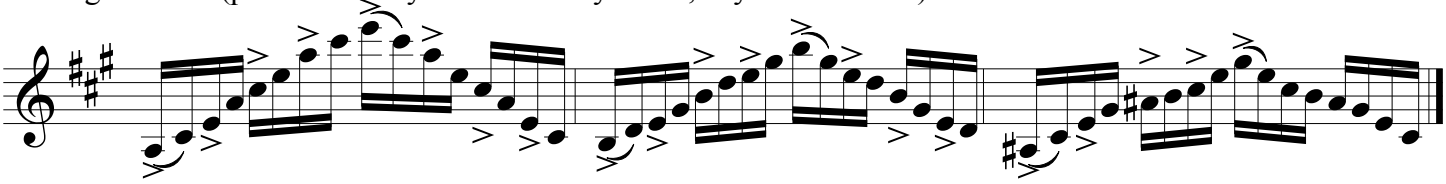
Continous note grouping using 3's



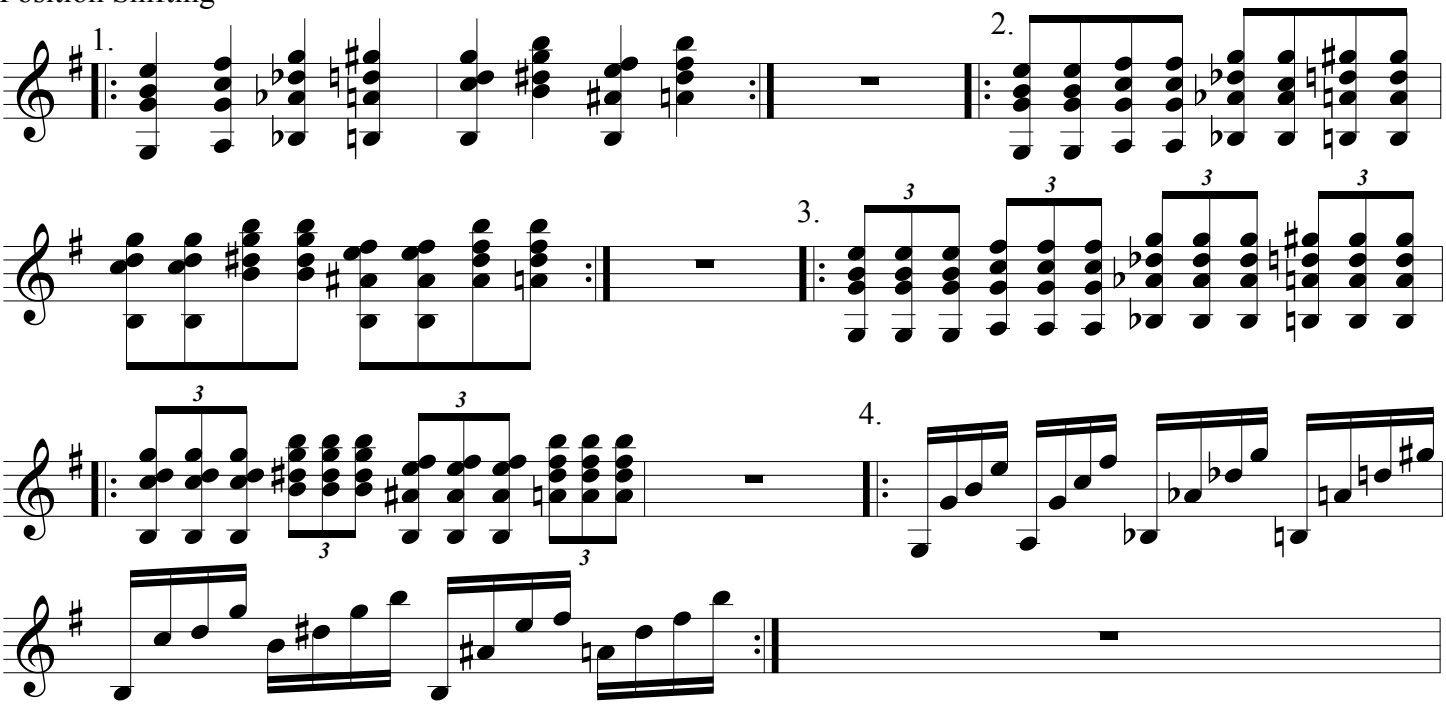
Duple in Triple (do the opposite for passages in triple)



