

Music, Mechanism, and the “Sonic Turn” in Physical Diagnosis

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ABSTRACT

The sonic diagnostic techniques of percussion and mediate auscultation advocated by Leopold von Auenbrugger and R. T. H. Laennec developed within larger musical contexts of practice, notation, and epistemology. Earlier, François-Nicolas Marquet proposed a musical notation of pulse that connected felt pulsation with heard music. Though contemporary vitalists rejected Marquet’s work, mechanists such as Albrecht von Haller included it into the larger discourse about the physiological manifestations of bodily fluids and fibers. Educated in that mechanistic physiology, Auenbrugger used musical vocabulary to present his work on thoracic percussion; Laennec’s musical experience shaped his exploration of the new timbres involved in mediate auscultation.

KEYWORDS: auscultation, percussion, sonic diagnosis, pulse (Western reception of Chinese theory), François-Nicolas Marquet, Théophile de Bordeu, Joseph-Jacques Ménuret de Chambaud, Albrecht von Haller, Gerard van Swieten, Leopold von Auenbrugger, R. T. H. Laennec

Myself: How is it that with such fineness of feeling, so much sensibility where musical beauty is concerned, you are so blind to the beauties of morality, so insensible to the charm of virtue?

He: It must be that virtue requires a special sense that I lack, a fiber that has not been granted me. My fiber is loose, one can pluck it forever without its yielding a note.

—Denis Diderot, “Rameau’s Nephew” (1761–62)¹

The development of modern physical diagnosis profoundly depended on the use of sound; a trained “medical ear” can transcend the visual limitations of “the medical gaze [*regard médical*].”² Despite vision’s traditional privilege among the senses, the

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- 1 Denis Diderot, *Rameau’s Nephew, and Other Works*, trans. Jacques Barzun and Ralph H. Bowen (New York: Bobbs-Merrill, 1964), 71.
- 2 See Michel Foucault, *Naissance de la clinique: une archéologie du regard médical*, 2nd ed. (Paris: Presses Universitaires de France, 1972). Even when he tries to include “the tactile and auditory dimensions,” Foucault still asserts that they remain “under the dominant sign of the visible”; Michel Foucault, *The Birth of the Clinic: An Archaeology of Medical Perception* (New York: Vintage, 1994), 165. On the history of anatomo-clinical medicine, see Kenneth D. Keele, *The Evolution of Clinical Methods in Medicine*

introduction of percussion and mediate auscultation allowed access to invisible but invaluable clinical signs, bearing in mind what Jacalyn Duffin called “a *longue durée* in the medical laying on of hands and in the active application of the five senses to diagnosis.”³ When, why, and how did physicians turn to audible diagnostic evidence, rather than remaining content with visual examination or purely tactile experience of pulse?

Though the careers of Leopold von Auenbrugger and R. T. H. Laennec have rightly received much attention, I would like to add a larger context that brings forward François-Nicolas Marquet’s novel description of the pulse in musical notation.⁴ French vitalists rejected Marquet’s work, but his ideas were included in the larger current of mechanistic physiology, particularly by Albrecht von Haller. Though Auenbrugger and Laennec did not cite Marquet, his innovations stand at the beginnings of a “sonic turn” that eventuated in their work; along with their common involvement in mechanistic physiology, their musical backgrounds also affected their emergent techniques and findings.⁵

THE ANCIENT RHYTHMIC BACKGROUND

The eighteenth-century developments we will consider referred to Greek medical traditions that emphasized physiological rhythms. As Pythagorean thinkers connected number with sound and the physical universe, the Hippocratic corpus applied number to physiology.⁶ The diagnostic value of the pulse was noted by Praxagoras of Cos (about 300 BCE) and may reflect a Pythagorean preoccupation with number. Galen noted that the stimulus to develop a systematic and quantitative theory of the pulse came from music theory, for “just as musicians establish rhythms according to certain defined sequences of time-units, comparing the *arsis* [upbeat] and the *thesis* [downbeat] with one another, so too Herophilus supposes that the dilation of the artery is analogous to the upbeat, while the contraction is analogous to the downbeat.”⁷

