

An Inquiry from an Amateur Pianist

The Letter to the Editor from Matthew Arthur¹ in this issue of *Medical Problems of Performing Artists* asks an important question for performing arts medicine professionals: why haven't we used the scientific method to determine optimal piano technique? More broadly framed, why is technique in most of the performing arts based much more on tradition and expert opinion than on the results of carefully designed scientific studies? There are some obvious answers to these questions, such as the fact that people have been playing the piano for several centuries, but have been using the scientific method to study the performing arts for only a few decades. This has given tradition and expert opinion (handed down through the generations) a huge head start over the scientific method.

Before we go any farther, we should define technique. It's interesting that the Merriam-Webster definition mentions both dance and piano as examples:

*the manner in which technical details are treated (as by a writer) or basic physical movements are used (as by a dancer); also: ability to treat such details or use such movements <good piano technique>.*²

So, the parts that pertain to the performing arts would define technique as "the manner in which basic physical movements are used or the ability to use such movements." Another definition of technique in the performing arts is "the most economical way to produce adequately what the mind conceives artistically."³

Since I'm no expert in piano technique, I asked several people who are to respond to this question. They are (in alphabetical order): Gail Berenson, Professor of Piano at Ohio University and Past President of the Music Teachers National Association; Sang-Hie Lee,

Professor of Piano at the University of Southern Florida; Kathleen Riley, pianist and researcher; and Brenda Wristen, Associate Professor of Music (Piano Pedagogy) at the University of Nebraska-Lincoln. You can read their full responses following Mr. Arthur's letter.¹ In the next few paragraphs, I attempt to summarize their thoughts and integrate their thoughts with mine in a coherent response.

More than one of these chosen experts pointed out that applying quantitative methods to a complex activity whose purpose is to create art and evoke emotion is problematic from the start. While some minimalist styles can be very artistic, most interesting music and dance have a moderate to high degree of complexity that makes scientific study almost impossibly challenging. Since the classical scientific method requires the isolation of a single variable, studying even something as simple as playing a repeated note on the same key at a steady tempo and volume would involve dozens if not hundreds of experiments in order to study each of the variables.

But if it's true that technique may contribute to some cases of performance-related injury, then a systematic examination of technique with the goals of reducing injury and improving performance is probably justified. We may have to make some assumptions and approximations in order to manage the complexity, but lots of complex phenomena are now understood due to the application of the scientific method.

Several articles on instrumental technique have been published in *MPPA*. As early as 1989, Bejjani did a study of one pianist playing the same music using three different hand positions.⁴ Other articles on piano tech-

nique include those of Sakai,⁵ Wristen,⁶ and Riley.⁷ An article on bowing technique by Palac⁸ appeared in 1992, and technique for several ballet moves has been described as well.⁹ More articles have appeared in other journals. However, we're still not close to being able to scientifically define optimal technique for even one instrument or one dance genre.

Are performing artists at a greater disadvantage when it comes to learning proper technique than people in other occupations? An obvious comparison with pianists would be typists, although the two keyboards are sufficiently different that direct comparisons would not be appropriate. The typing keyboard requires less force and much less range of motion. While accuracy is important for both musical and computer keyboarding, pure speed is the next consideration when typing letters and numbers, and artistry isn't a consideration. In some situations, computer keyboards are more adjustable than piano and organ keyboards. Injury rates are lower among typists, with a prevalence figure of 2% in the UK.¹⁰ But scientific studies of typing technique are not abundant,¹¹ and repetitive strain injury remains a significant occupational health problem.

