

# Why Sherlock Holmes Taps His Fingers

By Ron Doerfler

*"You really are an automaton -- a calculating machine"*

Watson to Holmes (SIGN)

This paper seeks to explain the propensity for finger tapping exhibited by Mr. Sherlock Holmes in the course of the famous mysteries recorded by Dr. John H. Watson. A few such occurrences can be attributed to impatience and nervous energy. However, at least two incidents demonstrate to the alert reader, if not to the good doctor, a conscious use of rhythmic finger tapping, or drumming, to measure a span of time to a high degree of precision. An argument will be presented that this method of timing has historical precedent in Renaissance science experiments such as those of Galileo Galilei, that Holmes likely had access to such knowledge and the musical talent to use it with exactitude, and that in at least one case presented to the public, Holmes produces a calculation which requires a timing of such precision that no other mechanism can suitably account for it.

There are a few accounts from the Canon in which it can be said without doubt that Holmes was in a state of restlessness manifested by nervous physical symptoms. Finger tapping and pacing are not unnatural in such conditions, and perhaps the most we can make of it is that Holmes did unconsciously associate tapping his fingers with the passing of time, as many of us do.

*More than once he fidgeted with his feet and tapped rapidly with his fingers upon the wall. It was evident to me that he was becoming uneasy, and that his plans were not working out altogether as he had hoped. At last, as midnight approached and the street gradually cleared, he paced up and down the room in uncontrollable agitation. (EMPT)*

*But when, for the fourth time, after pushing back our chairs from breakfast we saw the greasy, heavy brown swirl still drifting past us and condensing in oily drops upon the window-panes, my comrade's impatient and active nature could endure this drab existence no longer. He paced restlessly about our sitting-room in a fever of suppressed energy, biting his nails, tapping the furniture, and chafing against inaction. (BRUC)*

*We could but pray for patience and wait for the morrow. Sherlock Holmes was too irritable for conversation and too restless for sleep. I left him smoking hard, with his heavy, dark brows knotted together, and his long, nervous fingers tapping upon the arms of his chair, as he turned over in his mind every possible solution of the mystery. (LADY)*

However, there is at least one description by Watson, a chance observation that is nevertheless a revelation to us, of the singularly rhythmic character of Holmes' tapping fingers. It occurs in a most unlikely situation, a tense interval in which Holmes considers the fate of Mr. James Ryder in BLUE:

*There was a long silence, broken only by his heavy breathing and by the **measured** tapping of Sherlock Holmes's finger-tips upon the edge of the table.*  
[emphasis added]

Once again, Watson sees but does not observe. It is fortuitous indeed that in the one situation in which Watson is intently watching Holmes while he is drumming his fingers, the regularity is impressed on his mind just sufficiently to be reflected in the eventual record of the case in later years.

But there are other indications. In the very first published work on the detective, we find Holmes testing a suspected poison on a terminally ill dog.

*As he spoke he turned the contents of the wineglass into a saucer and placed it in front of the terrier, who speedily licked it dry. Sherlock Holmes's earnest demeanour had so far convinced us that we all sat in silence, watching the animal intently, and expecting some startling effect. None such appeared, however. The dog continued to lie stretched upon the cushion, breathing in a laboured way, but apparently neither the better nor the worse for its draught.*

*Holmes had taken out his watch, and as minute followed minute without result, an expression of the utmost chagrin and disappointment appeared upon his features. He gnawed his lip, drummed his fingers upon the table, and showed every other symptom of acute impatience. (STUD)*

Here it is obvious from the presence of the watch that the time required for the poison to take effect was critical to the recreation of the crime and the solution of the case. I submit that Watson mixed up the events that transpired—that Holmes in fact began by drumming his fingers to measure a short interval, then finally took out his watch in resignation as the minutes passed. In fact, it turned out that another pill contained the poison, and the terrier died within an extremely short time after consuming this second pill, as Holmes expected:

*The unfortunate creature's tongue seemed hardly to have been moistened in it before it gave a convulsive shiver in every limb, and lay as rigid and lifeless as if it had been struck by lightning. (STUD)*

So how regular can finger tapping be? For a practiced user, it can be very precise, and this method excels at timing short intervals with sub-second accuracy compared to using a watch. It has been suggested as the means by which Galileo measured time intervals in his famous experiments on falling bodies, in particular the experiments in which balls were allowed to roll down inclined ramps. Let us explore this a bit in preparation for the climactic demonstration of precision timing that Holmes ultimately provides.