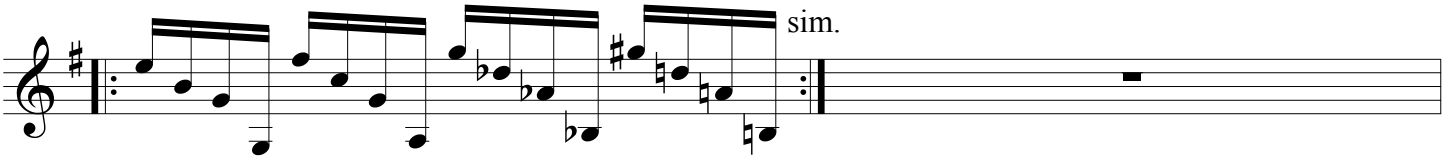
Adding Accents (put them everywhere and anywhere, any combination)



HVL excerpt from Etude 6 (original in 2/4 with eighth notes)
Position Shifting

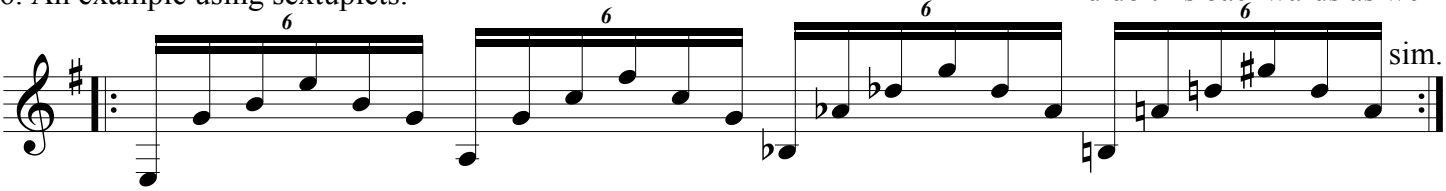


5. Now try that pattern backwards to ensure you did not cheat and get off the lower notes early.



6. An example using sextuplets.

And do this backwards as well

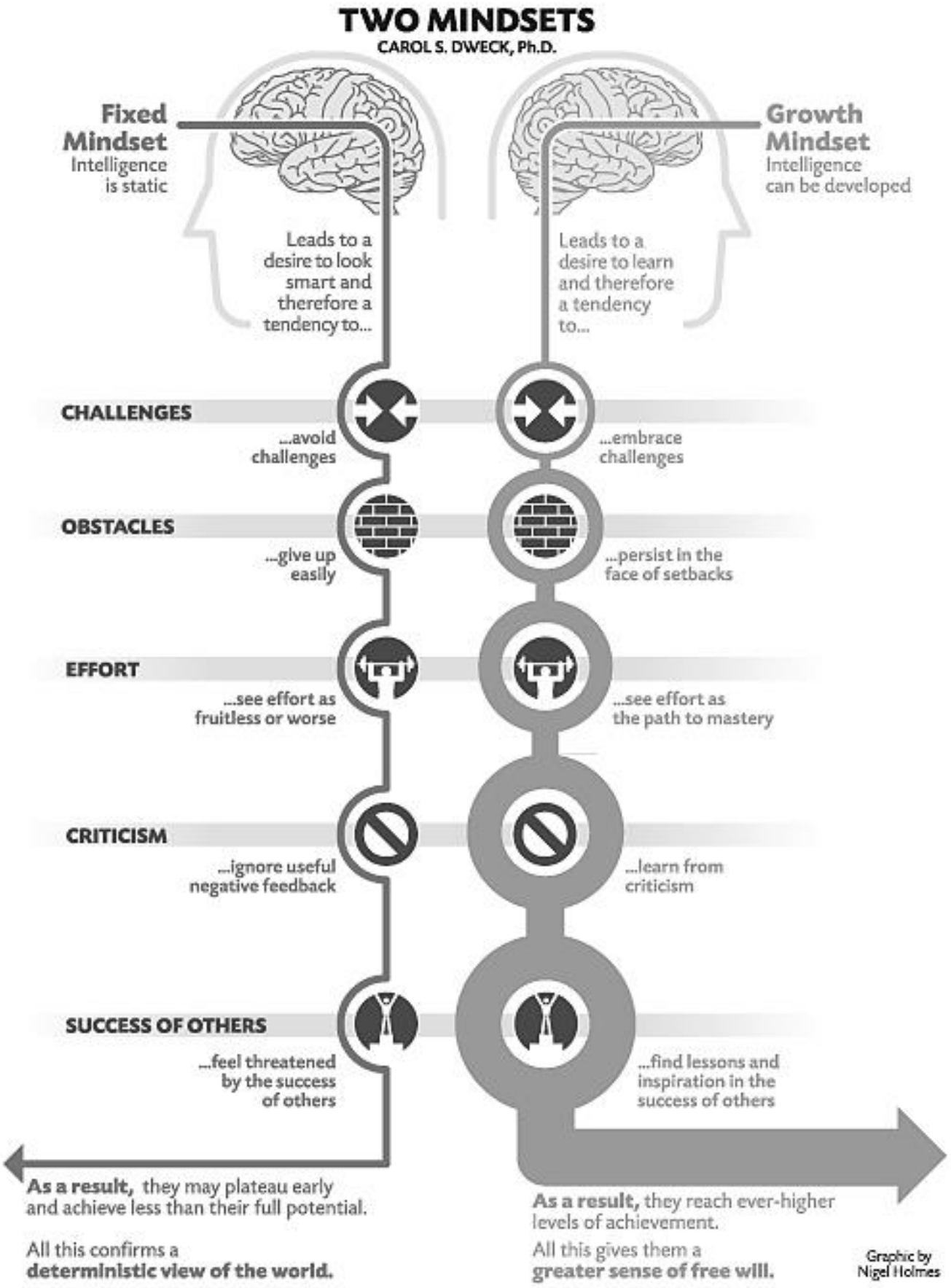


Mindset

- Researcher Carol Dweck and growth vs. fixed mindset.
    - Her three decades plus of research has addressed why, to put it colloquially, most of us can't get out of our own way when it comes to learning.
    - See attached handout
    - Praise the work, not the 'talent'. This is simply the truth and not a manufactured motivational strategy.
    - Perseverance/patience.
        - Setting goals is good, setting deadlines may not be.
- Don't believe the road signs that nature puts up along your quest for skill development.
    - Research shows that there is no fast track to improvement. Level of accomplishment always correlates with amount of practice.
    - Don't measure yourself against where you want to be, measure yourself against where you have been and how you have improved over the course of months, at least.
    - Setting goals is great, setting deadlines may not be.
    - Adults thinking they should learn music, or other brand new concepts, as they do in science and math and reading (All things they've had a massive amount of practice in over the years). They will not be able to assimilate a brand new skill like playing an instrument the way they acquire higher level knowledge in those fields.
