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# The Link Between Meditation and Effective Practice: Increasing the Pace of the Acquisition of Skill in Musical Practice

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# ABSTRACT

This thesis seeks to explore the idea of effective practice as being meditative in nature. Effective practice and meditation are both viewed independently, and elements of both are discussed. Meditation, in the literature, is viewed in different lights and is defined in many ways. This makes it difficult to nail down a single definition of meditation. The process itself is debated and several different categorizations are offered. Some research shows Unwanted Effects (UE) to meditation, but these concerns are not widespread. Meditation appears to be a healthy practice that may have health benefits. Effective practice is viewed next; Grit, deliberate practice, and other popular perspectives on effective practice are discussed. Select practice strategies are reviewed. Ultimately, the literature does not show a direct link between effective practice and meditation. However, the health benefits that meditation offers may promote better performance indirectly.



INDEX WORDS: meditation, effective practice, deliberate practice, musical practice

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***Introduction:***

The world's best musical performers are often viewed in such a light as to have achieved an unreachable plateau of beauty and elegance. This level may appear at any age, as both child prodigies and senior performers wow audiences with their playing and/or singing. Some, at the same age and experience level, may perform better or worse than their peers. What makes the difference between this advanced level and all other performers is the question this paper seeks to explore. The psychology of success reveals how some ways of practicing may be more effective for learning than others. Anders Ericsson introduces the idea of deliberate practice in his book *Peak: new secrets from the science of expertise*. He claims it is only one way of practicing effectively, and that other practices may also be effective.[1] For this reason, this thesis refers to "effective practice" as an independent idea to consider all practice strategies that may be effective in learning. His research reveals that this advanced level is not reached by only a select number of gifted individuals, but is instead based on how one practices and for how long. Effective practice may include strategies like chunking and varying practice speed, which are supported by the literature. This thesis is interested in meditation as a possible way of thinking about effective practice, which appear to be related on a ground level. Being "in the zone" when practicing or performing can seem like meditation in that the person is entirely focused on one goal. Running, for example, can seem meditative in that the individual does not speak, but is focusing their thoughts and ideas on the task at hand. A practice session or performance may resemble this mindset. This paper examines the literature to find links between Effective Practice and Meditation in order to assist performers in practicing more effectively. If there is a link, the

[1] K. Anders Ericsson and Robert Pool, *Peak: Secrets from the New Science of Expertise* (Boston: Mariner Books/Houghton Mifflin Harcourt, 2017), pg. 10.

most effective type of practice may be meditative in nature. By incorporating aspects of meditation into practice, one may be able to increase the pace with which they ultimately achieve a naturalness about their practice and performance.

This paper serves as a true thesis: it is a combination of ideas into one, usable statement. It combines research and logic, to the best of the knowledge of the author, in a manner representative of the state of current research for meditation and effective practice. The purpose is to draw a link between the two ideas in order to suggest a more effective way of practicing. The best musicians are the ones who practice the most, but it is not a formula that practicing more equals better performance. In fact, with performance anxiety and other individual factors, time spent practicing is only one important aspect of the final performance. The pace is the progression a musician makes in a given amount of time, and the idea is that, by increasing this pace, someone can reach true mastery of their instrument at an earlier time. This pace can be the difference between winning an audition or working side-jobs to pay the bills. It can also translate into scholarship money at colleges and universities, which can determine whether a person is able to study music at all. Effective practice is of prime importance to anyone seeking to perform.

All musicians are familiar with the idea of long-term practice. It is a staple to the performing arts, one that is often ignored by culture when performers are praised for their "natural talent." Angela Duckworth, in her book *Grit*, explains that, when individuals cannot understand how consistent practice over time has improved an individual's performance, people are inclined to praise the person for being abnormally talented.[2] However, talent is not the reason a person is skilled; effective practice is the secret. This is a sign of a fundamental

[2] Angela Duckworth, Grit (New York: Scribner, 2016), pg. 37.

misunderstanding in culture about the role of effective practice in increasing the pace of the acquisition of skill. Music, sports, acting, painting, drawing, sculpting, and arguably any hobby or occupation that requires skill requires practice to hone the skill. It is no secret the skills we learn can lessen over time if not practiced regularly and, vice versa, that someone who practices a lot increases their skill. This is evident when someone trains for a race and the another does not. The first trains several days a week for months while the other procrastinates and perhaps turns into a couch potato. Disregarding extenuating circumstances such as extreme age difference or being handicapped, the first will win and the second will be winded. This shows how effective practice, over time, leads to success over another who does not practice.

But how do the best performers in the world make things look easy? When the Olympics are on, in living rooms across the U.S. and the world, people may comment on how easy the person makes it look. Whether it is ice skating or tennis, there is a certain amount of skill that has been committed to muscle memory. They are doing things naturally (from muscle memory) that others have never learned. This is obvious in music as well, as seasoned performers will do advanced techniques in the most difficult pieces to play, yet still create beautiful music. They have practiced the technique so long and so well they do it from muscle memory, rather than having to consciously focus on it.

To truly develop something into a skill, rather than just an idea, one must practice the idea before it comes naturally to the person. Consider the pianist who is told they should "drop into the keys" for a particular section. At first it may seem awkward and unnatural, but, with practice, they may eventually drop into the keys without thinking about it. Every world-class performer at some point had no idea how to play their instrument, and consistent practice is necessary for any level of success. But some individuals, even those who have put in hundreds of

hours of practice, may perform better or worse than those at the same age and level as their peers. Some of these effects may be biological.

Myelin is made primarily of lipids that insulate nerve fibers and speed nerve impulses[3] and is the physical manifestation of skill.[4] Physiologically, this means that growth of skill and intelligence in the mind is really the growth of myelin.[5] In a 2014 study, researchers at the University College London confirmed: "Myelin [is] vital for learning new practical skills."[6] The study explained that, in certain activities, the body increases the number of cells that produce myelin.[7] Einstein had abnormal levels of myelin in his brain and, while it is easy to look at Einstein and say he was naturally gifted and talented at math and science, myelin can actually be grown.[8] Myelination also accounts for muscle memory, allowing those who do not practice anymore to still perform the skill at a greater level than a beginner.[9] This is evident in how someone who has not played tennis in 5 years, but spent 10 years playing every day will still be able to play better than a beginner. But myelin goes beyond skill, even into intelligence. The correlation here becomes practical when considering the pianist in the former example: the pianist first learned to drop into the keys and, as time continued, the pianist got better and more natural at it. As the act became more and more natural, the myelin grew, causing the nerve fibers to send nerve impulses more efficiently. This is why people watch the Olympics and say "Wow!

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[3] "Myelin Sheath," Dictionary.com, accessed November 23, 2017, http://www.dictionary.com/browse/myelin-sheath.
[4] "Myelin," Merriam-Webster, accessed November 23, 2017, https://www.merriam-webster.com/dictionary/myelin.
[5] Daniel Coyle and John Telfer, *The Talent Code unlocking the secret of skill in math, art, music, sport, and just about everything else.* (Place of publication not identified: BBC Audiobooks, 2010).
[6] University College London, "Myelin vital for learning new practical skills," *Science Daily*
[7] University College London, "Myelin vital for learning new practical skills," *Science Daily*
[8] Daniel Coyle and John Telfer, *The Talent Code unlocking the secret of skill in math, art, music, sport, and just about everything else.* (Place of publication not identified: BBC Audiobooks, 2010).
[9] "Intro to Myelin - Guide to Deep Practice," MyoBrain, March 30, 2015, accessed November 27, 2017, http://myobrainperformance.com/exercise-essentials/intro-to-myelin.

They're a fish!" or "How did they do that?" Similarly, a high school trumpet player may look at a college professor's playing and be amazed. A middle schooler in drama class may be shocked at how well professional actors perform. A seasoned performer (or, really, a seasoned "practicer") may make a certain skill look easy because they are doing it in an efficient way partly due to time spent effectively practicing. If a performer is interested in improving, they should be interested in the growth of myelin, and this happens with slow, deliberate practice.[10]

While rapid improvement in a skill is partly biological, it is also partly based on environmental stimuli: This brings up the typical nature versus nurture debate, and there is some validity on both sides. Biologically, a person's hands may be better suited to, say, play clarinet or shoot a basketball better than another. Someone who is tall may naturally be better suited to basketball or another sport. This indicates a significant physical and biological influences in the acquisition of skill. This can be seen in the first day someone tries something: a child picks up an instrument and is successful at making a noise. Their friend, however, cannot make a sound at all. One child was more inclined than the other to perform well on the instrument on that day. But if the first student does not practice effectively and the friend does, the friend might be playing better on week two. Even if one of the children is less inclined towards playing an instrument (say, it is difficult for them to get a lip buzz on a brass instrument), if they work through the situation, they may end up playing better than their friend without the same struggles they have. This demonstrates the validity of an environmental stimulus on an individual's performance. But, in skill building, the stimulus is practice, and this arguably has a greater long-term effect on success than does biology; the reasoning lies in perseverance.

