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articles concerning injury prevention and the biomechanics of piano technique. She also lists many performances to her credit, including a world premiere in December, 1998. Dr. Wristen was selected as a member of Sigma Xi Research Society in recognition of her original research and was also named to Alpha Chi, Pi Kappa Lambda, and Pi Kappa Phi national honor societies for her academic achievements. Dr. Wristen is currently assistant professor of piano at Chadron State College in Nebraska where she teaches studio piano, group piano, music literature, music history, and music appreciation.

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Technical Exercises: Use Them or Lose Them?

by Brenda Wristen

Piano pedagogues disagree about whether piano technique should be developed through practicing exercises or by isolating a musical passage which requires that a select technical motion be employed. Exercises are purely mechanical note patterns of varying length, usually only a few measures long. They are divorced from any musical content, and are devoted to only one technical skill. Like exercises, etudes usually concentrate upon developing one technical skill. However, etudes are fully developed pieces of some length which allow the player to build skill within a musical context. The essential difference between the practice of exercises versus isolating and conquering technical passages from repertoire lies in the goal of the practice. When practicing an exercise, the goal is usually conditioning of the hand and fingers, while in isolation of a technical problem, the goal is to apply the selected motions within a musical context.

Views of Piano Pedagogy Experts on Exercises in General

Nelita True, of the Eastman School of Music, believes that developing technique apart from repertoire is valuable. She found that as a young player, she was making musical decisions in her repertoire pieces based upon her physical capabilities. By developing her technique separately, she was able to learn repertoire faster. Based upon her personal experience, she recommends that students cultivate technique apart from repertoire. She holds the opinion that this approach helps prevent injury.¹

Dorothy Taubman, a pianist currently instructing students in building injury preventative technique, strongly disagrees with this position. She believes that many of the motions used in piano playing are too small to be seen with the naked eye. Most technical training exercises are based on the visible, not taking into account invisible motions which cause visible results. This, she claims, has led to an overemphasis on training the fingers.

Taubman further asserts that technical exercises do not serve their alleged purpose. While practicing Czerny and other etudes may not do harm in and of themselves, Taubman claims they are a waste of time. Singling out basic skills in an exercise will not solve a problem in repertoire which is related; problems encountered in repertoire often are related to their context, that is, what comes before or after. Thus isolation will not fix the technical problem. Taubman

purports that practicing exercises often only reinforces bad or incorrect habits.² In a similar statement, Kochevitsky condemned the practice of abstract exercises without practical musical application as one of the great deficiencies of the finger school. Though he believed that no exercise was good or harmful in and of itself, he felt that if teachers were to use them, the exercise material should be appropriate and carefully chosen.³

William Newman, like Taubman, had serious doubts as to whether technical exercises even served their supposed purpose. He stated that pianists practice these exercises on the "treacherous assumption" that somehow these exercises will apply. He stated that the belief in most fields other than music was that each person gets enough exercise for his/her chosen pursuit directly from the activities that pursuit requires.⁴ This last claim may deserve some skepticism based upon what is now known about the role of conditioning. For example, distance runners employ weight training in order to strengthen their leg muscles in order to improve performance. He believed that while Czerny, Hanon, and similar exercises might not directly cause harm, they did no good either. He pointed out that their repetitive nature led to "psychological lethargy" and left the student's mind free to wander, yielding wasted practice time. He further asserted that these exercises had little direct applicability in actual repertoire, stating:

The practice of a Czerny study leads mainly to the perfection of that Czerny study rather than to Beethoven or Chopin or composers in general. The way to learn Beethoven is first of all to practice Beethoven. The practice of Czerny can help Beethoven only when an *identical* passage occurs in both, and such practice can mean the wasting of a lot of valuable time. (emphasis added)⁵

Newman believed that the reason for the traditional adherence to Czerny and similar studies is the assumption that piano practice entails developing the piano playing muscles. Newman rejects this view as a fallacy, claiming that technique cannot be generalized in this way. Specific muscular coordination must be developed for specific situations. Newman did, however, admit that when a problem is encountered in repertoire, an exercise may be derived to address that particular problem which will help the player develop the coordinated motions he/she needs in that instance. Moreover, Newman approved of practicing trills, scales, arpeggios, octaves, and double notes separate from repertoire, claiming that these elements repeatedly occur in standard piano repertoire.⁶

Thomas Fielden, an English pedagogue of the mid-twentieth century, advocated the use of what he termed "gymnastics" in technical training rather than the use of traditional exercises. The gymnastics exercises offered by Fielden are to be performed away

from the piano with the muscles of the playing apparatus to develop flexibility. He adopted the maxim that technique in the long run is more mental than it is physical. Fielden believed that the teacher can equip the student with the physical means to technique, but the student must develop the mental means him/herself. He stated that gymnastic exercises are the best way to develop physical technical capacity, provided that the student relates them to the keyboard. The player must use his/her acquaintance with the muscles to develop appropriate movement patterns at the piano.⁷ However, Fielden claimed the daily use of these exercises would give the player all the physical equipment necessary to play the piano, and asserted that they served greater purpose than "tedious" and "nerve-wracking" repetitive finger exercises.