    - Don't compare yourself to others by age. Compare by hours put in and, more specifically, the type of work done during those hours.
    - How progress is measured. Days vs. weeks or months. The long arc of performance development.
- Perseverance and patience.
- Skill acquisition is set up backward to what most people perceive it should be. Many perceive that because something is hard at first and little progress is made with great effort that they do not have talent. In reality it is pushing through this initial phase and getting to a level of competence in which higher level accomplishment can be trained *is itself* 'talent'. Many tend to think that being really good at something right away (which never happens, the research is overwhelming on this) reveals a 'talent' and then hard work to reach one's potential can begin. This is part of the misunderstanding of talent.
- Accountability/assessment.
    - ASTA article 8/2012. Christopher Selby. "10 Strategies for Developing a Strong Student Practice Ethic"

Real Accomplishment as Motivator

- We cannot get there without pushing through the initial learning (Blearn, motivation, allocation of time, acquisition of instruction, etc.) just like your muscles would be sore and you would hurt for a while if you started working out, the brain will 'hurt' as one engages in meaningful skill acquisition. It is a myth that any given individual begins learning a skill *with no previous exposure or participation in that domain* significantly faster than anyone else.
- Development and Adaptation of Expertise: The Role of Self-Regulatory Processes and Beliefs by Barry J. Zimmerman.



