Abstract and Keywords

This intellectual-social history of Maelzel’s technology challenges current views that automatic metronomes are, and have always been, universally accepted indicators of an absolute a priori musical beat. Rather than focusing upon the exactitude of historical tempo technologies, this study seeks to answer the larger reasons why ticking machines became the prevailing indicators of musical movement in western educational, compositional, and performance practice traditions. Primary source evidence uncovers that historical attitudes toward metronomes were unlike those of modern-age pedagogues and performers. By contrasting accounts from Maelzel’s and Beethoven’s age with those of modernist musicians, it is shown how a new cultural trend emerged in which automatic metronomes transitioned from limited musical pulse references to essential regulators of a scientifically objective, mathematically reproducible tempo. Ultimately, this survey reveals a cultural paradigm shift, a metronomic turn in the way automatic tempo technologies have come to inform and influence the values underlying musical temporality and musicianship itself.

Keywords: metronome, rhythm, meter, tempo, time, technology, movement, pulse, performance, regulation, modernity, automatic, Maelzel, Beethoven, pedagogy, education, mechanical, precision, objective

1. Metronomes and Musical Culture over Time

To approach the topic of metronomes in historical and cultural contexts, one must first disregard boilerplate definitions that describe these technologies as innocuous “devices that measure the correct time in music.”¹ The connection between musical temporality and clockwork machinery has not been as absolute or unvarying as such statements suggest. Over the course of history, the changing values placed upon metronome technologies reveal complex meanings of musical temporality, both in theoretical and practical terms. Not merely tools to define and dictate tempo, metronomes reflect changing western ideals about musical motion in ways scholars and performers are only beginning to recognize.²

Metronomes are forever intertwined with theories about rhythm and meter, performance practices, music pedagogy, aesthetics, and the history of time telling itself. They act as prisms with which musicians, educators, and theorists express the aims of musicality in
Metronome

their own times. These machines and their indications therefore cannot be wrested from culturally specific educational, performance, and compositional practices. Indeed, the metronome’s history is more accurately the history of musicians’ relationships to metronomes. The present study is an initial attempt to provide a broader historical approach to this exceedingly commonplace technology, one now familiar to nearly every student, researcher, and practitioner of music in the western tradition.3

Previous metronome histories have tended to favor narratives of unstoppable technical advancement, in which Maelzel’s clockwork machine is cast as a mechanical savior that stamped out the vagaries of tempo forever. But such narratives omit more complicated tensions, readily found in stinging critiques and concerns about the clockwork technology’s undesirable impact upon traditional musical culture.4 The ticking of metronomes, as stated throughout the nineteenth century, did not reflect historical truths about tempo—instead, clockwork sound imparted new meanings to musical time itself. Throughout much of the nineteenth century, the efficacy of all tempo machines was seriously questioned. At times they were heard to benefit or diminish (or even destroy) qualities of tempo, pulse, meter, and rhythm in traditional musical contexts.

Tempo scholarship must therefore seek to include intellectual and social histories, focusing on the myriad ways in which musicians have received, used, and reacted to these automatic-beat technologies across time and place. It is a discussion heretofore absent from the standard scholarly and pedagogical discourse, overly focused on discovering (then prescribing) the “right” MM number in Beethoven’s symphonies or uncovering the exact functioning state of his metronome. Yet speculations about the precise indications and working order of Maelzel’s once novel technology cannot sufficiently explain any nineteenth-century composer’s complete intentions regarding musical time. The search for one authentic metronome indication has more to do with what modern culture desires rather than what nineteenth-century composers actually intended or asked for when performing their works. Since the twentieth century, scholars’ and pedagogues’ metronome use largely reflects—not Beethoven’s full intentions but our values and our needs for ever-greater exactitude, precision, and objectivity in musical time and performance practices.

Beyond asking such superficial questions as “What is the right metronomic tempo for such-and-such a composer in such-and-such a composition?” the more pressing inquiries that performers, educators, and scholars should be concerned with are these: How did a ticking machine ever become a universally trusted indicator of musical movement in the first place? Why does the sound of automated clockwork hold so much relevance in performance and compositional endeavors today? Or, in other words, how did a continuous mechanical beat ever become so highly regarded in the human activity of music making?

In seeking answers to these questions, this roughly 200-year survey reveals a cultural paradigm shift, a metronomic turn in the way automatic tempo technologies have come to inform and influence the values of musical temporality. This broader historical approach challenges any claim that clockwork and digital metronomes are merely the objective indicators of an absolute, objective musical beat. More accurately, our now ubiquitous
Metronome

metronomes are supporters of a culturally contextual belief system, an aesthetic of musical pulse and movement particularly suited to our age and for our time.

1.1 Telling the Metronomic Time

By positioning these automatic technologies in relation to past rhythmic theories and practices, it is apparent that metronomes are not a priori indicators of historical musical movement. Indeed, notions of musical meter, rhythm, and pulse existed well before precisely ticking clockwork technologies were readily available to musicians. Metronomes did not originate the idea of tempo despite the fact that they are the predominant tempo references in current compositional and performance practices.

Modern metronomes tell their own kind of musical time, which must be learned to be accepted. As contemporary educational methods verify, performing and practicing with the consistency of continuous clockwork rhythm is not innate or immediately intuitive to the musical mind. All musicians can attest to the fact that playing to the metronome is an acquired practice; thinking about musical movement in beats per minute (BPM) is an acquired knowledge. If the clockwork metronome and its indications were the only way to define and dictate musical time, there would have been no understanding of rhythm or tempo prior to 1815, the year Maelzel patented his device across Europe.

Every time-telling machine, Maelzel’s clockwork metronome being one among many, imparts a specific quality and meaning to the notion of temporality. The value placed on these time-telling qualities changes due to host of sociocultural and historical factors. (Who reads time from a sundial today? Who can even find a sundial today?) Despite falling out of popular favor, a sundial charts the daytime differently than a digital clock. A sandglass tells duration differently than a stopwatch. And an automatically clicking metronome tells musical tempo differently than a swinging pendulum or even a person’s heartbeat.

Modern time-telling devices are discernibly more precise temporal indicators than historical alternatives; their motion is more constant, perpetual, and divisible into smaller equal units (the very meaning of precision). But precise time telling doesn’t necessarily mean better time telling. It does, however, mean different, more exacting time telling. The digital clock is not a truer depiction of the time of day than the sundial. The metronome click is not a more correct indicator for historical music than the living heartbeat, or a walker’s stride, or a swaying arm. Through an automatic beat, modern metronome technologies make musical time concrete, objective, and repeatable. It is a beat that, while beyond personal idiosyncrasy, is not always desirable in every historical or creative context. If anything, the modern metronome is overly precise in relation to historical theories and practices of musical movement.5

A perpetually ticking machine is but one reference among many technologies and techniques that might aid in the understanding and recreation of musical pulse and movement. An automatic metronome is not the best or most sufficient reference for all repertoires. It is merely the machine that modern culture wishes to place its faith in for the
specific type of tempo it tells—a tempo once heard as being distinctly artificial as opposed to naturalistic.\(^6\) Metronomic tempo regulation was not always so highly regarded by many nineteenth-century instructors, who believed an external reference to musical time should be as simple and silent as possible. According to *Church’s Musical Visitor* in 1882: “The real use of the metronome, of any or all descriptions, is to *indicate* the speed of the movement. A few swings of the tape or pendulum are quite sufficient for this purpose. No good musician will need or use [Maelzel’s clockwork metronome] for ‘keeping time.’ ”\(^7\)