[10] Daniel Coyle and John Telfer, *The Talent Code unlocking the secret of skill in math, art, music, sport, and just about everthing else.* (Place of publication not identified: BBC Audiobooks, 2010).

Long-term commitment is key to success in mastering a skill. Daniel Coyle explains this phenomenon in his book *The Talent Code,* where he stated that one of the best predictors for success lies in the answer to one question: "How long are you going to be doing this?"[11] Research suggests that those who express a commitment in advance to an endeavor perform 400% better than those who commit for a shorter time.[12] This means that those who are devoted to spending more time on improving at a certain skill, whether they have yet or not, are more likely to succeed in that field. This means that some students, even those not as biologically inclined towards developing a skill, may perform better than someone who has the biological advantage. This indicates skill building depends largely on long-term commitment. Angela Duckworth explained this commitment by the term grit, a combination of passion and perseverance. In the previous study, one could explain the student's commitment as passion: the student's desire to get better was the passion that drove them to practice and improve. And over time, either child may become very skilled at their instrument. Both theories demonstrate a commitment to a long-term goal that results in better performance. But length of time practiced is not the only factor in increasing the pace at which one improves.

Quality of practice plays a significant role in the acquisition of skill. One must practice in order to achieve world-class performance and quality of practice is the defining factor in how fast one acquires skill. For example, in a great practice session, a student may make a significant step forward, for example, by 3 points. In this scale, there is an imaginary, quantified level of performance where experts have more points than a competent performer, and a competent performer more points than a novice. Someone with a consistently better quality practice will

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[11] Daniel Coyle and John Telfer, *The Talent Code unlocking the secret of skill in math, art, music, sport, and just about everthing else.* (Place of publication not identified: BBC Audiobooks, 2010).
[12] Eric Barker, "How to Become an Expert at Anything," Time, August 23, 2016, accessed November 26, 2017, http://time.com/4461455/how-to-become-expert-at-anything/.

move forward at a faster rate than someone with a lower average quality of practice. This is evident in how, after a week of practicing, the former student will have gained 21 points towards their goal of becoming an expert performer. A student with a lower quality practice, say, with an average 2 points per day in a week, will only improve 14 points total in a week. At the end of the week, the second student is 7 points behind the first and would have to practice 3.5 more days simply to catch up to where the first student is. It is evident that improvement is not quantified this way, but this demonstrates how some performers are considerably better than their contemporaries: they have learned how or instinctively practice more effectively than their colleagues/peers. This demonstrates how someone seeking to increase the pace of the acquisition of skill can increase the quality of their practice to achieve the level of performance they are seeking. The question is, how does one increase the quality of practice?

Anders Ericsson is one of the world's foremost authorities on expert performance and claims world-class performance is the result of deliberate practice. His research shows effective practice is deliberate. Again, he uses the term "deliberate practice" to explain what is the most effective practice. This thesis refers to effective practice to consider all practices that may be effective, including deliberate practice. He says that deliberate practice is goal-oriented. There is a specific goal for each day that targets weaknesses in performance. This means a brass player may work on lip buzzes and long tones in order to improve their embouchure. A violinist may practice slowly to work on their bowing technique. This is similar to how a runner who struggles with long distances may spend a particular run going farther than they normally would. Indeed, Ericsson's research suggests that all skill-related activities can be improved with deliberate

practice. A chess player, runner, visual artist or sculptor can improve with deliberate practice.[13] This shows that the most effective type of practice is deliberate.

Practicing mindlessly or incorrectly enforces bad habits; the myelin is growing to support whatever it is the individual is practicing and, if it is wrong, the person is learning to play something wrong really well. For example, if someone practices a given rhythm, maybe 2 quarter notes and four eights, they would want to practice it the way it is written to perform it the same way. They would not want to change the last grouping of eight notes to a dotted-eighth and 16th rhythm. If they practiced the passage incorrectly for long periods of time, it would be challenging to play the passage correctly the week before a performance. The neurons learned to fire in a particular way given the way they practiced, even though it was incorrect. This is even clearer with muscular patterns. For example, if a beginning saxophonist juts their neck forward each time they play a note and plays this way for 3 years through middle school, they will struggle to change this habit and keep a steady, level head in high school. It may take them several months to play differently, while a beginning saxophonist may easily learn to play without jutting their head forward, even though they may not be better players. This demonstrates how myelin grows to support whatever habits the individual is enforcing. Muscle memory is stored in the cerebellum and can be accessed indefinitely once the nerve axons learn to fire in a certain way.[14] This explains how learning a new skill is really learning from scratch. The first saxophonist must first stop doing something they have done for three years and is probably muscle memory. The circuits are myelinated to performing incorrectly. The second

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[13] Shana Lebowitz, "A top psychologist says there's only one way to become the best in your field - but not everyone agrees," Business Insider, June 12, 2016, accessed November 23, 2017, http://www.businessinsider.com/anders-ericsson-how-to-become-an-expert-at-anything-2016-6.

[14] Christopher Bergland, "No. 1 Reason Practice Makes Perfect," Psychology Today, March 27, 2015, accessed April 27, 2018, https://www.psychologytoday.com/us/blog/the-athletes-way/201110/no-1-reason-practice-makes-perfect.

saxophonist has to grow new myelin to support good technique, but they do not have any bad habits to stop learning. This means practicing must be deliberate and correct as far as the performer can make it.

How does a young musician know what correct technique is in the first place? This question identifies the need for expert instruction. Someone may practice what they think is correct for many years, and may even practice deliberately, but if they do not know what they are doing, they may be learning improper or technically inefficient habits. For example, a person may buy a violin and a beginner book and practice what they think they know for several months before going to a teacher. But the teacher will, in all likelihood, change the technique in some way. A beginner may very well hold the violin completely with their hand, in which case the teacher would ask the beginner to balance the violin on the clavicle/shoulder and rest the head on the chin rest. Technical alterations happen in all musicians' lessons, but problems like this may be severe in beginners who have not received information on proper playing technique along the way. Habituated, these technical problems can create bigger problems down the road when the student is ready for more difficult music and technique. Also, the beginner without expert instruction may have technique that is harmful to them. For example, someone wanting to sing may oversing or sing too long in a day. Either can cause extreme fatigue in the voice and eventually nodes or other disorders if sustained over long periods of time. A voice teacher would be able to tell them immediately to sing less and lead them to create a good sound without oversinging. So expert instruction can prevent injury and ultimately leads to increased efficiency in practice and performance. This shows how expert instruction is necessary to guide deliberate, correct practice.

The next question is: how is effective practice meditative? There are several issues with using the term "meditative." Meditation is a broad term and is applied everywhere from Eastern spiritual practices to mindfulness techniques in Western counseling.[15] Definitions range from thoughtful reflection[16] to resting the mind and achieving a different type of consciousness.[17] However, one must understand what meditation is before it can be applied to effective practice.

***Meditation***

Most people are familiar with some form of meditation. Whether they have taken a yoga class, meditate for religious purposes, or have just heard the word in conversation, meditation has become a part of American and world cultures. It is often associated with Eastern religions and some practice or avoid meditation for this reason. In fact, it has been employed by various religions over time, and its origins may go back as far as 5,000 B.C.[18] Sikhism, Jainism, Judaism, and others employ or did employ meditation at some point in time. In the latter half of the 20th century, however, meditation took a turn towards the secular.[19] Yoga was the bus that brought Transcendental Meditation to mainstream American culture in the 1960s by Mahesh Maharishi Yogi.[20] It was largely dismissed by researchers at first, however, a Harvard professor named Dr.