(London: Pitman Medical Publishing Co., 1963); Erwin Heinz Ackerknecht, *Medicine at the Paris Hospital, 1794–1848* (Baltimore: Johns Hopkins University Press, 1967); Ian Maclean, *Logic, Signs, and Nature in the Renaissance: The Case of Learned Medicine* (Cambridge: Cambridge University Press, 2002). On the history of clinical listening, see Stanley W. Jackson, “The Listening Healer in the History of Psychological Healing,” *Am. J. Psychiatry*, 1992, 149, 1623–32.

- 3 Jacalyn Duffin, “Jodocus Lommius’s Little Golden Book and the History of Diagnostic Semeiology,” *J. Hist. Med. Allied Sci.*, 2006, 61, 249–87, on 283.
- 4 Pioneering work on the relation between music and medicine can be found in Jamie Croy Kassler, *Inner Music: Hobbes, Hooke, and North on Internal Character* (Madison: Fairleigh Dickinson University Press, 1995). For a larger contextualization of the sonic work of Auenbrugger and Laennec, see Jonathan Sterne, *The Audible Past: Cultural Origins of Sound Reproduction* (Durham: Duke University Press, 2003), 99–136, and Axel Volmar, “Sonic Facts for Sound Arguments: Medicine, Experimental Physiology, and the Auditory Construction of Knowledge in the 19th Century,” *J. Sonic Stud.*, 2013, 4(1), <http://journal.sonicstudies.org/vol04/nr01/a13>. For Laennec, see Jacalyn M. Duffin, “The Medical Philosophy of R. T. H. Laennec (1781–1826),” *Hist. Phil. Life Sci.*, 1986, 8, 195–219; Jacalyn Duffin, *To See with a Better Eye: A Life of R. T. H. Laennec* (Princeton, New Jersey: Princeton University Press, 1998).
- 5 In relation to the physical and mathematical sciences, see Peter Pesic, *Music and the Making of Modern Science* (Cambridge, Massachusetts: MIT Press, 2014).
- 6 See the excellent discussion in G. E. R. Lloyd, *The Revolutions of Wisdom: Studies in the Claims and Practice of Ancient Greek Science* (Berkeley: University of California Press, 1987), 257–70.
- 7 Galen, *Corpus medicorum Graecorum*, 10.464.1–4, as cited in Lloyd, *Revolutions of Wisdom*, 283–84.

Herophilus (335–280 BCE) had already begun to classify different kinds of pulse with names such as “capering,” “double-hammering,” or “dropped,” terms implicitly relying on underlying regular rhythmic patterns.⁸

Galen himself distinguished twenty-seven main types of pulse, whose differentiation required great rhythmic sensitivity and whose rate measurement called for advances in timekeeping. Herophilus was said to have constructed “a water clock able to contain a specified amount for the natural pulses of each age. Going in to the patient, he would set up the water clock and feel the pulse of the person suffering from fever. By as much as the movements of the pulse exceeded what is natural for the filling of the water clock, by that much he declared the pulse too frequent, that is, there was greater or less fever.”⁹ G. E. R. Lloyd observes that this shows “the evident *ambition* to make the inquiry an exact one, to construct pulse theory on the model of music, the successful mathematization of harmonics.”¹⁰ Galen considered the movements of the pulse to be circular, comparable with the motions of the heavenly bodies and also manifesting numerical proportions.¹¹

In many places, music remained a regular part of the curriculum of the faculties of medicine, some of which (such as Bologna and Ferrara) were at the same time leading centers of both music and medicine. Italian physicians of the fourteenth and fifteenth centuries continued to ponder the Galenic connection between pulse and music. They debated Avicenna’s assertion that “the nature of music is found in pulse,” based on his interest in Galen’s analysis of cardiac rhythms as musical ratios, which Avicenna arranged in an ordered list.¹² The matter was controversial, pitting venerated authorities against the Italian physicians’ own indecisive attempts to verify Avicenna’s claim to have felt (for instance) a 5:2 ratio in a living pulse. Such claims evoked considerable skepticism among his medical readers, some of whom doubted that neither he nor anyone else could verify them observationally. Up to this point, the pulse was assumed to be felt by the physician’s fingers, a purely tactile rather than auditory phenomenon.