If the modern metronome is considered a better tempo-telling device today, it is only because we choose to believe (or are educated to believe) that it’s better for our present musical circumstances. Although the history of time telling cannot be addressed at any length here, suffice it to say that precise time telling machines are made necessary in a precisely ordered, rapidly moving, and globally connected world—a synchronized world of train and flight schedules, of radio and satellite communication systems. The kind of time telling modern society requires tends to correspond with the activities and working processes of our modern scientific-industrial age.\(^8\) An observation from a 1920 *New York Times* article still rings true:

Modern life is run on a timetable. The stop watch is perhaps the most typical modern invention, because it symbolizes the infinite subdivision of time that has come in since the industrial revolution... Really precise time telling has not been needed in the world until within a few years [before 1920]... It would be hard to run the Twentieth Century on a sun dial.\(^9\)

Western civilization became acculturated to automatic time-telling technologies in order to meet pressing scientific, social, political, educational, and economic needs. The modern musical landscape has undergone a similar acculturation with metronome technologies, which help to fulfill distinctly modern pedagogical, aesthetic, and cultural requirements that have arisen within the last century. This technological acculturation reflects a *metronomic turn* in western music making: During an age when “really precise” time telling came to fruition, new generations in modern society began to value Maelzel’s clockwork metronome for its more precise sonic regulation of the musical beat. Evidence for this metronomic turn appears across a multitude of modern-age compositions, educational methods, and performance practices. It would be hard to run twentieth-century musical time on a simple pendulum.

### 2. A Critical Reception of Maelzel and His Machines in the Nineteenth Century

To understand the tempo intentions of Beethoven and other nineteenth-century composers more fully, scholars and performers should account for the role that automatic machines played in nineteenth-century society. When guided by these larger technocultural issues, we find that historical musicians’ relationships and attitudes toward metronomes...
were unlike those of present-day scholars and performers. Indeed, many skilled nineteenth-century musicians placed far less value or attention on metronome numbers than current-day musicians might assume. Recent scholarship suggests that any search for a precise, replicable metronomic tempo in historical compositions, including Beethoven’s, will fail to yield wholly meaningful answers, because many renowned musicians of premodernist traditions considered that the notion of a mechanically precise, automatically driven tempo ran counter to the aesthetics of good musical performance.

One neglected path in understanding musicians’ ever-changing relationships to tempo machines can be found by way of Johann Maelzel’s biography. Maelzel’s life as a mechanical showman, illusionist, and entrepreneur is not incidental to his desire to establish a universally acceptable standard for musical time based on clockwork automation. A more inclusive study of this occasional Beethoven collaborator yields insights into the novel, occasionally foreign, and decidedly artificial machine culture he promoted to many musicians and nonmusicians alike.

Despite his zeal in promoting a metronomic system of tempo to composers across Europe, Maelzel (1772‒1838) was most recognized during his lifetime as a displayer of automata—self-moving clockwork machines, usually in the shape of man or beast. Some “played” music through pinned barrels that contained rotating, repeatable music programs, a technology similarly found in music boxes. Maelzel’s automata shows were for many Europeans and Americans the first glimpse into a technologically developing world, where automated objects replicated actions once thought to be exclusive to living beings.10 His most famous music-playing machines were the automaton trumpeter, which in 1837 was reported to be “the size of a man; and whose clarion notes cannot be equaled by those of any living performer,”11 and the Panharmonicon, a massive pinned-barrel contraption, best known today as the machine for which Beethoven composed Wellingtons Sieg Op. 91. Maelzel championed automatic sound and artificial motion well before western society utilized the many self-moving machines so commonplace today, such as automobiles, factory conveyor-belt systems, wristwatches, and even metronomes.

In the nascent Industrial Age, reactions against Maelzel’s automaton musicians were to be expected. The drastic distinction between mechanical and living performance seemed obvious to many, since clockwork sound and motion failed to express the variable and volatile nuances of musicality. Reacting to one mechanical performance display in 1818, a Times reviewer said that Maelzel’s automaton trumpeter, despite its fine technical qualities of articulation and speed, “fails only in expression, and in the swell of the note, a defect which is common to all music produced by mechanism.”12

The automaton trumpeter’s expressionless performance practice was largely immaterial to early audiences. Since European bourgeoisies heard the limited capacities of musical clocks and barrel organs in many urban and domestic settings, the unmusicality of machines was well known to early modern society. (It is worth recounting that Christiani labeled any performer in command of technique alone a “virtuoso of the music-box kind.”13) But because many of Maelzel’s automata were music boxes masquerading as living be-
ings, they became standard tropes to explain lifeless, uninspired, or dull performers. For example, George Templeton Strong expressed his disdain for a human musician, writing in 1842, “Maelzel’s automaton trumpeter has full as much expression. [The singer Charles Braham] looks as if he were some great piece of clockwork wound up before the commencement of the concert, and made to work itself into the room and emit musical sounds and then stalk out again at intervals.”

For Strong and others disenchanted with the superficial music of self-moving machines, Maelzel’s automata emblematized all that was unmusical. A lifeless human performer behaved and sounded merely as “clockwork.” Strong’s description is germane when considering Maelzel metronomes, since spring-driven clockwork motivated both his automaton trumpeter and musical timekeeper. Indeed, nineteenth-century criticisms of the clockwork tempo machine closely resemble those of Maelzel’s other music-emitting automata. In an early critique from October 1817, an anonymous British musician explains the distinction between the metronome rhythm and the tempo of the living musician:

The constant loud ticking which it makes at every beat, though perhaps esteemed an advantage by some, who cannot measure equal portions of time in their mind, is disagreeable to those who have a real feeling for music, and will render those who use it constantly, too mechanically uniform in their performance, as it will not permit that judicious acceleration and retardation of the time according to the genius of the passage, in which a great deal of the expression evinced by a performer of taste consists.

Explained above is a premodern epistemology of musical time that stipulates the expressive authority of the performer, over and beyond the objective certainty of any mechanical reference. The writer relates a common performance practice in which tempo is an expressive characteristic, not a mechanical precision, one that fluctuates by the phrase, rhythmic gesture, and harmonic progression. It is a musical time guided by creative will and intellect. Musicians’ true tempo is to be found “in their minds.” This 1817 comment should not be mistaken as an extravagant call for rubato, or some newly romanticized and affected performance practice. (For reference, in 1817 Beethoven’s Symphony no. 8 was premiered in Vienna. And Antonio Salieri (1750–1825), another original endorser of the metronome, remained an active composer at this date.)

Described above is not the “theft of time” but a nonmetronomic—rather a premetronomic—conception of nuanced musical movement. In rejecting a performance practice that is “too mechanically uniform,” this anonymous musician upholds, like so many others throughout the century, a nonautomated species of musicality. “In truth,” A. B. Marx similarly explains, “music is little concerned with the mathematically exact division of quarters. Her object is to excite and to manifest the emotions of the heart and of the soul.” The prevailing musical aesthetic in Maelzel’s own century ran counter to any strict tempo regulated by Maelzel’s clockwork metronome.
Hector Berlioz also implied that musicians adhering to Maelzel’s metronome would exhibit strange qualities, perhaps reminiscent of a lifeless android. “I do not mean to say... that it is necessary to imitate the mathematical regularity of the metronome,” he states in A Treatise on Modern Instrumentation and Orchestration, “all music so performed would become of freezing stiffness, and I even doubt whether it would be possible to observe so flat a uniformity during a certain number of bars.”