We often turn to sports medicine when looking for models that can be applied to performing arts medicine (and sometimes it's appropriate to do so). Swimming is sometimes recommended as a good form of exercise for instrumental musicians, but it has its own technical requirements. There are four basic swimming strokes with the "front crawl," commonly known as "freestyle," being the most efficient if done properly. Much has been written about freestyle technique, and videos are plentiful on the web. Swimming is

different from playing an instrument—but perhaps more similar to dance—in that the “target” that one strives to hit with one’s arm or leg is not an identifiable point in space. Controversy about the optimal path of arm motion and other details of swimming technique continue to this day. While it’s relatively simple to measure the primary outcome—speed—it’s more difficult to determine the energy used to generate that speed. Despite the abundance of information on swimming technique, casual observation during “lap swim” at any community pool reveals lots of very inefficient techniques.

Running is another common activity that can be done for routine aerobic exercise or at a highly competitive level. It seems simple, just putting one foot in front of the other (quickly). Like dancing, running requires the foot to hit no particular target to when it touches the ground. But a major controversy has arisen in the world of running over the last decade or so: which part of the foot should hit the ground first, the front or the back? The history of this debate is recounted well in *Born to Run*,¹² which draws on several sources of information to tell the story of how running has been an integral part of the evolution of the human species. However, research has produced some divergent results, and the controversy continues.¹³ Overuse injuries associated with running are fairly common, and at least some are likely related to technique.¹⁴

As with swimming, running technique varies greatly in the general public, and the difficult part of doing research on running technique lies in measuring efficiency. Running technique varies according to the distance one wants to run and, to some extent, on the surface on which one is running.

Optimal technique may be better defined for some of these less complex activities compared to playing an instrument or dancing, but even for widely practiced sports, the number of randomized controlled trials of one technique versus another is small; the randomized controlled trial is the “gold standard” for scientifically comparing one intervention to another. The number of randomized controlled trials of technique in the performing arts is vanishingly small, and it’s unlikely that anyone will undertake such studies in the foreseeable future due to a myriad of logistical difficulties. We can and should use other investigative methods to learn what we can about the role of technique in preventing injuries and improving performance, but we shouldn’t expect definitive answers anytime soon.

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Piano Technique

To MPPA Readers—I am an amateur pianist enquiring into improving piano technique but feeling slightly disillusioned by the lack of attention given to technique in the field of piano teaching. And whilst, however, there are many books out there written by great pianists that seem to combine logic, empirical knowledge, and scientific knowledge in a very convincing manner, their assertions are void of being subject to strict scientific investigation and therefore, in my opinion, cannot be treated too seriously.

This is why I have been looking at academic pieces on piano technique in journals such as *Medical Problems of Performing Artists* and have been slowly learning more credible information on technique. I have been able to get hold of a handful of pieces; however, it seems there are in fact hundreds of relevant pieces that have been written. In which case, it seems surprising that none of the books available on piano technique make use of, or reference to, the findings of the various studies and articles.

Is it that there has not been enough consensus between these papers for any valid assertions to be made? Or is there in fact a wealth of valid information to be learnt from the studies, which pianists today can apply with much more faith than what the collections of piano technique books say without much proof or foundation?

Many thanks,

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Replies

Indeed, there are numerous books written on piano technique. Piano technique has evolved from finger technique, to the use of arm and relaxation, to the modern coordination. All three schools are valid, as each was a result of responding to the changing development of the instrument and composers' demands on the sound and body. Unfortunately, some current piano pedagogues still try to favor one school against the other(s).

Luckily, there are a few good books that address the complete piano playing mechanism from finger to brain. The following are scientifically sound and artistically viable books: CPE Bach's essay on the "True Art of Playing Keyboard Instrument" (1753) paved the foundation of finger technique school, but he also addressed the movement of the arm, shoulder and mind. George Kochevitsky's *The Art of Piano Playing* (1967), William S. Newman's *The Pianists' Problems* (1950), Otto Ortmann's *The Physiological Mechanics of Piano Technique* (1929), and Abby Whiteside's *Mastering the Chopin Etudes and Other Essays* (1969) are some of the classics that are useful.