MARQUET’S MUSICAL PULSE

François-Nicolas Marquet (1682–1759) used contemporary French musical traditions to revisit this ancient topic by notating the pulse in music. His medical studies at Pont-

8 James Longrigg, *Greek Rational Medicine: Philosophy and Medicine from Alcmaeon to the Alexandrians* (London: Routledge, 1993), 203–5, and Heinrich von Staden, *Herophilus: The Art of Medicine in Early Alexandria: Edition, Translation and Essays* (Cambridge: Cambridge University Press, 1989), 277–88.

9 Marcellinus *De pulsibus* 11.463.260–67, cited in Lloyd, *The Revolutions of Wisdom*, 283–84, n230.

10 *Ibid.*, 284.

11 Galen found ratios such as 5:2, 7:2, 9:2 in the pulse; see Nancy G. Siraisi, “The Music of Pulse in the Writings of Italian Academic Physicians (Fourteenth and Fifteenth Centuries),” *Speculum*, 1975, 50, 689–710, at 697–98.

12 Siraisi, “Music of the Pulse,” 696–701, and Nancy G. Siraisi, *Medieval & Early Renaissance Medicine: An Introduction to Knowledge and Practice* (Chicago: University of Chicago Press, 1990), 125–27. See also Jerome J. Bylebyl, “Disputation and Description in the Renaissance Pulse Controversy,” in *The Medical Renaissance of the Sixteenth Century*, ed. A. Wear, R. K. French, and I. M. Lonie (Cambridge: Cambridge University Press, 1985), 222–45; Leo Franc Holford-Strevens, “The Harmonious Pulse,” *The Classical Quarterly*, 1993, 43, 475–79; F. Wallis, “Signs and Senses: Diagnosis and Prognosis in Early Medieval Pulse and Urine Texts,” *Soc. Hist. Med.*, 2000, 13, 265–78.

à-Mousson were interrupted by four years spent at Montpellier (1710–4), which had not yet become a center of vitalist physiology.¹³ Montpellier's strong orientation to botany probably stimulated Marquet's interest in that subject, which led to his encyclopedic study of the plants of Lorraine. After finishing his medical training, he practiced at Nancy, where he eventually became the doyen of physicians.¹⁴ Though he ascribed his fundamental idea to ancient physicians such as Hermophilus, Marquet's *Nouvelle Méthode, facile et curieuse, pour connoître la pouls par des notes de la musique* (*An Easy and Curious New Method of Knowing the Pulse by Musical Notes*, first edition Amsterdam, 1747) went much further than the ancients (or his contemporaries) in applying music to medicine.¹⁵

Marquet's cardiac history began with himself, for "having been attacked by heart palpitations, I had much leisure to examine seriously in myself the different derangements and intermissions of the pulse."¹⁶ Marquet viewed his symptoms from the dispassionate perspective of contemporary mechanical philosophy, asserting that "the heart has the same rank and performs the same functions in man as the pendulum of a small or large clock; the veins and arteries take the place of wheels and the nerves are the cords that make the hydraulic machine go."¹⁷ This mechanical view informed his treatment of cardiac rhythm, for

so long and to whatever degree the movement of the heart and arteries is regular, the human body remains in perfect health, but as soon as this movement is disturbed by whatever accident, the health is found altered by an infinity of maladies. In order to detect this disturbance, the touching of the pulse has been invented, which is a science absolutely necessary for physicians and surgeons, a science which has something of the divine in that it not only informs us of that which happens in ourselves but also instructs us of the future.¹⁸

13 For Montpellier, see Elizabeth Ann Williams, *A Cultural History of Medical Vitalism in Enlightenment Montpellier* (Aldershot: Ashgate, 2003).