According to Berlioz, any performer attempting to adhere to the metronome—it seems that such a practice was nearly impossible to achieve during the age—would exhibit an uncanny performance practice, a behavioral state resembling Maelzel’s chess-playing Turk or automaton trumpeter.

Other critics heard rhythmical tyranny in the clockwork invention, one that especially influenced musical novices. In 1840 the Musical Magazine suggested that when the metronome was used, “for the mere purpose of learning to keep time, [Maelzel’s metronome] would take away the spirit of the pupil’s performance, making it a mechanical affair, and him, if he succeeds in conforming to it, a slave of time.”

Just as Maelzel’s trumpeter was a spiritless musical machine due to its invariable clockwork construction, the music student seemed a mindless slave under the invariable clockwork sound of Maelzel’s metronome. This recognition extended into the next century, as Rachmaninoff concluded, “The most mechanical playing imaginable can proceed from those who make themselves slaves to this little musical clock.”

An odd metronomic effect was recognized soon after European publishers, who catered to a growing wave of amateur music consumers, added MM numbers to their latest editions with little to no concern for a composer’s actual tempo intentions. This editorial trend, which Schindler called “professional metronoming,” was especially prevalent in Beethoven’s publications. Schindler scorned, “To hear these Sonatas [specifically Beethoven’s Op. 27] according to the metronomic signs affixed to them leads one to wish that all pianoforte metronomers were put under the ban.” He called such editors “perverters of all truth in expression [whose reinterpretation] threatens soon to bring all genuine music under the domination of the superficial—if, indeed, it has not already submitted to that authority.”

According to Schindler, the metronome’s influence on performers was so strong that it reduced the volatile rhythmical qualities inherent in Beethoven’s compositions. In the Life of Beethoven, Schindler expressed a crisis in performance practices: “It must be borne in mind that Beethoven’s instrumental music has undergone a metamorphosis.” He stressed, “it is necessary first to acquaint the reader that this metamorphosis relates wholly and solely to metronomising, or the regulation of time by means of the metronome.”

Metronome numbers and metronomic beats were antithetical to Beethoven’s deeper musical intentions, Schindler concluded: “Let Beethoven’s pianoforte works be played according to the new metronomic directions, and it will soon be perceived that no more opportunity is left for feeling and expression that the most rapid fingering affords; and that this rule extends even to the execution of the Adagio.”

Schindler’s observations should be taken under serious consideration by anyone seeking the “exact truth” behind Beethoven’s metronome indications. Despite untrustworthiness
in other biographical matters, Schindler’s claims about the metronomic effect were echoed in many sources throughout the century.\textsuperscript{26}

Nineteenth-century conductors who lacked the skills to shape musical time expressively were especially chided when behaving like metronomes.\textsuperscript{27} In 1894, a \textit{New York Times} reviewer described a concert where “there were hardly any nuances of tempo at all. Mr. Damrosch beat off the measures like a metronome, and the orchestra, following his lead, played like an assembly of artisans.”\textsuperscript{28} Directing with a redundant metronomic rate seemed more appropriate for the factory floor than the concert stage. The inexorable pace of automatic machinery could not reflect the supple flow of musical time, according to an outspoken \textit{Harbinger} critic, who in 1847 scolded anyone who mistook metronomic regulation for a composer’s deeply considered musical intention:

\begin{quote}
Let no orchestra attempt to play very fast, which is obliged to be merely mechanical in its playing; in which there is not a pervading feeling of the composition which dictates to every instrument, by a simultaneous instinct, when to retard a little, and when to accelerate. No strict time-keeping by Maelzel’s metronome can possibly produce a piece of music as it existed in the composer’s mind, or fail to sacrifice its life and glow and meaning; and consequently that swift railroad speed, which does not yield to all the varying impulsations of a controlling feeling, will express as little as a rapid locomotive with a long train of dirt cars after it.\textsuperscript{29}
\end{quote}

For many others in the century, the ticking of Maelzel’s metronome, while failing to project the subjective, sensory qualities of musical movement, more accurately reflected the stark mechanical rhythm propelling the Industrial Age.

Ignacy Jan Paderewski (1860‒1941) was one of the last prominent performer-composers to relate the incongruity between an automated metronomic beat and traditional aesthetics of musical time, stating, “To be emotional in musical interpretation, yet obedient to the initial tempo and true to the metronome, means about as much as being sentimental in engineering. Mechanical execution and emotion are incompatible.”\textsuperscript{30} A few musicians even perceived how Maelzel’s automata career directly extended to his metronome. Constantin von Sternberg (1852‒1924), a former student of Liszt and dean of American music pedagogues, found the clockwork metronome to reflect the same qualities witnessed in Maelzel’s other self-moving machines. He offered this damning assessment in 1917:

\begin{quote}
How any musician could ever play with a metronome, passes my humble understanding. It is not only an inartistic, but a downright antiartistic instrument. In order to prove this and to explain the vogue it has had in spite of it, we must regard the inventor a little closer and consider the time in which the misfortune of his invention happened…. He “learned” music, but never played in public or composed anything. He did not even teach music, but only “gave lessons.” How much his pupils could have learned from him we can infer from the fact that he spent all his leisure time upon things that go against the very grain of every one who loves music. He constructed all kinds of mechanical instruments, such as an automaton
\end{quote}
Such bold statements by Sternberg and Paderewski might suggest a quick and lasting death to Maelzel’s metronome in the twentieth century. But modern practices show the opposite to be true—metronome technologies are used now more than ever in pedagogies, research methodologies, and compositional practices. Yet if so many performer-composers—including Liszt, Brahms, Wagner, and Saint-Saëns—expressed such serious reservations about the use of Maelzel’s metronome, why have these machines pervaded musical culture so deeply and with such lasting impact? The answers have less to do with advances in metronome technology than with the new importance modern musicians’ placed upon the metronome’s specific brand of artificial, automatic tempo.

3. Metronomic Tendencies Since the Twentieth Century

The notion that automatic metronomes can completely define and dictate an absolute standard of musical time reflects a drastic aesthetic paradigm shift in modernity, a metronomic turn for western musical culture. Paderewski once derided “the tempo sticklers and metronome believers,” but with the move into modernity, these “believers” further asserted that “good rhythm” and the “exactly right” tempo of long-since departed composers were attainable through a now-desirable ability, using Herbert von Karajan’s phrase, to “sustain the metronome.”

In this profound and lasting paradigm shift, mechanically aided and regulated behavior became seen as virtues rather than vices of individual human activity. This general trend emerged from around 1890 to 1920, when proponents of a scientifically oriented view of time and motion, one diametrically opposed to past aesthetics, regarded automatic metronomes as being both beneficial and necessary indicators of accurate, efficient, and “normal” personal behavior. These new attitudes first gained traction through an influential community of experimental psychologists who devised some of the first “time studies” to quantify rhythmic action in a host of human endeavors. Through these scientists’ research, metronomic regulations came to inform activities as far ranging as factory work, typewriting, handwriting, yoga breathing, and stage acting.