Numerous other good books exist such as by Matthay, Schultz, etc., but there are problems with semantics among various authors that cause confusion. There are also excellent tech-

nique books (music) that are often neglected today: *Exercises* by Isidor Phillip, Alfred Cortot, Brahams, off the top of my head.

The reality is that piano playing technique is all about body-mind coordination rather than precise mechanics. Due to individual differences, the common book-learning is limiting if not impossible. As an amateur pianist developing techniques on one's own, I would pay attention to how the body feels, particularly tension and minor discomfort. In my own research, knowing one's hand biomechanics (size, span, mobility, weight) is posited as a solution to many tension problems.

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Science has given us a number of valuable tools for studying piano technique. By employing scientific thinking and methodology, we can help objectify our observations, yielding findings that are more generalizable and less prone to individual idiosyncrasy. Moreover, the peer-review process by which empirical studies are vetted prior to publication does increase our confidence about the validity of findings. However, studying piano technique from a purely scientific approach is fraught with problems.

First, there is the issue of complexity. The more discrete a task, the more we can define its activity in biomechanical terms. Playing the piano is not like throwing a discus or performing a high jump. The movements are intricate, vary widely according to the demands of the music, and are performed over long periods of time. Studies in which piano technique is examined using objective (scientific) methodology and instrumentation tend to focus on a small, isolated motion made in one particular task (e.g., flexor activity when playing diminished 7th arpeggios) or more global motions that do not vary as much in response to task demands (e.g., force loading of the trapezius over the course of a practice or performance session). Basically, one can see the trees or the forest from this perspective, but not the entire picture. Thus, findings from these scientific studies can be quite difficult to apply to the "real world" task of playing a piece of music at the piano.

Secondly, there is the problem of establishing norms. Given the complexity of the playing task, though we can observe and describe the motions made by pianists using scientific inquiry, we do not have biomechanical or ergonomic norms to compare them to. While we could probably establish norms for each and every isolated motion used in piano technique, playing the piano involves virtually infinite permutations and combinations of these motions into larger movement patterns. This is especially true for the smaller motions made more distally (i.e., hands, fingers, etc.). Simply appealing to anatomic norms doesn't necessarily help us, since most of the injuries that arise from piano-playing result from activity in which normal anatomic limits for range and/or force are never exceeded. Confounding variables include repetitiveness and length of activity, posture, type of musculoskeletal loading (dynamic or static), how force is applied (steady, intermittent, etc), temperature and other environmental considerations, cognitive demands, and psychosocial dynamics.

Finally and most importantly, what scientific criteria should we apply to determine what constitutes a beautiful, exciting, or moving performance? These types of criteria are subjective and can only be experienced and described anecdotally.

Both anecdotal and empirical studies have their limitations, which good researchers understand and acknowledge. One perspective is not necessarily more valuable than the other (though, of course, one must acknowledge that there is good and poor quality work of both types). Rigorous work in each area can offer us valuable information in understanding piano technique. In the end, piano playing comes down to imagining a sound and then using the appropriate technical tools in order to bring that sound forth. Good piano pedagogy attempts to systematically guide students in establishing both the musical/artistic and technical skills to this end. Logic, anecdotal experience, and sound knowledge of scientific principles should all be brought to bear.

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To answer your question, today's teachers are more focused on a healthy, ergonomic approach to the instrument than ever before, with a number of significant books and videos by knowledgeable pianists who have devoted their careers to researching this topic available in today's marketplace. However, you are correct—often the ideas presented have not consistently been “scientifically” scrutinized. While there are absolutes that must be considered when teaching technique (laws of physics, biomechanics of the body, and the mechanics of the piano), how each individual interacts with all of those absolutes is unique, requiring teachers to customize what is said to each student. As a pianist helping my students expand their artistry, I feel it is important to teach the basic principles of healthy technique, but try to avoid teaching them in a vacuum since every gesture is so interconnected to sound production. Technique serves as the tool that allows each individual to express the emotion of the music. Having a good technique allows the movements we engage in to generate the appropriate sounds and to also enable the performer to effortlessly communicate the composer's vision. Effortlessness is the key to spontaneous and artistic musicality.