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Why Music Education Matters in Academics:

It May Not Be What You Think

by Gregg Goodhart

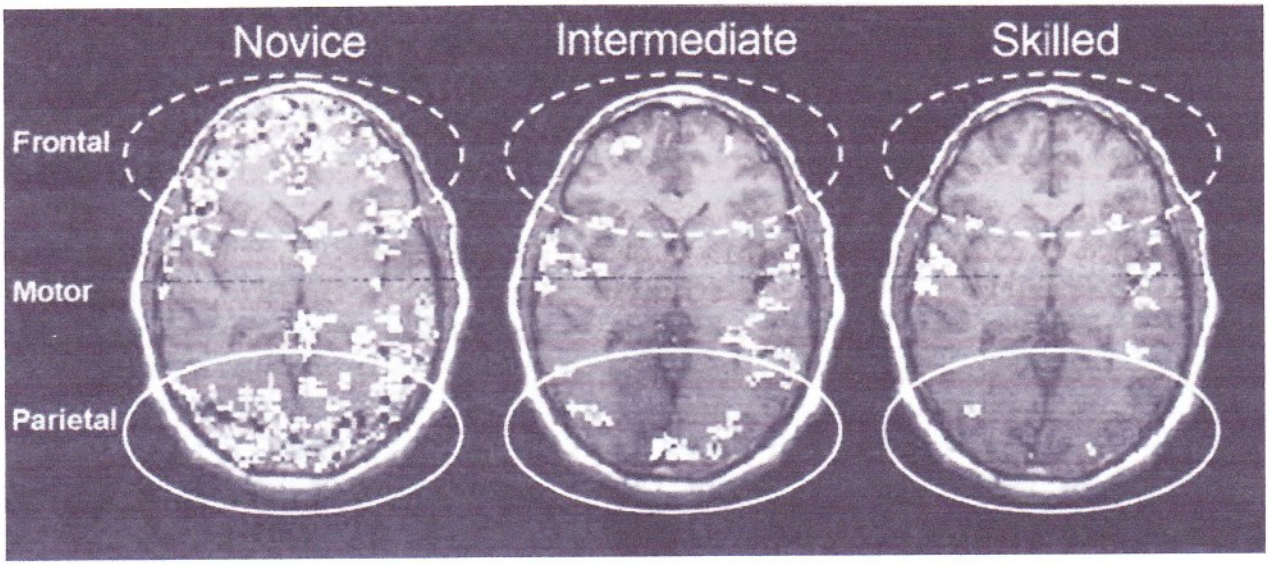
As much as I'd like to believe it, I've always been a little dubious about research citing music instruction as a causative factor of positive outcomes in other areas of life. The "Mozart Effect," ill-conceived as it was, took on a life, and an industry, of its own. I've wondered if the type of young person interested in playing the violin in orchestra is even the type of person who would ever be interested in joining a gang.