It was an age when mechanical progress was thought to parallel societal progress, and a new wave of teachers were convinced that a scientifically informed, mechanically assisted education was essential for the modern-age musician as well. These educators, guided by the latest scientific ideals, began to revise what good rhythm and tempo meant for musical culture at large. By surveying modernist pedagogues’ newly acquired attitudes about metronomes, many justifications arise for the way our contemporary culture continues to use tempo machines in music research and training today. It was only in the past century that the use of metronomes transitioned from mere occasional references of mu-
sical time to essential regulators of a scientifically objective, mathematically constant, and mechanically reproducible tempo.

### 3.1 The Scientific Influence: Mechanizing the Concepts of Tempo and Rhythm

Evidence shows that the rhythm and pulse of late-nineteenth-century scientific research ran counter to traditional musical sensibilities. To take one example, researcher Thaddeus L. Bolton worked to derive the latest rhythmical laws for performance culture, stating in his *American Journal of Psychology* article “Rhythm” (1894) that “Perfect time is the result of the application of scientific methods to music.” Experimental psychologists’ laboratory findings yielded tempo “truths” that seem completely incommensurate with music theories from centuries past, as Bolton’s definition makes clear:

> This general principle may be stated: *The conception of a rhythm demands a perfectly regular sequence of [external, metronomic] impressions within the limits of about 1.0 sec. and 0.1 sec. A member of the [external, mechanical] sequence may contain one or more simple impressions. If there are a number of impressions, they may stand in any order of arrangement, or even in a state of confusion, but each member of the sequence must be exactly the same in the arrangement of its elements.*

To attain this explanation, Bolton used a telephone apparatus, far more precise than a store-bought Maelzel metronome, which transferred clockwork clicks directly to the subject’s ear—an early example of automatic click-track technology devoid of any physical movement indicator. (History shows that scientists—not professional musicians—are usually the first to incorporate precision time-telling apparatuses into their working methods.) Like most experimental psychologists—who seemed completely unconcerned by the intentions or compositions of Beethoven, Berlioz, or Brahms—Thaddeus Bolton followed a trend set forth by the father of his field, Wilhelm Wundt (1832‒1920), who in 1875 established the first laboratory devoted to experimental psychology at the University of Leipzig. For his own studies Wundt too required a more precise and constant metronome. So he took a standard Maelzel model and retooled it with battery power and a louder bell indicator. An illustration of this important laboratory tool appears in his widely printed *Lectures on Human and Animal Psychology*. Using his state-of-the-art tempo clock, Wundt considered rhythm, and by extension musical time, inherently mechanistic and highly automatic. He explains:

> With rhythmical movements... their significance for the psychological development of time ideas is due to the same principle as that which gives them their importance as physiological organs, namely, the principle of the isochronism of oscillations of like amplitude.... Every single period of oscillation in such a movement is made up of a continuous succession of sensation which are repeated in the following period in exactly the same order.
Wundt described a human moving perfectly in time as someone behaving like a well-regu­
lated automaton. Guided by these pro-mechanical beliefs, he and his followers actively re­
formulated the basic values of musical temporality. Now accurate rhythm was something
intrinsically, a priori, metronomic.\footnote{39}

By the second decade of the twentieth century, experimental psychologists’ newly found
laws had pervaded other academic and educational disciplines. The career of experi­
mental psychologist Carl Emil Seashore exposes this influence all too well. Through his exten­
sive writings, Seashore prescribed ever-greater scientific ideals about rhythm, time, and
motion to a modern musical readership. In the \textit{Musical Quarterly} article “The Sense of
Rhythm as a Musical Talent” (1918), Seashore’s “musical talent” was predicated on
metronomic reaction and response. Intending for these laboratory-derived laws to replace
traditional musical aesthetics, Seashore stated: “First, the capacity for rhythm rests upon
certain fundamental powers which can be measured serviceably in various forms by
methods now being introduced through experimental psychology.”\footnote{40} He then related ver­
batim the technoscientific truths about tempo first devised in Wundt’s laboratory:

\begin{quote}
There are two fundamental factors in the perception of rhythm: an instinctive ten­
dency to group [objective, metronomic] impressions in hearing, and a capacity for
doing this with precision in time and stress. The subjective tendency is so deeply
ingrained, on account of its biological service, that we irresistibly group uniform
successions of sound, such as the tick of the clock, into rhythmic measure.\footnote{41}
\end{quote}

Seashore, who was firmly under the sway of Wundtian philosophies, believed that promis­
ing music students should gain access to metronomic laboratory equipment in order to
test their “precision in the time of rhythmic action.”\footnote{42} Considering such rhythmic action
to be the a priori standard of musical behavior, he dubbed professional performers’ occa­sional alteration from the metronomic beat—a performance practice he could not realistic­ally deny—the “Artistic Deviation” from “the pure, the true, the exact, the perfect, the
rigid, the even and the precise” in mechanically objective time.\footnote{43} What nineteenth-centu­ry musicians understood as artistry was now defined against the metronome as psycho­logically deviant behavior:

It was Seashore’s teacher, E. W. Scripture, an early Wundt acolyte, who urged many in
America toward a more metronomic and precise musicality in his popular text \textit{Thinking,
Feeling, Doing} (1895). Even though typical musicians lacked the state-of-the-art time dic­tating and recording equipment found in his Yale psychological laboratory, Scripture had
indeed recognized the increasingly familiar tool currently transforming average students
into scientists’ brand of “successful player”—the performer with the lowest levels of per­
sonal rhythmical variation who behaved with the most measurably precise tempo. It was
the machine indispensable to experimental psychologists in their own laboratories, as
Scripture explains: “By practice with the metronome successful players are able to re­
duce their $MV$ [mean variation, i.e., individual rhythmic idiosyncrasies] till it does not dis­
turb the playing. It is not known just how far this may be carried, as no one has ever tak­
en the trouble to make accurate measurements.”\footnote{44}
With continued use of clockwork metronome at home, the modern musician could finally enjoy the “success” that Rachmaninoff and Paderewski abhorred, namely the metronomic effect. Here was Schindler’s metamorphosis by the metronome, now recast as benefit in a new science of musicianship. In experimental psychology, the metamorphosis was welcome—Maelzel’s metronome helped to solve the scientific problems of musical-temporal deviance.

New scientific attitudes about rhythm and motion found their way into novel music pedagogies, which endorsed mechanically objective training and performance goals. In the *Musical Visitor* (1896), M. L. Karr proclaimed how Maelzel’s metronome “encourages precision, promptness, and accuracy—nay, insists, with its strenuous monotony, on all these.” Karr noted how its click tempered the many volatilities of human performance. “It is self that must be conquered, spasmodic, nervous, untutored self, before anything can be done in public,” said Karr; “and this calm, unemotional, logical little ticker is a support beyond words in the battle.”