Galileo describes these experiments in his famous treatise, Discourses and Mathematical Demonstrations of Two New Sciences, in the section associated with the Third Day. In that book, he indicates that his theory agreed with experiment to a tenth of a heartbeat. However, historians generally agree that Galileo's timings were too good to be true [1]. Some feel that water flow was used, wherein water flowed into different containers during each equal interval marked on the ramp. This may or may not provide the desired accuracy. Timing with a pendulum is a sort of circular reasoning, as pendulums also follow the laws of falling bodies. Besides, Galileo was under the mistaken belief that the period of a pendulum was independent of the amplitude, whereas it was later discovered that it is essentially independent only for small oscillations, so we would not expect Galileo to get precise results if he did use this method.

Stillman Drake, in a Scientific American article, proposed a different timing mechanism after studying a page of Galileo's notes (*f. 152r* in Volume 72 of the Galilean manuscripts preserved at the National Central Library in Florence), namely that Galileo used song to time his experiments to sub-second accuracy [2]:

*The conductor of an orchestra, moving his baton, divides time evenly with great precision over long periods without thinking of seconds or any other standard unit. He maintains a certain even beat according to an internal rhythm, and he can divide that beat in half again and again with an accuracy rivaling that of any mechanical instrument. If the cymbalist in the orchestra were to miss his entry by a tiny fraction of a second, say by a 64<sup>th</sup> note in the music, everyone would notice, not just the conductor... Few people can stand the irregularity of the ticks when a metronome or a pendulum clock is slightly tilted. Most of us can sing to an established beat and would wince if a pianist played a grace note where the principal note ought to be (that is, a hundredth of a second too late).*

Drake goes on to identify characteristics of Galileo's data that support a division of time into musical intervals. Most importantly to us, others have pointed to the use of musicians either drumming or tapping their fingers as a means of timing early science experiments.

Now Sherlock Holmes, we know, studied old manuscripts as an avocation. Recall his study of a palimpsest dating from the second half of the fifteenth century in GOLD. Or his "laborious researches in early English charters" in 3STU. Or this tantalizing bit of information revealed in BRUC:

*The first day Holmes had spent in cross-indexing his huge book of references. The second and third had been patiently occupied upon a subject which he had recently made his hobby -- the music of the Middle Ages.*

While Galileo did not live in the Middle Ages, these examples show that Holmes indeed had such interests. Is it too unlikely to suppose that he may have run across *f. 152r* and deciphered its meaning, acquiring a useful knack for finger tapping as the need arose? Galileo was an accomplished lutenist, Holmes a "very remarkable" violin player who often attended musical concerts. I personally find a decent regularity if I place my hand and fingers on a table or knee and settle on a rate of tapping of my index finger which is the maximum I can maintain without jerkiness—I find the rate to be fairly independent of minor changes in amplitude. The multiple taps per second provides the sub-second resolution.

If we assume that Holmes indeed developed such a capability, and it would seem he was a natural finger tapper to begin with, we have a solution to a conundrum investigated by a number of Sherlockians—the means by which Holmes performed a seemingly impossible calculation of the speed of a train in SILV:

*And so it happened that an hour or so later I found myself in the corner of a first-class carriage flying along en route for Exeter, while Sherlock Holmes, with his sharp, eager face framed in his ear-flapped travelling-cap, dipped rapidly into the bundle of fresh papers which he had procured at Paddington. We had left Reading far behind us before he thrust the last one seat and offered me his cigar-case.*

*"We are going well," said he, looking out of the window and glancing at his watch. "Our rate at present is fifty-three and a half miles an hour."*

*"I have not observed the quarter-mile posts," said I.*

*"Nor have I. But the telegraph posts upon this line are sixty yards apart, and the calculation is a simple one. I presume that you have looked into this matter of the murder of John Straker and the disappearance of Silver Blaze?"*