It is difficult to place scientific measures on artistry. As you stated, many pianists who author books are presenting “logic, empirical, and scientific knowledge” that often has not undergone scientific testing. However, I feel there is a great deal of consensus today amongst pianists and pedagogues about what constitutes a healthy, effortless technique. For many, this information, combined with an individual's own experiences,

provides more than sufficient guidelines to develop a natural approach to the instrument. New technology is providing more insights and scientific verification. Technology using surface electromyography has recently become available to provide a way to scientifically assess the efficiency of our technique with equipment that monitors the degree of physical tension held in targeted muscles as we perform (see *MTNA eJournal* Sep 2010 and Apr 2011). This can provide a window into the body to confirm how effortlessly we are working. As more medical professionals and research-oriented pianists seek validation of effective technique, more scientific studies will likely emerge. Regardless of the approach we choose, the effectiveness of good technique will still be judged through performances that display effortless artistry.

As you mention, there are many outstanding pianists writing and lecturing on the topic of piano technique. As an example of an article you might find useful, consider accessing one of MTNA's (Music Teachers National Association) “Ten Essential Skills” articles—“Essential Skills for Promoting a Lifelong Love of Music and Music Making: Developing the Fundamental Skill: Healthy, Injury-Preventive Technique,” written by Barbara Lister-Sink. Available at: <http://www.mtna.org/publications/american-music-teacher/essential-skills-series/essential-skills-part-2/>.

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Several studies have shown a correlation between body alignment/hand position and efficient use of muscles (Riley et al., 2005, 2010, 2011). The 2005 article in *MPPA* correlates surface electromyography (sEMG), video, and MIDI data tracking improvement with changes in hand position. Improper alignment can result in high sEMG readings of muscle activity. Without trained release of such levels of activity, continued practice can result in overuse injuries. The sEMG graph shown below displays symmetry of recruitment between left and right extensor muscles during playing, and during rest phases the muscle activity returns to baseline.

As Carl Seashore stated in the 1930s, the only two parameters that can be controlled on a keyboard are timing and velocity. In his book, *The Capture of Inspiration*, E. Robert Schmitz gave a very detailed list of every muscle involved in playing the piano and how it should be used. Schmitz defined technique as “the most economical way to produce adequately what the mind conceives artistically.”

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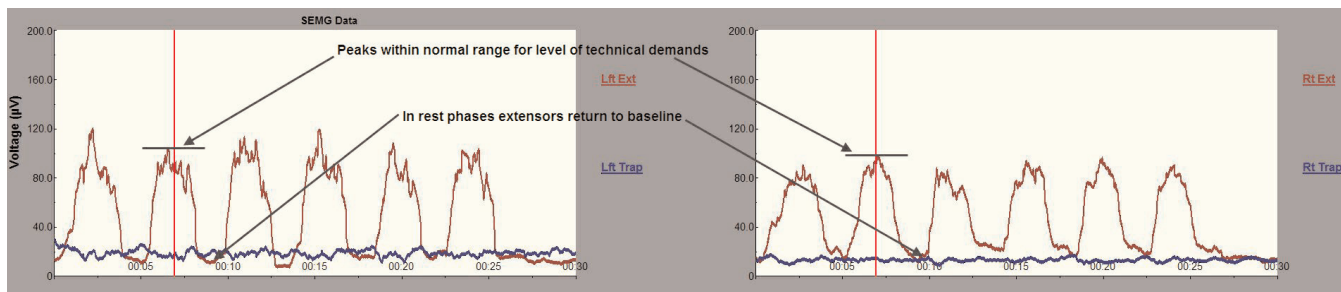


Figure. sEMG showing recruitment of left and right extensors during playing and rest. (see Riley).