Another early American champion of the machine, E. M. Bowman, reiterated in *The Essentials of Music* (1910), “The metronome will give you an exact standard of meter and rhythm, and help to train your sense of time.” Citing automation as an essential factor in music education, he states, “The metronome is a cold-blooded machine. It works the same way every day. It never gets excited or discouraged. It does not balk or run away.” In the following decades, others voiced the modern attitude that clockwork tools best instilled musicians with an objectively precise, scientific understanding of temporality. “I cannot urge too strongly the constant effort to play in time,” wrote piano teacher Harriette Moore Brower in 1920, “we must have a just sense of the mathematical values of notes.” Brower plausibly asserted, as did Seashore, Bowman, McLaughlin and Karr, that the only way to play with a desirable mathematical-metronomic consistency was to practice constantly with a metronome.

Modern educators’ new stance about musical time and technology can be assessed through A. B. Marx’s starkly oppositional comment: “In truth, however, music is little concerned with the mathematically exact division of quarters... the approximative directions of the composer are appropriate for her and true to nature, than metronomic exactitude.” By comparing these contrasting attitudes, we find that not only had the musical times changed but beliefs in what musical time ought to be had changed. The tyranny once despised in metronomic regulation was now to be encouraged. “The only way to have a metronome in one’s head, that is, to have a thoroughly grounded sense of rhythm,” Brower intimates in 1920, “is to make good use of this valuable little monitor. Let us stand up for this tireless little ‘policeman.’ ” A welcome policeman to some, a cold-blooded machine to others, the clockwork metronome and its mechanical pulse undoubtedly grew in stature for the typical twentieth-century musician.

The trend was clear. Paderewski’s derided “metronome believers” were gaining ground in modern society, beginning to refashion the aesthetics of musical culture at large. Mechanical execution was no longer incompatible with performance practices as the nineteenth-
century-trained pianist first believed; through modern pedagogies, metronomic time was quickly becoming the first principle of musicianship itself. The promotion of automatic tempo standards continued with increasing rigor throughout twentieth-century music instruction. In his preface to Mikrokosmos (1926, 1932–1939), Bartók calls for students to gradually acquire metronomic accuracy—using what had become, by the time of his publications, a commonplace fixture in musical training. Bartók instructs, “As progress is made, deviation from the [metronomic] tempo given should not be encouraged and in the fifth and sixth books the [metronomic] time indications must be adhered to.” Exercises in adhering to metronomic tempi continue to be promoted, perhaps more strongly than ever, in many popular “classical music” pedagogies today—including the Suzuki Method and Jaques-Dalcroze’s Eurhythmics—which incorporate recorded or computerized click tracks (or music continuously regulated by click tracks) at the elementary stages of performance training. These pedagogies are meant to instill a highly standardized sense of automatic rhythm, which students customarily apply to eighteenth- and nineteenth-century repertoires. Moscheles’s past assessment, “the musical world knows that marking time by a metronome is but a slight guide for performers and conductors,” is a universal truth no longer.

3.2 The Anachronism of Modernist Metronomic Scholarship

In the first three decades of the twentieth century, modern-age educators, scholars, performers, and composers cultivated a more precision-driven musical world than the one familiar to Moscheles and Beethoven. It was a world in which metronomic indications went beyond being meager pulse guides to become far more absolute tempo regulators. In this light, the professional metronoming of past compositions (a practice once despised by Schindler) gained greater validity, especially in twentieth-century academic circles. Affixing anachronistic MM numbers to compositions predating Maelzel’s technology became standard practices for modern scholars seeking precise tempo solutions to a range of Baroque music compositions. Research by Borrel (1928), Harding (1938), and following on to Schwandt (1974, 1977, 1980), displays a penchant for metronomic quantification not entirely dissimilar to early scientific time studies. Although metronomic tempo translations proved to be efficient, standardized ways to describe musical movement in the twentieth century, scholarly metronome data occasionally reifies historically stated practices by either denying or dissociating the embodied notions of mood, rhythmic nuance, and rhetorical gesture from music temporality. Often lost in modernist tempo scholarship is evidence suggesting how musical time in practice seldom conformed to one correct, universally accepted tempo over an entire work or genre. Indeed, modern metronomic precision was a separate matter from many historical conceptions of music meter and rhythm. Past theorists seldom considered music temporality as being motivated by a constant clockwork rate. As described by Mersenne, Couperin, Quantz, Rousseau, and others, music moved and flexed through a multitude of local rhythmic events corresponding to metrical pulsation, harmonic motion, physical gesture,
stylistic conventions, and the musician’s temperament—what experimental psychologists called “deviance” from the metronomic norm.\textsuperscript{52}

Under a metronome-centric methodology of historical tempo research, modern scholars often arrived at anachronistic and pseudoscientific laws for musical pulse and meter. Indeed Curt Sachs proclaimed in \textit{Rhythm and Tempo} (1953): “Ours is a mathematically counting notation” in which “the quarter note is our motor unit” of musical time.\textsuperscript{53} Sachs consistently described meter and rhythm through additive or divisive formulations. It is again worth recounting that A. B. Marx and Berlioz made the diametrically opposed assertion a century prior: historical musical time is not actually mathematical. Sachs’s brand of musical time more closely allied not with historical theories or practices but with the metronome-endorsing scientists, pedagogues, and avant-garde composers of his own uniquely motor-driven age.

\textbf{3.3 Metronomic Tempo as the Modernist Objective}

When trends in musical pedagogies change, musical performance and compositional practices soon follow. Modernist composers’ views about “good rhythm” and “exact tempi” further uncover the mechanistic values in musical time that Sachs considered operative throughout much of western musical history. The ideal of objectivism in performance became a very apparent part of the modern musical aesthetic, and many iconoclastic composers of the self-dubbed Machine Age placed much greater emphasis on the right tempo being attainable only through metronomic regulations.\textsuperscript{54}

Perhaps the composer who best exemplifies and promotes this aesthetical shift toward metronomic precision is Stravinsky. Fascinated by mechanical-musical instruments and the possibilities of purely objective, repeatable performances,\textsuperscript{55} Stravinsky explained the “regulative laws” he placed upon musical time, theories reminiscent of experimental-psychology definitions:

\begin{quote}
The laws that regulate the movement of sounds require the presence of a measureable and constant value: \textit{meter}, a purely material element, through which rhythm, a purely formal element is realized. In other words, meter answers the question of how many equal parts the musical unit which we call a measure is to be divided into, and rhythm answers the question of how these equal parts will be grouped within a given measure.\textsuperscript{56}
\end{quote}

In the hands of Stravinsky and other Machine-Age composers, a new first principle in musical time took hold. Rhythm and meter became discreet mathematical-musical units—wholly measurable by clockwork metronomes. Ever-greater tempo controls—first observed in \textit{le Sacre} (1913) and later in \textit{Renard} and \textit{Les Noces} (premiered in 1922 and 1923, respectively)—helped to actualize ever more complicated rhythmical and metrical constructions. Contemporaneous comments reveal that the results of Stravinsky’s objectivist aesthetics were prominently heard on the concert stage. For Paul Rosenfeld, writing in 1920, “The new steel organs of man have begotten their music in \textit{Le Sacre du printemps}. For with Stravinsky, the rhythms of machinery enter musical art.”\textsuperscript{57} In 1925 Mitzi Kolisch...
pointed to the composer’s new sensibilities when she commented, “Stravinsky had turned mathematician... his mind has become too involved in the geometric problems of splitting rhythms.”58 The automatic metronome’s time had come: When a composer’s intention is firmly rooted in aesthetics of mathematical-mechanical rhythm, a regulative metronomic tempo is both necessary and desirable. It is no surprise that Stravinsky, as one student observed in 1940, kept a newfangled pocket-watch metronome in his jacket for easy reference.59