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[15] Mark Williams et al., *The Mindful Way through Depression: Freeing Yourself from Chronic Unhappiness* (New York: Guilford Press, 2007).
[16] "Meditation," Dictionary.com, accessed November 24, 2017, http://www.dictionary.com/browse/meditation.
[17] Swami Rama, "The Real Meaning of Meditation," Yoga International, June 03, 2013, accessed November 24, 2017, https://yogainternational.com/article/view/the-real-meaning-of-meditation.

[18] Robert Puff, "An Overview of Meditation: Its Origins and Traditions," Psychology Today, July 07, 2013, , accessed January 04, 2018, https://www.psychologytoday.com/blog/meditation-modern-life/201307/overview-meditation-its-origins-and-traditions.
[19] Ashley Ross, "Meditation History: Religious Practice to Mainstream Trend," Time, March 9, 2016, accessed January 04, 2018, http://time.com/4246928/meditation-history-buddhism/.
[20] Robert Puff, "An Overview of Meditation: Its Origins and Traditions," Psychology Today, July 07, 2013, , accessed January 04, 2018, https://www.psychologytoday.com/blog/meditation-modern-life/201307/overview-meditation-its-origins-and-traditions.

Herbert Benson published *The Relaxation Response* in 1967. He noted the participants in the study had lower heart rates and used oxygen more efficiently. Meditation came to higher acclaim in the 1970s with endorsements from popular artists like the Beatles and Mia Farrow. By the mid-1990s, books like Chopra's *Ageless Body, Timeless Mind* were popularized and received endorsements by Demi Moore, Michael Jackson, and others.[21] But does it live up to the hype? Will meditation rise and fall like a bad diet fad? Modern research largely confirms the touted benefits of meditation, with reservations.

The potential benefits are notable: reduced blood pressure,[22] psychological well-being,[23] improved emotion regulation, increased satisfaction with relationships,[24] increased immune system function,[25] enhanced psychological flexibility, improved focus,[26] and anxiety reduction,[27] among others. These benefits may range from young children to the elderly: In 2014, an elementary school in Richmond California employed a 5-week Mindfulness-Based Meditation

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[21] Ashley Ross, "Meditation History: Religious Practice to Mainstream Trend," Time, March 9, 2016, accessed January 04, 2018, http://time.com/4246928/meditation-history-buddhism/.

[22] Hongchang Yang, Xueping Wu, and Min Wang, "The Effect of Three Different Meditation Exercises on Hypertension: A Network Meta-Analysis," *Evidence-Based Complementary and Alternative Medicine* 2017 (April 26, 2017): , accessed January 1, 2018, doi:10.1155/2017/9784271.

[23] Cindy A. Kilgo, Amanda L. Mollet, and Ernest T. Pascarella, "The Estimated Effects of College Student Involvement on Psychological Well-Being," *College Student Journal* 51, no. 1 (Spring 2017): , accessed January 1, 2018, http://eds.b.ebscohost.com/eds/detail/detail?vid=0&sid=0cf9a0a9-4f1e-4b33-9e35-773404562bae%40pdc-v-sessmgr01&bdata=JnNpdGU9ZWRzLWxpdmUmc2NvcGU9c2l0ZQ%3c

[24] Daphne M. Davis and Jeffrey A. Hayes, "What are the benefits of mindfulness? A practice review of psychotherapy-related research.," *Psychotherapy* 48, no. 2 (June 2011): , accessed January 2, 2018, doi:10.1037/a0022062.

[25] Davidson RJ et al., "Alterations In Brain And Immune Function Produced By Mindfulness Meditation: Three Caveats," *Psychosomatic Medicine* 65, no. 4 (July & aug. 2003): accessed January 2, 2018, https://www.ncbi.nlm.nih.gov/pubmed/12883106.

[26] Daphne M. Davis and Jeffrey A. Hayes, "What are the benefits of mindfulness? A practice review of psychotherapy-related research.," *Psychotherapy* 48, no. 2 (June 2011): , accessed January 2, 2018, doi:10.1037/a0022062.

[27] David W. Orme-Johnson and Vernon A. Barnes, "Effects of the Transcendental Meditation Technique on Trait Anxiety: A Meta-Analysis of Randomized Controlled Trials," *The Journal of Alternative and Complementary Medicine* 19, no. 0 (2013): accessed January 4, 2018, doi:10.18411/a-2017-023.

course which improved classroom behavior for up to seven weeks after the course.[28] Young people are not the only beneficiaries: a study in São Paulo, Brazil revealed meditation can increase quality of life in elderly patients[29]. Even college students have shown benefits from meditation: a 2017 study at Grand Valley State University examined the effect of a meditation class on well-being. The subjects indicated they had a greater sense of well-being after the course.[30] These studies indicate meditation is an important part of a healthy lifestyle.

But what do these claims mean? What types of meditation are there? For example, a Buddhist and a Hindu may say they are going to meditate, yet they likely have different perceptions of what they are going to do. Buddhism offers many ways to meditate: anapana sati (mindfulness of breathing) and metta bhavana (loving kindness meditation) are among two of the most common types.[31] The first involves awareness of the body and awareness of physical surroundings. The second involves chanting a mantra like "May I be happy"[32] or other positive statements. These two examples, while seemingly separate from mainstream U.S. culture, are actually great representations of what research-based literature calls Mindfulness-Based Cognitive Therapy and Transcendental Meditation respectively. Other types of meditation include Heart Rhythm Meditation, Calming Meditation, Spiritual Meditation, among a plethora

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[28] David S. Black and Randima Fernando, "Mindfulness Training and Classroom Behavior Among Lower-Income and Ethnic Minority Elementary School Children," *Journal of Child and Family Studies* 23, no. 7 (October 19, 2014): accessed January 2, 2018, doi:10.1007/s10826-013-9784-4.

[29] José Antonio Curiati et al., "Meditation Reduces Sympathetic Activation and Improves the Quality of Life in Elderly Patients with Optimally Treated Heart Failure: A Prospective Randomized Study," *The Journal of Alternative and Complementary Medicine* 11, no. 3 (June 2005): , accessed January 21, 2018, doi:10.1089/acm.2005.11.465.

[30] Claire Crowley and Dana Munk, "An Examination of the Impact of a College Level Meditation Course on College Student Well Being," *College Student Journal* 51, no. 1 (Spring 2017): accessed January 2, 2018, http://eds.b.ebscohost.com/eds/detail/detail?vid=3&sid=61fc9916-95a7-4b29-a988-bde162420d25%40sessionmgr102&bdata=JnNpdGU9ZWRzLWxpdmUmc2NvcGU9c2l0ZQ%3d%3d#AN=121530618&db=slh.

[31] Ven. S. Dhammika, "Meditation: good question, good answer," A Basic Buddhism Guide: Meditation, accessed January 01, 2018, https://www.buddhanet.net/e-learning/qanda06.htm.

[32] Ven. S. Dhammika, "Meditation: good question, good answer," A Basic Buddhism Guide: Meditation, accessed January 01, 2018, https://www.buddhanet.net/e-learning/qanda06.htm.

of specific focuses and types of practice. The clarity sets in when one realizes that the Buddhist and Hindu may actually be doing the same thing. For example, if the atheist is using a guided meditation app like Headspace on their smartphone, they are actually doing mindfulness-based meditation, similar to the Buddhist practice of anapana sati (mindfulness of breathing). These individuals have very different beliefs, but are using the same practice to further their life goals. Why would two such different people be doing the same thing? This shows how it can be easy to separate types of meditation by the goals of the meditator (religious goals, stress-management goals, mental and physical health goals, etc.), but there are better ways to categorize types of meditation.

*Classification:*

There are two clear distinctions in meditation, with lots of overlap: religious meditation and clinical meditation. The second is based on the first, but has been studied and is used in secular and scholarly settings for clinical treatment. Most studies actually refer to some form of spiritual meditation in an attempt to clarify the type of meditation they used in the study, further diluting the mixture of religious and secular meditation.[33] This is evident when scholarly works refer simply to "Buddhist Meditation" instead of a set of standard, accepted terms. A few terms are used regularly (Mindfulness Based Cognitive Therapy, Mindfulness Based Stress Relief, Transcendental Meditation, relaxation, and sometimes Guided Meditation), but the studies fail to explain exactly how the meditation took place, or what each term means in context. That means one study might say they used Mindfulness Based Cognitive Therapy (MBCT), when they

[33] Stefan Schmidt, "Opening Up Meditation for Science: The Development of a Meditation Classification System," *Meditation – Neuroscientific Approaches and Philosophical Implications Studies in Neuroscience, Consciousness and Spirituality* 2 (2013): accessed January 11, 2018, doi:10.1007/978-3-319-01634-4_8.

employed techniques from Mindfulness Based Stress Relief (MBSR). This can lead to confusion between terms, and will be explored later in depth. Due to this confusion, classification of meditation is similarly subjective: some choose to classify by the types of meditation, while others choose to classify the activities within the process of meditating itself.