Matthay also disapproved of the use of finger exercises to develop technique, stating that it is "absurd and hopeless to try to acquire technique dissociated from its purpose to express music." He further believed that while trying to gain technical facility, the player must give close attention to the musical concepts expressed by a piece of music. He based his opinion upon his view of music as time-dependent, i.e., movements made when playing pieces of music are related to the flow of the piece. He outlined four time principles:

1. Movement of the key must be timed toward the sound desired.

2. Notes fall into natural groupings. Each group of quick notes moves toward the pulse ahead.

3. Similarly, note groups fall into phrases which move to a climax point (by extension, phrases may in turn be grouped into larger phrases.)

4. The sections of a piece function similarly in knitting the piece together as a whole.

Evidence From Motor Learning Studies

The skepticism raised by these piano pedagogues concerning the effectiveness of practical technical exercises apart from repertoire is supported by evidence from the field of motor learning studies. One of the principal characteristics of theories of motor learning is their insistence upon the value of practice variability in learning new motor skills.⁹ Increased variability in practice is often associated with increased performance error. However, research evidence shows that more performance error can maximize skill learning when it occurs in the early stages of learning the skill. This observation suggests that, theoretically, practicing a new piano skill in multiple different forms, as opposed to practicing the same form repeatedly, might enhance learning. In an experiment conducted by Edwards and Lee (1985), subjects were asked to move their arms through a specified pattern within a certain period of time. Some of the participants were prompted by a "ready, one, two, three" count on tape.

Other participants were informed of the time limit and then attempted to achieve the movement through a trial-and-error approach, receiving critical feedback about their timing errors after each attempt. Results showed that the two groups performed equally well in retaining the skill. However, the trial-and-error group performed the arm movement with greater accuracy. This is notable because the group who practiced with the prompting tape experienced much less error in practicing the arm movement skill than did the trial-and-error group. Yet experiencing less error during practice had no impact upon retention of the skill, and was actually shown to be detrimental in transferring the skill to a novel situation.¹⁰ This finding seems to suggest that practicing technical exercises may have limited value in learning motions to apply to repertoire pieces.

Another observation from the area of motor learning studies which relates to the use of piano technique exercises concerns contextual interference. Contextual interference results from practicing a task within the context of the practice situation. A high degree of contextual interference may be present when a learner practices several different, but related, skills within a single practice session; low contextual interference exists when a learner practices the same skill repeatedly during a single practice session.¹¹ Many people view such interference as negative, and thus assume practicing the same skill repeatedly will lead to

a superior performance. However, several experiments have shown that the opposite is true: practice which is high in contextual variability leads to much greater retention and ability to apply the skill in novel situations. One such study, undertaken by Shea and Morgan (1979), involved practicing three separate motor skills. Some participants practiced each skill separately, in blocked segments, while the other participants practiced the skills in a random arrangement. While the blocked practice group performed better during practice trials, the random practice group demonstrated superior performance during retention and transfer trials, where they encountered the same skills in a slightly different situation.¹² A later experiment by Hall, Dominguez, and Cavazos (1994) demonstrated that the contextual interference effect exists not only for beginners, but for already skilled individuals.¹³ While researchers do not fully understand the underlying reasons for the positive contextual interference effect, two hypotheses have been advanced. The first is that higher levels of contextual interference may increase the complexity of the memory representation of the skill being practiced. The second purports that the effect may exist due to the need for the learner to more actively reconstruct an action plan for a trial of skill when trials of different skills have intervened.¹⁴ In either case, this observation about contextual interference suggests that both beginning and advanced pianists might theoretically

benefit more from practicing multiple skills in one practice session rather than repeatedly practicing the same exercise.

Finger Independence Exercises

Exercises which are purported to cultivate finger independence are of special concern in terms of physical demands imposed on the pianist. There are many variations upon this exercise, which has been practiced for as long as the pianoforte has existed as a distinct instrument. The merits of these particular types of exercises have recently been questioned, both by piano teachers, and performing arts medical specialists. Finger independence exercises typically involve one finger holding a note while the other fingers of the same hand alternately play in a pattern around the sustained note ([Figure 1](#)). A frequently encountered variation of this exercise involves articulating one note at a time while the other fingers sustain a chord, or voicing to various notes of a sustained chord ([Figure 2](#)). It is slightly easier when the sustained note is played with a digit at the extreme of the hand; in this case, wrist rotation can be used to help the other fingers play around the sustained note. In any case, whether the exercise involves sustaining one note or more than one note, the action of the long extensors running along the forearm are visible as they move at the back of the hand. The fingers must be lifted high to activate the

key, a motion accomplished by using the intrinsic extensors in the hand. Thus, the long forearm extensors and the shorter, intrinsic finger extensors must be simultaneously activated. In many instances, this results in a visible stiffening of the wrist and forearm.