Modernists such as Stravinsky, Bartók, Hindemith, Ravel, and Antheil desired greater precision in musical time, and their own performance practices often reflected the ideals of metronomic musical motion. This newly found exactitude impressed Ezra Pound (1885–1972), who commented in 1926, “The mind, even the musician’s mind, is conditioned by contemporary things. [George Antheil and Olga Rudge] have acquired—perhaps only half consciously—a new precision.”60 But some thought that modernist musicians sounded oddly mechanistic compared with past musical artists. In 1922, Percy Scholes described Bartók’s pianism as “a hard, cold rattle of a keyboard, violently attacked in chance combinations of keys and notes, with the stiffened metal muscle of a jerkily rhythmic automaton.”61 Pound too heard an automaton-like metamorphosis in modernist performance practices. He ascribed a root cause to this more exacting musicality in the 1920s, claiming the ability of professional orchestral musicians “to count, their metronomic ability, has engulfed them, and they have become insensitive to shape.”62

While these composers redefined meter in objective mathematical-metronomic frameworks, prominent conductors, now considered to be some of the best interpreters of the common-practice orchestral repertoire, pledged greater allegiance to metronomic tempi under the presumption that the machine offered the absolute, authoritative rules of musical movement. No longer exclusive to avant-garde compositions, the rhythmic objectivity and precision desired in the music of Stravinsky, Antheil, Bartók, Ravel, and Hindemith transferred to the pulse of past repertories.

Gone was insult of “behaving like a metronome” when Toscanini attended closely, and consistently, to metronome marks affixed in Tannhäuser. As David Ewen reports, “Toscanini [in 1930 at Bayreuth] quietly summoned his critics to a piano and there, with the aid of a metronome, proved that his tempo was meticulously perfect, precisely the way Wagner had so carefully designated in the score.”63 Ironically, Wagner considered his own MM indications meager reflections of a more fluid and supple temporality—he did not seek tempo perfection, consistency, or precision with the clockwork machine. Wagner eventually found MM data so impractical and insufficient that he stopped using the system entirely.64 In describing the optimum way to understand musical movement, Wagner remarked, “Our conductors so frequently fail to find the true tempo because they are ignorant of singing.”65

The modern metronome now informed the movement of eighteenth-century repertoire as well. At the 1933 Salzburg Festival, Richard Strauss conducted what seemed to be a mechanically regulated interpretation of one Mozart symphony, inciting a reporter to politely
remark, “His style was rigourously, perfectly classical—a metronome beat, a set balanced colour-scheme. But the effect was dull.” Strauss’s conducting style seemed to ally closely with contemporaneous instruction methods. The century witnessed many student conductors following the metronome beat, “perfectly” recollecting MM rates for classical music and beyond. In 1919, Oberlin Professor Karl Gehrkens described the new standard procedure in conducting, in which “hours of practice in beating time will be necessary... it should also be done with the metronome clicking or with someone playing the piano much of the time, in order that the habit of maintaining an absolutely steady, even tempo may evolve.”

Hermann Scherchen, a conductor greatly influenced by modern trends in tempo scholarship, applied MM numbers equally (and anachronistically) to both avant-garde and historical compositions, especially the music of J. S. Bach. By the end of the twentieth century, recounting a continual series of metronome clicks was well within the norm of professional conducting activity. None other than Herbert von Karajan prided himself on recollecting and repeating metronomic tempi with near-scientific precision.

[My brain] is not a computer,” he told Richard Osborne, “[but] I trained it with metronomes. And I still test myself. I can walk in 120 [bpm] and sing in 108; and if you ask me to sing in 105 now, I will manage it. If I get it wrong, I feel it with my whole body. And in the orchestra, if a solo comes in slower or faster [in metronomic time], I sense it right away; it makes me feel uneasy.

Karajan’s metronomic training exercises were likely made possible with modern metronomes that projected more constant and perpetually sounding tempi. Automatic sound units were the ideal pulse references for many professional musicians by the second half of the twentieth century. In 1920 Brower detailed the twentieth-century training methods that Stravinsky, Sachs, and Karajan independently considered intrinsic to musical temporality. Having “a just sense of the mathematical values of notes,” Brower maintained, “is only acquired by constant timekeeping and counting.... Time-beating exercises may be made by using short pieces of moderate difficulty and tapping the time value of the notes to the beat of the metronome.”

In this age of precision, with the metronomic beat dictating a mathematically exacting type of meter and rhythm, musicians’ regard for silent, nonautomatic tempo references such as simple pendulums noticeably diminished. In our present musical culture MM numbers are largely assumed to reflect automatic metronome clicks and not simple pendulum swings (the reference favoured by G. Weber and others). To be sure, tempo pendulums continued to be invented, but more audibly precise, automatic technologies were increasingly favored for many of the latest pedagogical practices. And, in a trend that extends through the present day, the most un FAILING, automated tempo technology also became de rigeur for avant-garde compositional practices. Musique concrète composer Pierre Schaeffer (1910–1995), in a journal entry dated April 3, 1948, voiced a twentieth-century mantra regarding musical-time regulation: “I need a metronome. The one that was sent to me does not beat in [precise clockwork] time, nor do the ones that followed. It
is incredible how much a [typical clockwork] metronome can lack a sense of [absolute clockwork] rhythm! The one-time pejorative behavior, acting to a constant metronomic sound-source, has become a pejorative no longer but a natural expectation to “good” and “correct” musical performance for many students and professionals in the modern age.

4. Metronomic Technologies and Tendencies Today

Today the technocultural desire continues for increasingly automatic, precise, and as some would say, “better” metronomes. User manuals of commonplace digital devices, such as Korg’s “Dr. Beat,” continue to mark western culture’s revised relationship to tempo technologies, a trend that began over a century ago. The 1997 Korg booklet describes an objectified musical time completely disassociated from performer agency, stylistic distinctions, or composer intentionality, noting: “The DB-88 is a high-quality rhythm training machine equipped with quartz-precision timing. It readily accommodates a wide range of musical genres—from jazz or rock to classical.” As these instructions exemplify, modern metronome technology is often considered necessary and appropriate for all forms of musical “rhythm training.” These “high-quality” (read “precisely automatic”) tempo machines are often employed with an assumption that musical time—despite differing historical, aesthetic, and cultural contexts—can be defined through one modern, monolithic technology. As trends may continue to show, the objectified rhythm endorsed in modern pedagogy and upheld through current compositional and performance practices seems intertwined with the beat emanating from the latest, most perpetually automatic metronome.

In more recent years, metronomic rhythm training has gained even greater popularity through music and dance video games including the Rock Band franchise, first released in 2007, by Harmonix Music Systems. These games promote musical temporality as being a fully automated procedure in which players’ individualistic treatment for pulse and rhythm becomes completely null and void. Bound by an implicit click track corresponding to conveyor-belt–like visuals, players must hit buttons precisely in tandem with the continuously streaming note cues. (The singing player is allowed slightly more temporal flexibility.) The motoric aspect of the rhythm-performance game becomes evident, as one reviewer explains that winning requires “tasks like keeping the band’s Overdrive active for as long as possible, or keeping a [precisely placed] note streak going.” The rules demand the players’ synchronization, sublimation, and rapid response to a regulated series of note markers. In such so-called rhythm games, the most precisely metronomic performance wins.