However, there have been many attempts to create a single classification system. A 2013 article in the Frontiers in Psychology Journal suggests two methods. The first is to separate by the processes themselves:

> 1. Normal (the user is in pre-meditation; no changes are occurring in the mind), 2. Intention to Begin (just the intention itself), 3. Preliminaries (rituals are practiced; a certain posture and/or room may be a part of this stage), 4. Method (practices used to meditate; may include visualization, concentration, others) 5. Enhanced Mental State (the psychological state of consciousness inspired by the meditation itself). They also suggest third-person terms taken from Psychology and Cognitive Science such as "affect and cognition."[34]

A separate review in the second volume of the *Studies in Neuroscience, Consciousness and Spirituality* series of books suggested:

> "(i) attention regulation, (ii) motivation (iii) attitude and (iv) practical context[35]" as a way to describe the processes of meditation.

A 2017 study posted in the Journal of Cognitive Enhancement separates meditation into Focused Attention Meditation (FAM) and Open Monitoring Meditation (OMM), suggesting one might be

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[34] Jonathan D. Nash and Andrew Newberg, "Toward a unifying taxonomy and definition for meditation," *Frontiers in Psychology* 4 (November 20, 2013): November 20, 2013, accessed January 9, 2018, doi:10.3389/fpsyg.2013.00806.

[35] Stefan Schmidt, "Opening Up Meditation for Science: The Development of a Meditation Classification System," *Meditation – Neuroscientific Approaches and Philosophical Implications Studies in Neuroscience, Consciousness and Spirituality* 2 (2013): accessed January 11, 2018, doi:10.1007/978-3-319-01634-4_8.

more or less beneficial for certain performance activities.[36] FAM is a way of intently focusing on something, while OMM is a way of observing thoughts in a non-judgmental way. Other articles have used FAM or OMM as part of their studies,[37] but these, along with the terms above are broad, only dividing the significant amount of meditative types into large groups which need further categorization and definition.

These suggestions are a response to the numerous classifications in recent literature. Many studies say "meditation," but may refer to several processes. These definitions are a way of defining what meditation is in a scholarly world that often uses "meditation" to mean many things. This could be particularly problematic when performing future studies on meditation. Instead of referring to one of a dozen definitions for meditation, one may be able to refer to one of the studies above to classify and define meditation. This means a study may conclude that meditation is or is not beneficial in some way, but they may have been actually testing related ideas instead of meditation itself. This lack of clarity serves to confuse the existing literature, and more definition is needed to classify what meditation is before researchers can come to concrete conclusions on the benefits of meditation.

*Types Studied*

The literature focuses on two of the most common types of meditation: Transcendental Meditation (TM) and Mindfulness-Based Stress Reduction (MBSR).[38] The first involves finding

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[36] Lorenza S. Colzato and Armin Kibele, "How Different Types of Meditation Can Enhance Athletic Performance Depending on the Specific Sport Skills," *Journal of Cognitive Enhancement* 1, no. 2 (2017): April 11, 2017, accessed January 9, 2018, doi:10.1007/s41465-017-0018-3.

[37] F. Isil Bilican, "The Relationship Between Focused Attention Meditation Practice Habits, Psychological Symptoms, and Quality of Life," *Journal of Religion and Health* 55, no. 6 (December 22, 2016): accessed January 9, 2018, doi:10.1007/s10943-016-0204-0.

[38] Daniel Gutierrez, Jesse Fox, and Andrew W. Wood, "Center, Light, and Sound: The Psychological Benefits of Three Distinct Meditative Practices," *Counseling and Values* 60, no. 2 (October 1, 2015): accessed January 4, 2018, doi:10.1002/cvj.12016.

a comfortable position and repeating a mantra. The goal is an awareness that is alert, but also relaxed. The technique comes from India's Vedic religion[39] and is taught by certified instructors.[40] Transcendental Meditation was introduced in the U.S. in the 1960s by Maharishi Mahesh Yogi, and is used in commonly in Yoga.[41] Subscribers to this technique are asked to focus on a set of religious words unique to them (called a "mantra"). Marishi Mahesh Yogi puts it this way:

> By using this mantra, the practitioner experiences the thought of that sound and starts minimizing that thought to experience the finer states of that thought – until the source of thought is fathomed and the conscious mind reaches the transcendental area of being."

Someone practicing TM will sit and chant a mantra; the goal is not to focus, but to simply repeat the chant. TM in particular has a strong religious connotation due to it's origins and current practice, so it is an established practice with a specific meaning in today's culture.

Mindfulness Based Stress Relief, however, came about less organically. It was created by Dr. Jon Kabat-Zin and is a present-based awareness based on Buddhist teachings. Mindfulness has been defined:

> "In its more common usage in recent clinical literature, it has come to mean the awareness that emerges as a by-product of cultivating three related skills: (a) intentionally paying attention to moment-by moment events as they unfold in the internal and external world, (b) noticing

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[39] "Vedic Meditation." The Meditation Trust. Accessed January 06, 2018. https://www.meditationtrust.com/vedic-meditation/.

[40] "The 3 Steps to Learn TM," How To Learn Transcendental Meditation (TM), accessed January 06, 2018, https://www.tm.org/learn-tm.

[41] "Transcendental Meditation," WebMD, accessed January 04, 2018, https://www.webmd.com/balance/guide/transcendental-meditation-benefits-technique.

habitual reactions to such events, often characterized by aversion or attachment (commonly resulting in over-thinking), and (c) cultivating the ability to respond to events, and to reactions to them, with an attitude of open curiosity and compassion."[42]

Present-based awareness is a tool that alters one's relationship to thoughts. The goal is to have healthier inward and outward reactions.[43] In MBSR, individuals focus on awareness of the present: physical surroundings, the body, the breath, et cetera as a way to break the cycle of depressive thoughts.[44] The practice is a form of psychotherapy that is potentially beneficial for treating Major Depressive Disorder.[45] Even off-shoots of MBSR have shown promising results. A 2008 study published in the *Journal of Consulting and Clinical Psychology* noted that Mindfulness based Cognitive Therapy (MBCT), a more specific type of MBSR, was more effective in reducing depression symptoms than traditional medication. They also noted 75% of the MBCT group stopped taking anti-depressants completely.[46]

Both MBSR and TM are offered in clinical settings, however many mobile applications offer mindfulness-based meditation for non-clinical use. Some popular applications include Headspace, Calm, Sattva, and others. The reliability

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[42] Mindfulness Based Cognitive Therapy, accessed April 14, 2018, https://mbct.co.uk/.
[43] Your Guide to Mindfulness-Based Cognitive Therapy, accessed January 05, 2018, http://mbct.com/.
[44] "Understanding Psychotherapy and How it Works," American Psychological Association, accessed January 05, 2018, http://www.apa.org/helpcenter/understanding-psychotherapy.aspx.
[45] "Mindfulness-Based Cognitive Therapy," Psychology Today, accessed January 05, 2018, https://www.psychologytoday.com/therapy-types/mindfulness-based-cognitive-therapy.
[46] Kuyken, Willem, Sarah Byford, Rod S. Taylor, Ed Watkins, Emily Holden, Kat White, Barbara Barrett, Richard Byng, Alison Evans, Eugene Mullan, and John D. Teasdale. "Mindfulness-based cognitive therapy to prevent relapse in recurrent depression." *Journal of Consulting and Clinical Psychology* 76, no. 6 (2008): 966-78. Accessed January 5, 2018. doi:10.1037/a0013786.

of these applications is debatable, as each seeks to implement their own version of meditation. As these applications are relatively recent, little research has been done on their effectiveness. From what little research has been done, the results are mixed. One study puts it this way: "To date, research on both the design and potential uses of mindfulness-based mobile apps (MBMAs) is scarce. According to Plaza et al., while a wide selection of MBMAs seems to be available in the market, there is a complete lack of evidence to support the usefulness of those apps on health indicators."[47] This notes the difficulties in assessing the effectiveness of a treatment that is delivered in a real-world environment and the lack of research supporting the effectiveness of MBMAs. Another consideration is the difficulty in assessing the different kinds of meditation employed by each app. For example, the Headspace app claims to combine elements of both insight and calming meditation, while still promoting mindfulness.[48] It may be difficult to identify the effectiveness of apps apart from the type of meditation they use. For example, a study assessing the effectiveness of headspace specifically may not apply to an app that employs a different type of meditation. The question, though, is one of acceptance and quality.