Advances in science clarify learning

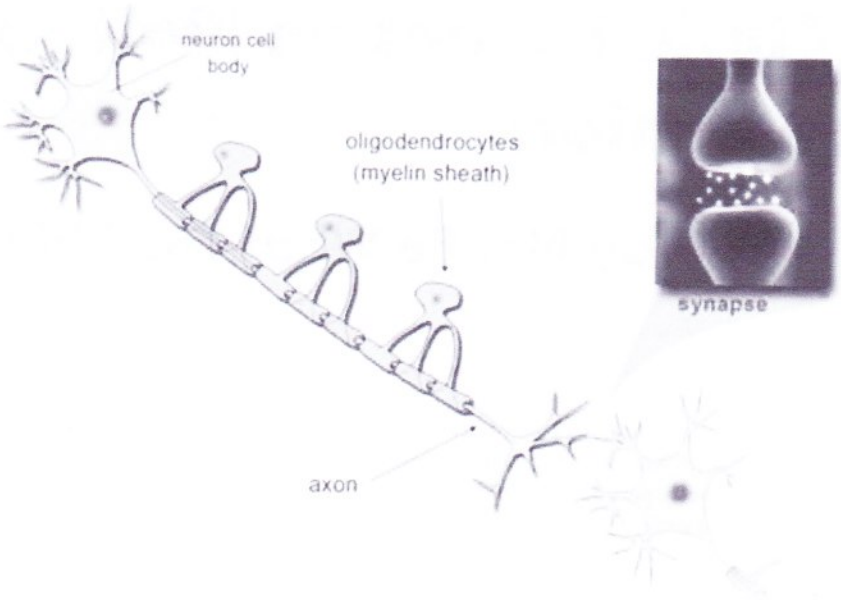
Significant advances in neuroscience are painting a pretty clear picture first brought to us by cognitive psychology educational best practices, and the answers are enlightening, unintuitive and powerful.

We may have heard that we only use 10 percent of our brain, and by inference might assume that if we used more, much more, we would be smarter, better, faster. However, when too much of the brain is active a seizure occurs. The initial, and one of the most significant parts of the learning process, involves using less of the brain.

In "Changes in the Development of Expertise: Neuroanatomical and Neurophysiological Evidence about Skill-Based Adaptations," (Hill and Schneider) researchers published functional Magnetic Resonance Imaging (MRI) showing the brain learning a task. At first it is lit up like a Christmas tree. Most notably the pre-frontal cortex, responsible for executive function, is very involved. As the task is learned, more and more regions drop out as the brain finds the perfect efficiency point for the desired ability. This has been called a process efficiency change and a skill is learned once it is completed. This process involves difficulty and frustration as the brain is trying to figure out how to best deal with it.



But this is only the first step to becoming fluent in that skill. At this point a specific neural network has been created. Everything we do and think is represented by neurons (brain cells) connecting with other neurons and these communications are neural networks. Each time an action potential (electrochemical nerve impulse) is sent between neurons it travels down an axon then across a gap called a synapse. When that happens, specific cells attached to a part of the axon (specifically the internodal parts), called oligodendrocytes, produce an insulating sheath for the axon called myelin (Araque and Navarrete; Wake, Lee, and Fields). The more of this insulation there is, the stronger the current (action potential) remains, and the faster it travels. It takes a lot of repetition, but the more myelin that is wrapped around an axon the faster we think, play or execute any other skill we are working to learn.



What this means, in simpler terms, is one must focus and continually problem solve even when it is frustrating until the solutions to learning the skill are found (process efficiency change). This crucial step in high-efficiency learning has been called desirable difficulty by researchers (Bjork and Bjork). Then the skill needs to be repeated over and over to increase processing speed (myelination). As of this writing, researchers have not been able to find the upper limit of this speed. Take a moment and consider what that means with regard to the potential of all students.

Moving in the right direction, and finding answers

In 2009, the Dana foundation published "How Arts Training Improves Attention and Cognition," by the eminent education research psychologist Michael Posner and a colleague. Posner has done a significant amount of work over 50 years on the brain's attention networks (focus). He wrote, "If there were a surefire way to improve your brain, would you try it? Judging by the abundance of products, programs and pills that claim to offer 'cognitive enhancement,' many people are lining up for just such quick brain fixes. Recent research offers a possibility with much better, science-based support: that focused training in any of the arts—such as music, dance or theater—strengthens the brain's attention system, which, in turn, can improve cognition more generally. Furthermore, this strengthening likely helps explain the effects of arts training on the brain and cognitive performance that have been reported in several scientific studies, such as those presented in May 2009 at a neuroeducation summit at Johns Hopkins University (cosponsored by the Dana Foundation)."