To date the ultimate method for metronoming musical time in professional venues is found through digital recording and composition programs. Through the process of quantization, the musician’s rhythmical variations can be mediated out of a performance altogether. Now, to play with mechanically exacting tempo and rhythm, as defined by the latest computer processor, one need only press a button and all recorded notes align to the
desired level of metronomic beat precision (e.g., quarter, eight, sixteenth, etc.). Thus the imperfections perceived in a player’s actual performance are effectively erased through quantization, in addition to other digital manipulations, such as time compression or stretching. Ironically perhaps, these digital audio processes supplant the need for individuals to practice with automatic metronomes in the first place. Through computer technology, the possibility exists for musical time to be a fully automated procedure, making obsolete the modern-age musician’s need to play exactly “in time” with the clicks of an external tempo clock.

5 Concerning Modern Metronomic Times

Through research that embraces technological, social, and intellectual viewpoints, performers and scholars will continue to discover how metronomes are not merely devices that measure the time of music. Both in theory and practice, metronomes reflect what accurate rhythm is for some and musical tyranny is for others. Playing to the metronome, once a limited and unwelcome concept for many skilled nineteenth-century musicians, has become a prevalent, largely accepted component of musical training. What was once “artificial” mechanical rhythm is now a normative musical reference. Today, metronomic musicality is seldom criticized. Rather, it is an expected, desired, and instilled quality, made ever present in our modern musical times. Yet given that many musicians’ first steps are now supported by clockwork beats, today more than ever contrasting musical ideals from the past are worth remembering. Vocal pedagogue Julia E. Crane, in her Music Teacher’s Manual (1889), succinctly summarized the failure of this technology in her age when she warns, “By accurate [musical] rhythm is not meant metronome accuracy.” American piano prodigy Joseph Hofmann, sixteen years later, reiterated why musical time and precise metronomic sound represented two seemingly antithetical qualities. “Never play with a metronome,” Hofmann exclaimed in 1905, “for according to the metronome a really musical rhythm is unrhythmical—and on the other hand, the keeping of absolutely strict time is thoroughly unmusical and deadlike.”

Metronomic rhythm has its place in modern repertoire to be sure, and many composers since the twentieth century have intended their music to run in consistent and exacting metronomic tempi—not to create deadlike rhythm but to facilitate new compositional processes that diverge from the standard metrical patterns of historical western music. Nevertheless, musical culture should reflect upon the ancient adage “Times change, and we are changed in them.” (Tempora mutantur, nos et mutamur in illis.) Today’s educators, scholars, and performers should therefore attempt to better distinguish the previous times—what tempo meant theoretically and practically within various historical contexts. This brief study should lend credence to our own musical instincts on the matter: Not all compositions ought to run with the incessant regularity of clockwork rhythm, not all musical measures ought to beat with an implicit tick-tock pulse, and not all tempi were as automatic and unyielding as modern metronomes would lead us to believe.
Metronome

According to many historical witnesses, Schindler and Rachmaninoff among others, there is a real danger in adhering to metronomic beats, even in the early stages of musical education. The metronome’s automatic sound can change a musician’s experience of pulse, fixating it into discreet intermittent clicks and away from more variable, willful movements that inform the historically described “elastic tempo.” The metronomic effect can transfer via professional publications as well. Metronoming historical music does not necessarily make tempo better understood; rather, it holds the potential to make historical rhythm and meter more mechanistic. By emphasizing metronomic sound as the truth underlying musical tempo, other ways of knowing musical movement—through rhetorical and poetic analogs, bodily gestures, and so on—can be lost to the tautological qualities of clockwork. In seeking the one right MM number to express past composers’ intentions, many metronome-centric research methods and interpretations discount more significant, antiautomatic tempo qualities. According to Marx, Beethoven’s true notions of tempi could never be found in MM indications because

However valuable the instrument may be to the composer, for a safe placing of the tempo desired by him, an absolute determination of the tempo is not in accordance with the spirit of art. The tempo is determined not only by the thought out of which a work of art has sprung, and by the manifold contents thereof, but also by the temporary mood of the performer.... This probably explains (at least in part) the unanimous declaration of Czerny, Madame von Ertemann, and others [that] Beethoven...played his compositions differently every time.  

Apart from mathematical-metrical formulas, pseudoscientific laws, and “motor units” of time made popular in the twentieth century, Marx verifies alternative modes of musical movement, other epistemologies of tempo not tied down to precise mechanical place markers.

Modern musical culture might benefit from a return to a critical discourse about metronomes and the roles of all automated tempo technologies (e.g., digitized click tracks, sequencers, accompanying programs, looping machines) in living musical performance and education. We should take stock of how musicians gain from using these technologies and, less frequently considered, what musical qualities are lost in the process. Metronome technology provides a case study in this regard. When an entire musical culture treats one technological system as the best (or only) way to achieve the “the right tempo and rhythm,” then a mechanical hegemony over that culture has surely arisen and past epistemologies and practices have become neglected or forgotten.

A Luddite’s call for the death of metronomes is not necessary, but musicians should pay heed to what history tells us about the complex tensions between human creativity and automated processes. Only in an era of rapid automation did metronomic sound become the dominant reference and regulator of musical time. There is no mystery as to why, in 1923, Man Ray took a Maelzel metronome, glued the picture of an eye onto its tempo indicator, and gave his Machine Age portent the name Object to Be Destroyed. Being a “slave to the clock,” in daily life or in music-making, is no empty turn of phrase. A self-
Metronome

moving machine that affords exactitude and efficiency also has the potential to impose tyranny over previous ways of being. Contemporary musicians fixated on the mechanized beat should come to recognize that these tensions, between feeling a pulse or following a precision, remain ever present—and reflect upon whether musical movement is fundamentally an act of their expressive autonomy or a sonic regulation derived from their automatic metronome.

Notes:

1. These conventional definitions are kept alive not only in print but on the Internet as well, through sources such as the *Webster’s Revised Unabridged Dictionary* (1913) [http://machaut.uchicago.edu/websters] and Wordnik [www.wordnik.com].

2. The historical arguments and evidence introduced here are presented more comprehensively in Alexander Evan Bonus, “The Metronomic Performance Practice: A History of Rhythm, Metronomes, and the Mechanization of Musicality,” (PhD diss., Case Western Reserve University, 2010).

3. This study is concerned primarily with automatic metronomes and not simple tempo pendulums, devices that some twentieth-century tempo scholars erroneously considered to be interchangeable in purpose and value. Silent and simple tempo pendulums, appearing from the seventeenth through twentieth centuries, were finite references for what remained a largely volitional and embodied sense of musical time. Automatic clocks and metronomes, as historical sources attest, project a vastly more artificial and regulative pulse standard. Focus is given to automatic metronomes because these technologies—in clockwork, electric, and now digital varieties—predominate in current musical theories and practices.