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[47] Claudia Carissoli, Daniela Villani, and Giuseppe Riva, "Does a Meditation Protocol Supported by a Mobile Application Help People Reduce Stress? Suggestions from a Controlled Pragmatic Trial," Cyberpsychology, Behavior, and Social Networking 18, no. 1 (2015): accessed April 26, 2018, doi:10.1089/cyber.2014.0062.
[48] "What Kind of Meditation Is Headspace?" Help Center, accessed April 27, 2018, https://help.headspace.com/hc/en-us/articles/218394158-What-kind-of-meditation-is-Headspace-.

*Objections:*

*1. Religion*

There is a general hesitancy towards fully accepting meditation in clinical practice, partially due to the undeniable link to religious practice. Many religions practice meditation, and someone may be understandably standoffish towards meditation for this reason. Those considerations are up to the final discretion of the individual considering whether or not to meditate.

*2. Research Focus and Quality*

It seems those in opposition to meditation are yelling just as loud as those for it, but there are fewer critics. For example, the research largely focuses on the potential benefits of meditation, while very few studies focus on the Unwanted Effects (UE) of meditation. These UEs occur during meditation and suggest some serious implications for future research. One 2017 study found 25.4% of participants experienced UEs. They note individuals with existing psychiatric issues may have severe reactions to long-term meditation and that these reactions wildly vary. These UEs may be severe (hallucinations, anxiety, psychosis, others), and others mild, but ultimately that the UEs were transitory. This raises serious concerns with meditation, albeit these effects are mostly mild and temporary.[49] Another study found it common in meditation practitioners to experience feelings of dread while meditating,[50] showing these and other UEs are relatively unknown. One study suggested many of the more serious effects were in those who went to long-term retreats, rather than periodic Mindfulness Based Interventions

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[49] Ausiàs Cebolla et al., "Unwanted effects: Is there a negative side of meditation? A multicentre survey," *Plos One* 12, no. 9 (September 05, 2017): accessed January 24, 2018, doi:10.1371/journal.pone.0183137.

[50] Suzanne L. Russ and Melody S. Elliot, "Supplemental Material for Antecedents of Mystical Experience and Dread in Intensive Meditation," *Psychology of Consciousness: Theory, Research, and Practice* 4, no. 1 (2017): accessed January 24, 2018, doi:10.1037/cns0000119.supp.

(MBI), so the average, moderate meditator may not need to worry about UEs.[51] More research is needed to validate and categorize the Unwanted Effects of Meditation.

This problem was addressed in an earlier study that found those who meditated longer had more adverse effects. They examined twenty-seven individuals, who were then arranged in three groups by time spent meditating. The first group (n=10) had meditated less than two years and spent around 45 minutes a day meditating. The second group (n=10) had meditated between two and seven years and spent about 45 minutes meditating a day. The final group (n=7) had meditated for over seven years and spent over an hour per day meditating. The subjects attended Vipassana meditation (which employs mindfulness) retreat; data was collected via a questionnaire beforehand and at two points after the retreat. The treatment was the same except for the duration of the retreat. Surprisingly, 40% of group one (the shortest time spent meditating) reported Adverse Effects, while 75% of group three (longest time spent meditating) reported Adverse Effects. This suggests that meditating for a longer period of time can actually increase UEs. However, the test subjects said they had more positive than negative effects overall.

Another consideration is that meditation may be more beneficial for some than others. One 2017 study tested (n=77) university students in a 12-week course incorporating meditation. They found that women had greater decreases in negative affect (negative effect is a "feeling of

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[51] Kathleen B. Lustyk et al., "Mindfulness Meditation Research: Issues of Participant Screening, Safety Procedures, and Researcher Training ," *Advances* 24, no. 1 (Spring 2009): Spring 2009, accessed January 27, 2018, https://pdfs.semanticscholar.org/b2ba/012fc51a682838b28e88c3ded03553c11ded.pdf.

negativity"[52] as a response to a stimulus, tied to lesser well-being[53]) than men. Due to clinical and biological differences in men and women, they suggest gender specific modification for future meditation studies. These results are akin to how a doctor treats a patient: a doctor may prescribe small doses of a medication in order to assess the effectiveness of the particular medication on the particular patient. Not every medication works (or works the same) with every patient. So meditation, similarly, may be have different effects on different individuals. This makes sense from a theoretical perspective as well; at least each meditation experience is different for each person. This is clear because meditation is a looking inward, and each person is different. Therefore, an inward perspective of a single individual and his/her thoughts is going to look different than another's.

It may be easy to assume that, due to UEs, meditation is, in a word, "bad." More likely is that meditation has positive and negative effects. Just like medicine in how the effects are different on each individual, the medication may have good effects on the patient (relief from a condition, normalization of an abnormal characteristic, et cetera), and bad effects at the same time (just as any medication may have unwanted side effects). This would explain the results of the previous study. The literature shows a view of meditation that is largely clinical, but with religious undertones. However, the quality of these studies has been brought into question.

A 2012 meta-analysis studying the psychological effects of meditation in the Psychological Bulletin found an initial 595 studies in major journals and databases from 1970 to 2011. From this list, they chose to exclude therapy and physiological studies; the causation for

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[52] Pam M.S. Nugent, "What is NEGATIVE AFFECT? definition of NEGATIVE AFFECT (Psychology Dictionary)," Psychology Dictionary, June 19, 2015, accessed January 27, 2018, https://psychologydictionary.org/negative-affect/.

[53] Dua J. K, "The role of negative affect and positive affect in stress, depression, self-esteem, assertiveness, Type A behaviors, psychological health, and physical health.," *PubMed* 119, no. 4 (November 1993): accessed January 27, 2018, https://www.ncbi.nlm.nih.gov/pubmed/8150272.O

the results of these studies may lie in the physical treatments themselves. They found many studies had methodological problems, such as not including a control group with which to compare the treatment group. This is concerning because interpretation is limited; the results could easily be inflated, and no one would be able to tell how much due to the lack of a comparable group. They also took out studies that only reported on transient effects, as they were interested in long-term effects. Statistics were often not reported; for example, only the test statistic was reported, but the degrees of freedom and sample size were not included. After these reductions, only a little more than 25% of the studies remained. In their words, "It turned out that almost three quarters of the originally selected 595 studies either did not fulfill our content criteria or (and this was the majority of them) suffered from severe methodological constraints and therefore had to be omitted from further analysis. This left 163 studies for inclusion in the meta-analyses."[54] Out of the plethora of studies on meditation, most were found to be of poor quality in this particular study. Another meta-analysis reporting on 64 empirical studies only selected 20 that were suitable for the purpose of their study. They also found studies lacking information, poor evaluations, and insufficient statistical analysis, among other reasons. Quality is a serious concern in taking a holistic view of the literature on meditation. Does this mean the positive results are non-factual? Should a reader dismiss the whole of research on meditation as useless?

Thankfully, no. This study found that MBSR was effective in helping the subjects cope with problems. A 2014 review noted the concern with quality of meditation research, but also

[54] Peter Sedlmeier et al., "The Psychological Effects of Meditation: A Meta-Analysis," *Psychological Bulletin* 138, no. 6 (2012): accessed January 31, 2018, doi:10.1037/a0028168.

stated meditation can have a moderate effect on emotional and physical symptoms.[55] Another study in the Clinical Psychology Review ran an effect size analysis on 209 current studies (n=12,145 test subjects) to determine how effective meditation was in light of the inconsistent results in current literature. They found that Mindfulness Based Therapy was no different than CBT (Cognitive Based Therapy), other behavioral therapies, and pharmaceutical treatments. This means that meditation may be just as effective as taking OTC prescriptions or psychotherapy. They concluded meditation was a moderately effective treatment option, especially for reducing stress, depression, and anxiety.[56] Another meta-analysis found that TM specifically was effective in reducing anxiety, and that those with the highest initial levels of anxiety had the greatest reduction in symptoms after treatment.[57] This suggests that, while the research on meditation has some important downfalls, it is still a viable treatment option in clinical settings.