Baring-Gould alone provides several speculations on this "simple" calculation [3]. The first of these, by A. D. Galbraith, assumes that by giving the speed to the half-mile an hour, the speed must be accurate to a quarter of a mile an hour. Since a second of error in two minutes of timing (while counting telegraph posts) would amount to almost a half mile an hour, he deems it impossible to attain the stated accuracy, and concludes, "Is Homes trying to impress Watson, or is Watson trying to impress his readers?" Guy Warrack maintains the impossibility of timing with a pocket watch a time interval between posts to a tenth of a second. S. C. Roberts postulates that Holmes had looked at his watch earlier (unseen by Watson), counted fifteen telegraph posts (ignoring the quarter mile posts) to cover a distance of a fraction over half-a-mile, and glanced again at the watch to note that 34 seconds had elapsed, about ten percent over 30 seconds, yielding a speed about ten percent under 60 miles per hour. George W. Welch reports that allowing two seconds for every yard and another second for every 22 yards of a known interval such as the sixty yards between telegraph posts, then the number of posts passed in this number of seconds (123 seconds in this case) is the speed in miles per hour (53.5mph in this case). Or, allowing for one second for every yard of the known interval, then  $2.1/22$  times the number of posts passed in this number of seconds (60 in this case) gives the speed in miles per hour. Finally, Dr. Julian Wolff suggests dividing 1227 by the time required to travel 1800 feet (30 posts) to find the speed in miles per hour.

As the author of a trifling monograph on techniques of mental calculation [4], I have often been drawn to this episode. My solution is a simple one, given our assumption of the sub-second timing capabilities of Holmes. I concur with the implicit conclusion of nearly all the above that the single glance at the watch recorded by Watson was not the sole timing mechanism employed by Holmes—in fact, I feel it most likely that the glance recalled by Watson was simply a matter of Holmes, having calculated the speed of the train by other means, determining the time they should arrive at their destination. Watson no doubt did not observe the commonplace tapping of Holmes fingers prior to the latter's remark that "We are going well."

It takes 2.29 seconds to travel 60 yards while traveling 53.5mph. If we are to take Holmes at his word that he had not observed the quarter-mile posts, then we can assume that at most he timed seven of the 60-yard intervals. A total of 16.06 seconds elapses over these seven intervals at this speed.

My natural timing by my personal method given earlier yields just over 6.5 taps per second. The upbeat of the finger provides a doubling of the resolution, or half a tap, particularly for a musician accustomed to syncopation. A count of just under 104.5 finger taps would occur in the span of seven telegraph posts at 53.5mph. A difference of one-half tap in either the reading or the average regularity amounts to a difference of about .5% in the result, or just within the quarter-

mile per hour resolution we were seeking. Therefore, I submit that this was indeed the method employed by Holmes.

Moreover, if we dare, we can make an educated guess at Holmes' finger tapping speed, based on his remark that the calculation was a simple one. Amongst the possible number of telegraph post spans to time and the frequency of the finger-taps, a relatively simple technique for a very precise calculation emerges if a tapping frequency is tuned to 5.5 taps per second. Then Holmes could always find the speed in miles per hour by multiplying the number of telegraph posts by 2700 and dividing the result by 4 times the number of taps that occurred:

$$\text{Speed (in mph)} = (\text{posts} \times 2700) / (4 \times \text{taps})$$

If Holmes stopped at a post at which he finds the denominator to be a round number, then the entire calculation is indeed a simple one. It turns out that at the speed at which the train was traveling, Holmes would have hit just over 75 taps (actually 75.6) at the sixth post. Then  $4 \times 75 = 300$ , and he arrives almost too simply at 54mph. (A simple reduction of this by 0.6 out of 75.6, or about 1%, yields the final answer as 53.5mph.)

To summarize, then, we have shown in this paper a reasonable timing mechanism for the remarkable train speed calculation demonstrated by Holmes, we have shown that Holmes may very well have encountered the use of this method in old manuscripts, we have attributed his capabilities in this area to his innate musical ability, and we have demonstrated that Holmes was often recorded as tapping his fingers, even in a measured way. Why did Holmes not reveal this method? In fact, following the announcement of the train speed, he immediately and deliberately diverted the conversation onto a different topic. As Drake observed,

*Even in his [Galileo's] day, it would have been foolish to write, "I tested this law by singing a song while a ball was rolling down a plane, and it was quite exact."*

I suspect that Sherlock Holmes might have had a similar thought.

### *References*

1. Sharratt, Michael. **Galileo: Decisive Innovator**, Cambridge University Press, 1996.
2. Drake, Stillman. *The Role of Music in Galileo's Experiments*, Scientific American, Vol. 232 No. 8, June, 1975, pp. 98-104.
3. Baring-Gould, William S. **The Annotated Sherlock Holmes**, Clarkson N. Potter, 1967, Vol. II, pp. 262-3.
4. Doerfler, Ronald W. **Dead Reckoning: Calculating Without Instruments**, Gulf Publishing, 1993.