4. The obsolete term *automatical* referenced a unique quality of time and movement, which the widely popular *Webster’s Dictionary* (1828) defined as, “1. Belonging to an automaton; having the power of moving itself; mechanical / 2. Not voluntary; not depending on the will.”

5. For other historical epistemologies of musical time see Alexander Bonus, “A Treatise from Lost Times, Part I,” *Current Musicology* 95 (Spring, 2013).

6. The 1828 *Webster’s Dictionary* defines this historical notion of artificiality—which applies directly to clockwork machines—as “Made or contrived by art, or by human skill and labor, in opposition to natural.”


Metronome


(9) From “Time and Clocks,” *New York Times*, June 27, 1920, 60. It can be argued that the metronome vies with the stopwatch as being the scientific-industrial timekeeper par excellence.

(10) The history of automata, which parallels the history of clocks, is out of scope for the present study. See Paul Metzner, *Crescendo of the Virtuoso* (Berkeley: University of California Press, 1998), for the cultural history behind Maelzel’s automata exhibition.


(12) [“Reviews”], *The Times*, September 23, 1818, 2, col. F.


(15) The 1815 British patent announcement for Maelzel’s first metronome design is purposefully ambiguous, implying that the invention was not yet fully conceived or perfected: “John Malzl, of Poland-street, Middlesex, Machinist; for an instrument or instruments, machine or machines, for the improvement of musical performance, which he denominates a Metronome, or musical time-keeper. Dated December 5, 1815.” See *The Repertory of Arts, Manufacturers, and Agriculture* XXVIII, Second Series (London: J. Wyatt, 1816), 127–128.

(16) Philharmonicus, “An Explanation of the Notation Employed in the Scale of Maelzel’s Metronome,” *The Edinburgh Magazine and Literary Miscellany* I (October, 1817): 223–224. The metronome discussed here is an older model with a more limited MM scale. Closer to a cuckoo clock in design, it had to be fixed to the wall.

(17) The *Musical Magazine* provided a similar warning: “We would not recommend its constant use, lest the style of the singers should become too evidently labored and mechanical, but occasionally introduced it will be of great service.” See “The Metronome,” *The Musical Magazine* I (April 1836): 304.


See James Francis Cooke, *Great Pianists on Piano Playing: Study Talks with Foremost Virtuosos* (Reprint, Philadelphia: Theodore Presser, 1917), 213. During an age in which the machine was quickly becoming a commonplace fixture in music education, Rachmaninoff comments, “The metronome itself must not be used ‘with closed eyes,’ as we should say it in Russia. The player must use discretion.” For Paderewski’s additional comments, see Henry T. Finck, *Success in Music and How it Is Won* (New York: Scribner’s, 1909), 321, 455–456.

Ignaz Moscheles provides a good case study in the nonauthoritative treatment given to editorial MM numbers in the nineteenth century. He admitted that the reasoning behind some indications was to counteract the prevailing tendencies of the age, stating, “In some of [Beethoven’s] quick movements I have purposely refrained from giving way to that rapidity of piano-forte execution, so largely developed at the present time.” Moscheles included slower MM numbers so that inexperienced players would stop playing Beethoven’s piano music so quickly.


Ibid., 97.

Ibid., 114.


A *Harbinger* reviewer in 1846 suggested that the playing with a mechanized, beats-per-minute concept actively defiled musical expressivity, alongside any sense of a living performance practice: “To bang through an overture like a machine is not the thing; no machine has whims and inflections, and therefore, it only makes cast-iron music ... a mere beater of time is worth nothing, but to embarrass all parties and to kill the music, and Maelzel’s metronome were quite as good a thing and less expensive.” See “Musical Review,” *Harbinger, Devoted to Social and Political Progress*, March 7, 1846, 204.


“Musical Review,” *Harbinger, Devoted to Social and Political Progress*, February 27, 1847, 185.

Metronome

(31) Constantin von Sternberg, *Ethics and Esthetics of Piano-Playing* (New York: Schirmer, 1917), 79–80. He continues: “From all this it is easily seen that the impulse leading to the invention did not come from an artistic temperament.”

(32) Finck, 321.


(35) Ibid., 237. Influential rhythm psychologist and former Wundt student Ernst Meumann offered similar definitions, which were cited well into the twentieth century.

(36) Bolton’s justification: “The click of the telephone is about as simple and instantaneous a sound as it is possible to [mechanically] produce.” See Bolton, 116. The need for more precise sonic metronomes—endorsed by scientists far more than composers in the nineteenth century—stems from a desire to quantify laws of rhythm, not express rhythms through traditional musical practices.


(41) Ibid., 507.


Metronome


(48) Bartók’s scientific ethnographies and “metronomed” folk transcriptions are not in the scope of the present study. Suffice it to say that Bartók was a meticulous quantifier of tempo and rhythm. Using MM indications past the limits of clockwork metronome precision (e.g., MM = 500), he researched musical performances with methods previously set forth by experimental psychologists.

(49) For a comparative analysis of historical training methods with metronomes, see Alexander Evan Bonus, The Metronome Rules: An Historical Guide for Modern-Day Musicians, (forthcoming).

(50) See Schindler, ed. Moscheles, 111fn.


(52) See Bonus, “A Treatise from Lost Times, Part I” Current Musicology 95 (Spring 2013): 7–34.

(53) See for example Sachs, 168, 173.

(54) It is worth mentioning that when Paul Hindemith published instructions on playing his “Ragtime” from Suite 1922, Op. 26, he urged, “Hold very steady in rhythm, like a machine.” In following years he showed great interest in composing for self-playing musical instruments.


Metronome


(62) Pound, 132.


(64) Wagner admitted: “In my earlier operas I gave detailed directions as to the tempi, and indicated them (as I thought) accurately, by means of the Metronome…. In my later works I omitted the metronome and merely described the main tempi in general terms, paying, however, particular attention to the various modifications of tempo.” (Emphasis mine.) From Richard Wagner, *On Conducting (Über das Dirigiren)*, trans. Dannreuther (London: William Reeves, 1897), 20–21.

(65) Ibid. 19.

(66) [Reviews], “Salzburg Festival. Mozart and Strauss,” *The Times*, August 15, 1933, 8, col D.


Seldom do today's musicians issue the mea culpa “I perform like a metronome.” The one-time pejorative is now recast as a compliment. Professional performers and critics alike now use terms such as, “precise,” “transparent,” “nimble,” “exacting,” “clean,” and “a faithful reading.” Yet these qualities are simply the opposite side of the same metaphorical coin, what I call the metronomic performance practice.


Implicit in many minimalist compositions is a metronomic aesthetic to pulse and rhythm. Terry Riley’s direction for *In C* (1964)—the prototypical minimalist work—all but calls for a sonically automated tempo: “The ensemble can be aided by the means of an eighth note pulse played on the high c’s of the piano or on a mallet instrument. It is also possible to use improvised percussion in strict rhythm.... All performers must play strictly in rhythm and it is essential that everyone play each pattern carefully [i.e., precisely].” Nevertheless the “[metronomic] tempo is left to the discretion of the performers,” and Riley offers no MM indication on the score. See Terry Riley, *In C*, <http://imslp.org/wiki/In_C_Riley,_Terry>, accessed June 15, 2013.


Perhaps even more prophetic are his many variations currently displayed around the world, each sharing the same title: *Object Indestructible*.