***Effective Practice***

To fully understand the connection between meditation and effective practice, one must first understand effective practice independently. Psychology offers several ways to think about skill acquisition; grit, flow, and deliberate practice are all sides of the same coin. This paper suggests pace as a way to think about the acquisition of skill by employing these practices. Everyone runs life at a different pace and practice is no different. Just as someone may take on more at work or school, one can take on more with practice. This may mean more hours

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[55] Madav Goyal et al., "Meditation Programs for Psychological Stress and Well-being: A Systematic Review and Meta-analysis," *Jama Internal Medicine* 174, no. 3 (January 6, 2014): January 6, 2014, accessed February 2, 2018, doi:10.1001/jamainternmed.2013.13018.

[56] Bassam Khoury et al., "Mindfulness-based therapy: A comprehensive meta-analysis," *Clinical Psychology Review* 3, no. 66 (August 2013): June 7, 2013, accessed February 2, 2018, doi:https://doi.org/10.1016/j.cpr.2013.05.005.

[57] David W. Orme-Johnson and Vernon A. Barnes, "Effects of the Transcendental Meditation Technique on Trait Anxiety: A Meta-Analysis of Randomized Controlled Trials," *The Journal of Alternative and Complementary Medicine* 19, no. 0 (2013): accessed January 4, 2018, doi:10.18411/a-2017-023.

practicing, or simply more effective practice. However, there is a certain pace at which someone improves. This paper means to suggest there is a way to increase that pace so one can reach new levels faster. This pace may be improved by adding studied practice techniques like chunking and varying practice speed to a practice session.

*Pace*

Does it matter that practice is effective? The answer is a resounding yes. If practice is not effective, it means the individual got no better at what they were practicing. It is implied that practicing more effectively means more progress was made than if someone were practicing less effectively. If a cellist's goal is to be the best musician they can be, effective practice means they have improved some aspect of their playing. Maybe they are performing a piece with more expression, better technique, or with greater ease. The result is they moved towards their goal. More effective practice means they have made a bigger or more significant step towards their goal, maybe in the ways listed above. In other words, effective practice is inherently based on one's progress towards a goal. This progress can be measured: more effective or less effective. So more progress is the result of more effective practice and the results are measured by the quality of practice. Over time, the effectiveness of practice compounds into notably better performance. This can be demonstrated with a concept from physics.

Velocity is distance divided by time and is defined as speed in a direction. It appears so:

$$velocity = distance/time$$

Velocity can be high or low, depending on the distance an object travels over time. Someone who is not a physicist may say the object is fast or slow. Greater velocity is the result of greater distance and/or less time. This applies directly to gaining skill: a person may gain, say, 2 points

forwards in a given direction. The direction or goal is to play better and the points are a numerical representation of the progress a person makes in a direction. Someone may move 2 points forward each hour and another move 3 points forward per hour. The first person is moving at a velocity of 2 points per hour and the second three points per hour. After 12 hours, the results are so: the first person has improved a total of 24 points. But the second person has improved a total of 36 points. The difference is 12 points forward between the first and second individuals. In other words, the second individual is performing 12 points better than someone who practiced just as long as they did. This demonstrates how effectiveness of practice can result in a large difference in the total amount of progress towards a goal. In practice, this can mean someone who raises the effectiveness of their practice slightly can see large differences in performance over time. After a full semester or year of more effective practice, the resulting difference is incredible. With an increase in the quality of effective practice, the pace at which one moves toward his/her goal increases.

This pace (represented by velocity in the equation above) is determined largely by the quality of practice. The velocity here does not necessarily cover how much repertoire one gets through in time or how many technical exercises, but the mean amount of progress forward over time. With the substituted terms, the resulting formula is thus:

$$pace = progress/time$$

This means anyone wanting to increase the pace of the acquisition of skill would want to increase their progress without increasing or by reducing time. This progress is largely determined by the quality of practice and effectiveness of measures used. For example, a pianist who has been simply replaying a phrase may choose to practice rhythms instead (this is when a pianist chooses to stop on certain beats in the measure, but plays the others at regular or faster

speed). Instead of mindless practice, they are now intentionally changing the way they play to increase the progress they make over time. This, in turn, increases the pace the individual acquires skill. But how can one increase the progress they make over time?

*Practicing as performance*

Robert A. Duke, Amy L. Simmons, and Carla Davis Cash performed a study posted in the Journal of Music Education, titled, "It's not much, it's how: Characteristics of practice behavior and retention of performance skills." 17 Undergraduate and Graduate piano students participated in the study. The selected excerpt was from a Shostakovich concerto and, while difficult to sight read, could be learned in one practice session. The participants were placed in a room, given two minutes to warm up, then were given the excerpt, a metronome and a pencil. They were allowed to practice as long as they wanted. The following day they returned, were again given two minutes to warm up without working more on the excerpt, then were asked to play the excerpt 15 times without stopping. All practice and test sessions were recorded, and data was recorded numerically. They first measured trials for "correctness," or getting the pitches and rhythms right. They followed by independently measuring character, tone, and expression of the recordings and ranked the performances in these terms. The authors largely agreed on their rankings. All practice strategies were noted:

A. "Playing was hands-together early in practice. B. Practice was with inflection early on; the initial conceptualization of the music was with inflection. C. Practice was thoughtful, as evidenced by silent pauses while looking at the music, singing/humming, making notes on the page, or expressing verbal 'ah-ha's. D. Errors were preempted by stopping in anticipation of mistakes. E. Errors were addressed

immediately when they appeared. F. The precise location and source of each error was identified accurately, rehearsed, and corrected. G. Tempo of individual performance trials was varied systematically; logically understandable changes in tempo occurred between trials (slowed down enough; didn't speed up too much). H. Target passages were repeated until the error was corrected and the passage was stabilized, as evidenced by the error's absence in subsequent trials[58]."

Notably, the three highest-scoring pianists scored significantly higher than the other pianists and learned the piece differently than the others. They all portrayed F, G and H on the list above, while few others evidenced these characteristics. These strategies all concern error management, and were often absent in the other pianists' practice sessions. This suggested the best performers handle errors differently than others. Namely, the best performers don't practice errors.

The results show no significant correlation to retention in time practiced, number of performance trials, number of complete trials, or total numbers of correct and near-correct trials. However, the results do show a significant correlation to percentage of correct trials in all cases (correct, near-correct, correct and near-correct). This leads the researchers to consider that behavior while practicing is a better indicator of retention than time practiced or in the total number of complete trials. This means that, while practicing a long time might improve performance, practice time alone was not the best indicator for performance success. Rather, the proportion of correct trials to incorrect trials made the difference in this study. This makes sense in real life; if someone practices a phrase wrong for three months before a performance, but tries

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[58] Robert A. Duke, Amy L. Simmons, and Carla Davis Cash, "It's Not Much; It's How: Characteristics of Practice Behavior and Retention of Performance Skills," *Journal of Research in Music Education* 56, no. 4 (2009): accessed March 25, 2018, doi:10.1177/0022429408328851

to fix it the day before, it is likely the individual will perform the phrase incorrectly. Even if the person runs the phrase 100 times correctly the day before, but had run it 10,000 times incorrectly over the last three months, the performance will likely be incorrect. This means, for lack of a better word, the best performers practice their music correctly. If they want to perform it a certain way, they practice it as they intend it to be performed.

This idea agrees with the current neuropsychological view of skill acquisition. When people learn, the brain actually changes. Cell bodies in the brain are connected via nerve axons and fire at a certain speed. These axons are covered by a type of glial cell called myelin that insulates nerve impulses. When the individual gains skill, more myelin is added to the myelin sheath to insulate the nerve. Myelin is increased when people learn new skills, and information is relayed more quickly cell to cell due to this increase in myelin. This means that, if a given skill requires certain cells to fire (for example, playing piano activates certain parts of the brain), having more myelin means the skill can be accomplished more efficiently. More importantly, doing something over and again means the nerve axon is further insulating itself with more myelin. This means that myelin grows with practice. However, whatever is practiced sticks, even if it is wrong. This demonstrates the importance of practicing in the way one intends to perform. The pianists in the example above worked out errors early because they wanted to perform the piece correctly.[59] However, certain types of practice grow myelin more than others. This is evident in Anders Ericsson ideas on deliberate practice.