Taubman especially disapproves of practicing these exercises which supposedly strengthen the fingers, believing that they are actually responsible for many injuries. She warns that practicing these exercises may lead to tendinitis, tension, and pain. This is because of the antagonistic motion which inevitably results from such exercises. All the fingers are held down, and one at a time is lifted as high and fast as possible. The weight of the hand is down, yet the fingers must pull upward against this weight. Taubman claims that this motion is especially hazardous with the fourth finger. Lifting this finger just a little immediately moves it to its extreme range of motion since it does not have tendon independence from the fifth finger. Hence, instead of true finger independence, which is the aim of the exercise, feelings of inequality are created. Taubman purports that it is the weight of the forearm lined up exactly behind each finger as it plays that lends a feeling of finger independence, not actions by the muscles of the fingers themselves.¹⁵

Kochevitsky agreed with Taubman in this regard, claiming that strengthening the fingers does not improve their agility. He stated that the fingers already

have sufficient strength for the work of piano playing at birth. He referred to finger strengthening exercises as "unnatural" and "harmful." He further claimed that true finger independence was achieved with the ability to press any key and produce a tone without calling forth muscular tension in nonparticipating fingers. In order for this to be achieved, the entire playing apparatus should be free from tension.¹⁶

Gyorgy Sandor claims that practicing to achieve independence of the fingers is only useful if it is undertaken within the concept of interdependence. He has pointed out that traditional finger independence exercises are practiced due to the perceived unequal strength of the fingers. He states that much of this perceived inequality is a result of uncoordinated use of the playing apparatus. Lining up the fingers with their respective forearm tendons so that the tendon runs in a straight line into the finger and using the upper arm to position the forearm can ameliorate some finger inequality. He asserts that use of finger exercises might possibly be helpful in enhancing coordinated movement, but only if the position and participation of the arm is considered. He bases this belief upon his conclusion that we cannot really strengthen the finger muscles, because it is the forearm muscles which actually move the fingers.¹⁷ His assumption is partially correct; it is almost impossible to strengthen the intrinsic muscles of the finger. However, his assertion that only the forearm muscles act to move the fingers is

incorrect. The fingers are controlled both by extrinsic (forearm) muscles and intrinsic (hand/ finger) muscles.

Anatomical Constraints

Due to the design of the hand, some fingers are stronger than others. Each finger is equipped with flexor tendons, which allow for the finger to be flexed at the joints and pulled toward the palm. The flexor pollicis longus controls flexion of the thumb into the palm. The flexor digitorum superficialis emerges from the wrist and divides into four separate strands which connect to each finger. Since the flexors are attached in the same way to each of the four fingers of the hand, they have little impact upon the relative strength of the fingers. It is instead the extensor tendons which are the cause of strength and flexibility limitations of the various digits.

The extensor digitorum tendon, which is ultimately responsible for extending the fingers, is situated along the forearm. As it passes through the wrist, it divides into three main tendinous strands. On the radial side, the first strand is tied exclusively to the second finger. The second strand directly fines up with and ties to the third finger. The third strand connects to the fourth finger, with a small tendinous slip branching off at the base of the fourth finger to connect to the fifth finger at its base. In addition to this branch off the third tendon

connecting the fifth finger, there is also a branch which connects the third tendon to the second. Therefore, the extensor tendons of the third, fourth, and fifth fingers are interconnected. Though the fifth finger has no independent extensor digitorum tendon, it has its own extensor tendon (the extensor digiti minimi) which contributes to its ability to be raised back up while the other fingers remain in a flexed position. Moreover, the fifth finger gains strength due to its position on the end of the hand where it may be supplemented by forearm rotation. Though also connected to the fourth finger, the third finger has its own strand of the extensor digitorum and can thus still function relatively independently. However, as may be appreciated from the above description, the fourth finger is restricted in its independence. From a mechanical perspective, the fourth finger is inherently weaker than the other digits. This observation is readily appreciated by making a loose fist and attempting to fully extend the fourth finger without extending the other digits. The lack of ability to independently extend the fourth finger has direct bearing upon the finger independence exercise. After all of the fingers have descended onto the keys, the fourth finger lacks the ability to raise itself for the next keystroke as long as the other fingers are held down. The thumb and fifth finger have the greatest ability to apply force because they may be supplemented by forearm rotation. The second finger is the next-strongest finger due to the independence of

its primary extensor tendon, which allows it to be raised for the keystroke. The third finger is next in terms of relative strength, followed by the fourth finger. These observations concerning anatomy lend support to the views of Taubman, Kochevitsky, and Sandor. The fingers are inherently unequal in strength, and attempting to strengthen intrinsic muscles might actually be potentially harmful.

The debate over the appropriateness of using exercises in developing piano technique is ongoing. Despite the concerns about the potential for physical damage and questions about applicability of exercises raised by many pedagogues, the use of technical exercises is still commonplace and widespread. Definitive medical studies investigating whether a correlation exists between practicing technical exercises and developing injuries have yet to be done. However, according to many performance arts medical specialists, empirical evidence suggests that repeated execution of the same passage within a short period can lead to overuse injuries.¹⁸ It seems apparent that overuse may result from using the same muscles over and over.

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