At the time, Posner had only a hypothesis about the building of attention networks. He wrote, "Taken as a whole, the findings to date tell us that music training can indeed change brain circuitry and, in at least some circumstances, can improve general cognition. But they leave unsettled the question of under what circumstances training in one cognitive area reliably transfers to improvements in other cognitive skills." He continued, "As we have seen, recent studies have transcended the failed paradigm of simply exposing people to the arts, and now concentrate on the effects of arts training over months and years. We need more studies like these to determine whether, beyond strong correlation, causation occurs. Arts training may influence cognition through other brain processes as well. Because arts training strengthens the brain network related to the art being practiced, other tasks that rely on the same brain circuitry or pieces of it presumably would be affected."

We are now getting that research. The study, "Improved Effectiveness of Performance Monitoring in Amateur Instrumental Musicians," identified the link in 2014. Among other findings it noted, "More importantly for present purposes, higher levels of musical practice also were associated with a better engagement of cognitive control processes, as indicated by more efficient error and conflict detection… and reduced post-error interference and post-conflict processing adjustments." To put it another way, it trains the brain to search for areas of error, maintain focus instead of giving in to frustration, and then make adjustments based on finding those errors over and over as one works. I believe we teachers have a word for that—learning. That is how learning works for any subject, any skill, anything. The more you do of it the better, smarter and faster you get.

The study went on to say, "Here we show that already moderate levels of musical activity are associated with improved executive functioning when performing basic nonmusical cognitive tasks." Executive function refers to the basic ability to choose "should" over "want," a crucial skill for adult self-reliance, as well as good learning now. This is wired up in the prefrontal cortex (PFC) of the brain. The PFC is underdeveloped in the young and will not finish developing until the age of 25. Have you ever wondered why your insurance goes down, or you can't rent a car until you are 25? Actuaries have noticed this phenomenon for a very long time; now we have insights from neuroscience to bear this out.

In the enlightening book "Willpower; Rediscovering the Greatest Human Strength," researchers Baumeister and Tierny show, among many other amazing insights, that the PFC functions like other parts of the cortex. That is, you learn a skill (wire up a neural network) and then, through repetition, make it stronger (myelination). This is to say that focus, self-discipline, perseverance rely on strong neural networks that need to be created in the PFC. Notice I did not identify a specific skill. This is the ability to focus, push through frustration, and learn at a high level for anything. This ability to control one's focus and behavior successfully is the essence of self-reliance, and how well students build that skill will translate directly to how successful they are as adults.

Putting all of this together we can begin to see that these networks are created and strengthened in music training, then are made available for all academic work. Why is this?

There are no B+ averages in music

There are no B+ averages in music. Imagine a performance in which a full 11 percent of it was mistakes. Yet, many times,

students who maintain a B+ average for an academic class are considered excellent.

This is because arts teachers must teach process over content, while the general strategy usually employed elsewhere emphasizes content over process. How much did teachers teach you how to learn? And was it drilled over and over the way content was drilled? Creating the neural networks and myelinating them over and over, for years? It is that learning process that you need to become fluent in the domain while using the content during that process.

Music teachers must, as a normal part of their jobs, to be considered "good," get all of their performing students to about 98 percent or better. The really good ones get very close to 100 percent. I taught music successfully for 13 years at the high school level. It is a common myth that music teachers at the pre-college level seek out "talented" students, or identify them in their classes, and then develop them. What we do is take anyone and everyone, and know that if they will follow our directions (the learning process in its purest form) they will get good. This develops the PFC as well.

Think of your rehearsals or performance classes, is that how math and science are taught? That is why you see such a stratification of grades in academic classes. In a competently designed curriculum there is no reason anyone should get below an A with reasonable effort. The reason this does not happen is that most students do not know how the learning process really works. They are left alone to figure it out and their grade will reflect how well they did so. An A means, at best, fluency, not mastery. That is another level. The few that can figure out the process on their own are called "gifted."

How do we deal with gifted students? We place them in accelerated courses for focused training within the rich mental models they have already built. This fits squarely into the paradigm of skill development; work properly over time, build a mental model in order to think critically in the domain, once fluency (A's) is achieved then get intensive higher level training to progress toward mastery. This process can be taught to any healthy student, and everyone is capable of "gifted" achievements.

The gifts are already there waiting to be opened by all. They are in music. With any luck, academics will catch on to this process. Currently, there is a nascent national interest in neuroeducation.