*Deliberate Practice*

[59] Alison Pearce Stevens, "Learning Rewires the Brain," Science News for Students, August 06, 2016, accessed March 25, 2018, https://www.sciencenewsforstudents.org/article/learning-rewires-brain.

Anders Ericsson is a psychologist who studies the effects of deliberate practice on expert performance. An "expert on experts,"[60] he claims that deliberate practice, not biology, is the difference between world-class performance and the average joe. He and Bill Chase performed a study in 1980 which challenged the idea that people are predisposed to have a certain amount of short term memory. In other words, psychological science at the time believed individuals could only memorize a certain number of digits in short-term memory. Current research of the day held that people could generally remember 7 or 8 digits at a time, but no more. Ericsson worked with an undergraduate student for several hour-long sessions several times per week to see if the student could increase short term memory. Ericsson called out numbers at a one second interval, starting at 5 digits. When the subject correctly repeated the numbers, Ericsson moved to 6, continuing upward in this way. If the student missed a sequence of numbers, Ericsson went down 2. The student started with a max of 7 digits and, by the fifth session, the student could remember 11 digits. After two years of deliberate practice, he could remember 82 digits. This study demonstrates how, with effective practice, one can learn new skills and accomplish seemingly impossible goals. Why is this important to the acquisition of skill? Ericsson claims deliberate practice is "the most effective and powerful form of practice we know of.[61]" In other words, in the search for more effective ways to practice, deliberate practice is the strongest weapon in the arsenal. If someone is not practicing deliberately, adding this to a practice regimen will only serve to increase the pace of the acquisition of skill.

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[60] Shana Lebowitz, "A top psychologist says there's only one way to become the best in your field - but not everyone agrees," Business Insider, June 12, 2016, accessed November 23, 2017, http://www.businessinsider.com/anders-ericsson-how-to-become-an-expert-at-anything-2016-6.

[61] Ericsson, K. Anders, and Robert Pool. *Peak: Secrets from the New Science of Expertise*. Boston: Mariner Books/Houghton Mifflin Harcourt, 2017, pg. 10.

*Grit and Flow*

Angela Duckworth is a 2016 Macarthur "genius" Fellow and leading American psychologist. She says grit, a combination of passion and perseverance, is the key to success. She addresses how people are often praised for their innate talent, but the work they have put in to honing their skills is often ignored. If fact, talent is only a small part of achievement. She claims that:

$$talent\ x\ effort = skill$$

And

$$skill\ x\ effort = achievement$$

This means that, while talent cannot be ignored, it counts half as much as effort. This equation points back to Ericsson's research, where the effort in Duckworth's reasoning often takes the form of deliberate practice. The world's best instrumentalists have spent countless hours practicing deliberately in order to maximize their achievement.[62]

Mihaly Csikszentmihalyi is another leading psychologist who suggests that what performers feel when they perform is a state of flow. It is a state of ease and awareness that exists through full concentration. This may seem contradictory to Ericsson's research (hours of often unpleasant practice), but Angela Duckworth has a simple explanation: "deliberate practice is for preparation, and flow is for performance." This means that deliberate practice, while often unpleasant, can lead to a performance that is pleasant.

[62] Angela Duckworth, Grit (New York: Scribner, 2016), pg. 132.

***Applications of Effective Practice***

Knowing the theories behind effective practice is important, but understanding its implications in musical practice is another. For example, a pianist may very well understand that practice should be deliberate, but if they do not understand what they are supposed to do with that information, it will never help them. Likewise, someone may have grit, but may not know how to practice. This section seeks to break down some of the more practical considerations of current research in effective practice.

*Organized*

Effective practice is not haphazard; it is organized and goal-focused. One study took 40 collegiate brass players at Indiana University and analysed a single 23-minute practice session. Effectiveness was measured by the amount of improvement from a pre- and post-test to the practice session. Each student was measured with the Nowicki-Duke Locus of Control Scale for Adults (1974), the, Eysenck Impulsiveness Questionnaire for Adults (1985), and a practice questionnaire designed for the study. All practice habits were analysed and recorded. They found low-impulsive students performed better than high-impulsive students.[63] This suggested that the students who performed best had structured practice sessions; they weren't impulsive about their practice.

The study also found certain practice strategies had a significant relationship with performance achievement. These strategies were: "whole-part-whole," "repeat section," "varying

[63] Peter Miksza, "Relationships among Impulsiveness, Locus of Control, Sex, and Music Practice," Journal of Research in Music Education 54, no. 4 (December 1, 2006): accessed April 3, 2018, doi:10.1177/002242940605400404.

pitch," and "marks part."[64] The presence of these strategies suggested a thoughtful, informed practice session. This harkens back to Ericsson's research, where the best practice is deliberate. The study also found no significant relationship between performance and time spent playing during the practice session. This suggested what the earlier piano study suggested; how one practices is more important than time spent practicing alone. What are some specific ways to practice deliberately?

*Chunking*

Chunking has been identified as an effective way to learn. One study took 28 subjects and asked them to perform a memory test. The participants were placed in front of a computer and asked to perform several trials: when a word or nonword (chunks of letters versus known words) appeared on the screen for .5 seconds and subsequently disappeared, the participants had 5 seconds to type the word or nonword. The study had a total of 48 nonwords and 48 words broken down into blocks. Each block had repeated words and nonwords for each subject. The results found, when nonwords reappeared, the recall error percentage reduced over time. This reduction was greater for nonwords than words. New nonwords did not have a reduction in recall error, meaning the participants identified non-words they recognized better with more trials. Paired-sample t-tests confirmed that the recall error percentage depended on the recognition of nonwords the participants had seen before (p=.006), but not for words they had seen before

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[64] Peter Miksza, "Relationships among Impulsiveness, Locus of Control, Sex, and Music Practice," Journal of Research in Music Education 54, no. 4 (December 1, 2006): accessed April 3, 2018, doi:10.1177/002242940605400404.

(p=.378). These results indicate that participants learned nonwords by chunking.[65] This process also works for music.

Thirty-four piano students at the Hanover School of Music were asked to play several two octave scales hands separate and hands together. The pianists used standard fingerings and were recorded. The results were measured by keystroke onsets and instability/irregularity. The second showed how some notes had lower timing variability between trials (G in the C major scale was "reliably around 8ms late"); this variability was termed irregularity. However, other notes had higher timing variability (the first pitch in the C major scale was often different between trials). The IQR of the note timings served as the quantified measure of instability. They found that scales started slow, sped up, and slowed down again at the end. This indicates a single musical phrase. However, the instability readings surprised the authors: "the instability trace reveals a different picture, showing three distinct peaks that coincide with the octave boundaries…instead of two peaks in the irregularity trace."[66] This means that the octave indicates a single motor process and that there is higher instability at the transition between octaves. In other words, participants had chunked the octaves as individual motor processes, even though they performed two processes in one scale.[67]

Chunking can aid in learning, but also in memory. Erkisson and Kintsch, in a 1995 thesis, present the idea of Long-Term Working Memory (LT-WM) and Short-Term Working Memory (ST-WM). They suggested information is stored in LT-WM, but it needs cues from ST-WM in

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[65] Motonori Yamaguchi et al., "Pushing Typists Back on the Learning Curve: Memory Chunking Improves Retrieval of Prior Typing Episodes.," *Journal of Experimental Psychology: Learning, Memory, and Cognition* 43, no. 9 (2017): accessed March 31, 2018, doi:10.1037/xlm0000385.

[66] Floris Tijmen Van Vugt, Hans-Christian Jabusch, and Eckart Altenmüller, "Fingers Phrase Music Differently: Trial-to-Trial Variability in Piano Scale Playing and Auditory Perception Reveal Motor Chunking," *Frontiers in Psychology* 3: November 16, 2012, accessed March 31, 2018, doi:10.3389/fpsyg.2012.00495.