The brain is designed to enjoy learning

Making oneself do this can, at first, seem unpleasant for a young person. Many times they need to be structured into these behaviors (creating PFC neural networks). However, on the other side is a rich engagement of the brain that produces what the researcher Mihaly Csikszentmihalyi calls "flow." This is the state the brain enters when it is fully engaged. We have experienced this as hours, seeming like minutes, when we are engrossed in a task. He argues this is the most enjoyable state for the brain to be in and makes a distinction between pleasure (lying on the beach, playing a video game) and enjoyment (when the brain is fully engaged and we are truly enjoying learning). This state can only be achieved once some fluency is acquired as it involves higher level problem solving in the domain, and that is the difficulty (desirable difficulty) of the initial part of learning.

The good news is it appears the brain is designed to crave high level problem solving/cognition. After all, that is how humanity has advanced over the course of time. But the price of this productive state of enjoyment is persevering through the initial unpleasant stages. Most do not want to do that, thus few seem to be "gifted."

After the initial difficulty, true fluency in a domain produces enthusiasm for learning more about that domain generating genuine and lasting learning, self-esteem and self-reliance (Zimmerman). Passion for music can be created by learning to play it well.

There also are strategies to begin gradually building positive habit patterns so that doing work properly becomes habituated (Duhigg). Starting and engaging in focused learning becomes like tying your shoes. It is neither pleasant nor unpleasant. It is just something that you do. After that, flow is not far behind.

These things are very important. But what I have written here is just the tip of the iceberg. Please research and decide for yourself. There is a bibliography included, and you can get more information and resources at my website betterlearningthroughneuroscience.com.

Also, make sure students eat well and get exercise. They must nourish and take care of their bodies, for they will grow into the ones they'll need as adults. And make sure students genuinely participate in music. Like their bodies, they must nourish and take care of their brains.

Implications for music teachers

I'm sure we can see the use of this information for advocacy with administrative and faculty members. There are a few other things to consider.

Every good experienced music teacher I have encountered understands the basic issues I've outlined as part of their normal teaching. What is new is the coalescing of research, first from cognitive psychology and then neurobiology, that allow us to fill in the blanks and understand how all of these things function as part of a larger model. When we come to understand that, we learn how to teach others to do what we do.

We will certainly need more than one article in a journal to get to this place. However, when we do, we can advise entire departments—all of them in fact—on to how all students can achieve that 98 percent. Any good, experienced music teacher is very close to understanding how to teach that. Teaching it should take about as long as it takes to develop students to be in your top orchestra, and the process will be the same. Depending on where a given teacher is in their own development, this could take one to four years.

I started an after-school discussion group that was well attended by faculty. The process slowly began interesting others with all of the good information available, as well as relevant contributions from the group.

If we look around, we can see a groundswell of things pushing education in this direction. There are websites that claim to train your brain; the excellent work and conventions held by The Learning and the Brain Society, The Dana Foundation; areas

such as graduate study in music cognition like the one at Eastman; a slew of books addressing myriad issues surrounding this paradigm — including the currently popular "Focus."

I believe no other conclusion can be reached: our issues with education lies in the teaching of process, and technology can take care of most of the content.

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Gregg Goodhart has a passion for excellence in music education even though he teaches guitar! He founded and directed the internationally acclaimed Servite High School Classical Guitar Program in Anaheim, California for 13 years. In 2009, he was named the ASTA Outstanding School Music Teacher of the Year for Los Angeles and Orange Counties and received the 2011 Outstanding Contributions to Education award from the Orange County Department of Education. His writing and research in music education have been published in *Soundboard*, *The American String Teacher*, and *The Orange County Register* among others. In pursuit of excellence in teaching, he has spent years doing extensive research in cognitive and behavioral psychology and neuroscience. In 2014, he founded *Better Learning Through Neuroscience* to coach students and teachers in the foundational learning process necessary to truly master any domain, or just get as good as they would like. He travels the country doing small and large workshops for students, teachers, and administrators as well as doing distance coaching in these areas by Skype. There is more information on his website betterlearningthroughneuroscience.com.

Weekly Time Inventory

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