[67] Floris Tijmen Van Vugt, Hans-Christian Jabusch, and Eckart Altenmüller, "Fingers Phrase Music Differently: Trial-to-Trial Variability in Piano Scale Playing and Auditory Perception Reveal Motor Chunking," *Frontiers in Psychology* 3: November 16, 2012, accessed March 31, 2018, doi:10.3389/fpsyg.2012.00495.

order to be accessed reliably.[68] For musicians, say, a vocalist memorizing an opera, they would need to revisit the pieces they know in order to retain access to LT-WM. Roger Chaffin, a psychologist, and Gabriella Imreh, a pianist, theorize that novices learn with procedural and auditory memory, whereas an expert would have a large, fully-encompassing view of the piece through conceptual memory. They conclude that Western Art Music is organized into sections that an expert performer can refer back to.[69] Roger Chaffin takes this a step further and says that expert performers chunk information by structures they already know (scales, chords, et cetera), that the importance of the structures is ordered according to the structural hierarchy in the piece, and that performers practice retrieving this stored information in Long Term Memory (LTM).[70] This is evident in how a pianist, for example, may memorize a certain chunk of information as "the B section," or "the adagio section." They may practice learning by section so that if a teacher or auditor were to ask for only a certain section, they would be able to play it. In other words, expert performers chunk information according to the structure of the piece.

*Practice Speed*

Nearly every musician has heard about slow practice. Many may flash back to their childhood piano teacher saying "now run this slowly twenty times before I see you next week." This memory may be positive or negative, but the idea of slow practice is especially beneficial when learning a piece. Going back to myelin, the brain enforces whatever is practiced, whether

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[68] Anders K. Ericsson and Walter Kintsch, "Long-Term Working Memory," Psychological Review 102, no. 2 (April 1995): accessed April 2, 2018, doi:http://dx.doi.org/10.1037/0033-295X.102.2.211.

[69] Geeves, Andrew, Doris J.f. Mcilwain, John Sutton, and Wayne Christensen. "To Think or Not To Think: The Apparent Paradox of Expert Skill in Music Performance." *Educational Philosophy and Theory* 46, no. 6 (2013): 674-91. Accessed April 2, 2018. doi:10.1080/00131857.2013.779214.

[70] Geeves, Andrew, Doris J.f. Mcilwain, John Sutton, and Wayne Christensen. "To Think or Not To Think: The Apparent Paradox of Expert Skill in Music Performance." *Educational Philosophy and Theory* 46, no. 6 (2013): 674-91. Accessed April 2, 2018. doi:10.1080/00131857.2013.779214.

right or wrong. When starting a piece, it is important to get as many correct repetitions as possible so as to learn the piece the way one wants to perform it. One may ask, "how do I perform this up to speed if I am constantly playing it slow?" The answer is that, because of the complexity of new tasks, one needs to play a piece slower to coordinate their body and mind. Tying a shoe, for example, is easy for most of us, but, when first learning, it was probably incredibly challenging. There are 61 muscles in the forearm and hand, and each muscle must be perfectly coordinated with others in order to successfully tie one's shoe.[71] In other words, practicing slow is to ensure one is practicing fine motor movements correctly. It is beneficial to correctly fire the nerve axons so one can spend their practice time in the most effective way. Imagine someone who plays a piece incorrectly 20 times, but correctly 10 times. Imagine also they have a lesson the following day. They have only played the piece correctly 10 times. Playing the piece incorrectly only grew the musician's ability to play the piece incorrectly and is useless by practical measures. The time they spent practicing incorrectly is also useless because the performer hopes not to use the incorrect material learned during that time. According to the piano study under the "practicing as performance" heading, the proportion of correct trials was more important than the total number of correct trials. This particular musician would likely perform incorrectly because they have performed the piece incorrectly twice as much as they have performed it correctly.

Practicing up to speed is also an important factor in preparing for performance. Many actions, say, playing four notes to outline a chord on the piano, would often be performed as a single gesture. Gestures are difficult to practice in slow motion. In addition, other aspects of

[71] Thomas Robb, "How to Play like a Pro: The Neuroscience of Muscle Memory," Oxford Neurological Society, September 22, 2016, accessed April 27, 2018, http://neurologicalsociety.org/play-like-pro-neuroscience-muscle-memory/.

technique, depending on the instrument, may be impractical. For example, a vocalist may not practice long tones like a brass player because of the limited time one can spend singing in a day. Singing long tones uses more vibrations than singing up to tempo or just under. Things like air capacity cannot be changed, so even long tones are limited to a certain degree. A brass player practicing a phrase at four times slower than tempo will quickly find they need to take more breaths than if they performed at tempo. In a sense, practicing up to tempo, or faster in general, is practicing something new; gestures, possible embouchure resets, fewer breaths, and other techniques offer new challenges when the tempo is altered depending on the instrument and piece. This indicates both slow practice and practice up to tempo are both beneficial to the performer.

***Results: Putting it together***

Meditation and Effective practice have been researched and viewed independently up to this point. This thesis sought to identify similarities between the two ideas to inform performers of techniques that may help them improve at a faster pace. So far, however, little of the research above suggests much overlap between meditation and effective practice. Several studies have found that meditation changes white matter[72], but it is not clear how this may affect practice or performance directly (White matter consists of the nerve axons found in the brain. Some of these axons are surrounded by a sheath of myelin[73]). This connection, however, offers no real definition to the relationship between effective practice and meditation, only that there may be one. Certain lines can be drawn between the two ideas. One is that visualization is used often as a

[72] David Laneri et al., "Effects of Long-term Mindfulness Meditation on Brain's White Matter Microstructure and Its Aging.," *Frontiers in Aging Neuroscience* 7 (2016): accessed April 27, 2018, doi:10.3389/fnagi.2015.00254/full.
[73] "White Matter of the Brain: MedlinePlus Medical Encyclopedia," MedlinePlus, accessed April 27, 2018, https://medlineplus.gov/ency/article/002344.htm.

practice technique and often used as a meditation technique. Focus, again, is required to do either well. Those who practice effectively and those who meditate often choose to practice these ideas frequently over long periods of time. For example, a pianist may practice several hours a day over many years. Likewise, someone may choose to meditate every day for a year or more to suit their own purposes. This demonstrates that meditation is practiced. In both of these cases, there is a desired result that either meditating or practicing effectively helps them reach. For musicians, this desired end may be performance or personal enjoyment. For meditation, the result may be clearer thinking, better health, or any number of benefits discussed above.

These benefits may themselves be the link between effective practice and meditation. One study puts it this way:

> "Long-term engagement in mindfulness meditation has been found to be effective in achieving optimal athletic performance through decreasing the level of anxiety, ruminative thinking, and enhancing the experience of flow."[74]

In other words, the benefits of meditation may lead to increased performance. One study in *The Sport Journal* studied 29 junior-athletes in a 12-week mindfulness training program. The participants noted positive results in their ability to focus and sleep.[75] Any athlete or musician would benefit from being able to focus longer, be less anxious, or have a more positive experience while performing. Improved sleep may help several of these issues. Meditation itself may only be an activator of these positive benefits. This means that increased focus, for example, would improve performance, and meditating may increase an individual's ability to focus. In this

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[74] Lorenza S. Colzato and Armin Kibele, "How Different Types of Meditation Can Enhance Athletic Performance Depending on the Specific Sport Skills," Journal of Cognitive Enhancement 1, no. 2 (June 2017): April 11, 2017, accessed April 13, 2018, doi:10.1007/s41465-017-0018-3.

[75] Furrer, P., F. Moen, and K. Firing. "How Mindfulness Training May Mediate Stress, Performance and Burnout." *The Sport Journal* 19. July 15, 2015. Accessed April 13, 2018. http://thesportjournal.org/article/how-mindfulness-training-may-mediate-stress-performance-and-burnout/.

example, the link would be secondary: meditation may lead to certain benefits that increase performance. For now, this is one of the most conclusive statements that can be offered.

There are no studies, to the author's knowledge, where meditation increased performance directly. More research is needed to validate a link between meditation and effective practice before large-scale conclusions can be drawn. As to increasing the pace of the acquisition of skill, one has only to look at the types of effective practice above. The research suggested that some practice is more effective than others. By practicing in more effective ways, one can improve the quality of their practice. However, no research suggested a pace specifically as a way of thinking about musical improvement. More research is needed to validate the idea of a pace before it can be applied to meditation or effective practice.

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# THE LINK BETWEEN MEDITATION AND EFFECTIVE PRACTICE: INCREASING THE PACE OF THE ACQUISITION OF SKILL IN MUSICAL PRACTICE

By

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