14 For Marquet's career, see Nathalie Dos Santos Costa, "François-Nicolas Marquet: sa vie, ses oeuvres et ses démêlés tardifs avec le Collège Royal de Médecine de Nancy" (M.D. diss., Université Henri Poincaré, Nancy 1, 2008), 20–21.

15 Besides Herophilus, he placed his project in the lineage of "Avicenna, Savonarola, Saxon, and Fernel, and many other learned physicians of antiquity," who proposed this connection between music and cardiac rhythm, "though unable to execute it." François Nicolas Marquet, *Nouvelle méthode facile et curieuse, pour connoître le pouls par les notes de la musique*, 2nd ed. (Paris: Didot, 1769), 4–5. All translations are by the author, unless otherwise noted. Among the few mentions of Marquet's medical/musical work, see Kassler, *Inner Music*, 220–21, which gives our figures 1 and 2 a without commentary. There are brief descriptions in Bonifacio Pistacchio and Eleonora Pistacchio, "François Nicolas Marquet (1687–1759) e il suo metodo per annotare con le note musicali il polso dell'uomo," *Rivista di storia della medicina*, 1996, 189–204; Georges Grignon, "François-Nicolas Marquet, Le pouls et le menuet (1682–1759)," *La lettre du musée*, 1998–97, (2), 6–7. The most significant treatment of Marquet to date is in Ingrid Sykes, *Society, Culture and the Auditory Imagination in Modern France: The Humanity of Hearing* (Houndmills, Basingstoke, Hampshire: Palgrave Macmillan, 2014), 60–63, which helpfully contextualizes different modalities of hearing.

16 Marquet, *Nouvelle méthode*, 2–3.

17 Ibid., 1.

18 Ibid., 1–2.

Marquet acknowledged that his quest for this kind of prophetic knowledge of the heart through musical notation may seem “something bizarre,” but (in his view) no more so than the universally recognized practice of representing the “sounds of music itself with the same notes, or depicting numbers with numerical symbols [*chiffres*] or finally depicting words with letters of the alphabet.”¹⁹

Marquet’s work applied mechanistic physiology to the ancient theory of humors.²⁰ In light of “the wonderful mechanism of [Joseph Guichard] Duvernay [1648–1730],” Marquet thought the cochlea caused the sensation of tone by resonating to various incoming vibrations.²¹ This mechanism then transmits these vibrations to the internal fluids, which thereby change their state according to the character of the music. Asserting that the sympathetic vibrations of the ear “in fact are a kind of touch” received from the vibrating air, Marquet thus understood music as a complex result of the mechanical percussion of the eardrum. Music “stimulates the auditory nerve and other sympathetic nerves, which being struck agreeably” affects the lymphatic and cardiac systems, “from which come sweet and agreeable ideas.”²²

Marquet based his theory on the “natural regular pulse” (*pouls naturel réglé*) in which the spacing between heartbeats “ordinarily equals the cadence of a minuet in movement,” which he specified as about sixty bars per minute, so that each measure—and heartbeat—takes about a second (fig. 1). His 3/4 time signature assigns three-quarter notes (equivalent to six eighth notes, which he calls *tems*) to each measure. The felt pulse coincides with the downbeat, the first eighth note of each measure, followed by five eighth notes of rest between pulses. In modern terms, Marquet heard the minuet “in one,” rather than “in three,” feeling the dance’s primary pulsation on the downbeats, which give its literal heartbeat. Marquet thus gave useful information about the performance practice of the minuet in his time, well before the establishment of metronomes (about 1800) or other mechanical tempo measurements.²³ “As if one sings or plays a minuet on some instrument, in that way one touches a tempered pulse,” so that the “touch” by which the musician sensitively evokes the minuet becomes the model for the physician’s equally sensitive—and musical—“touch.”²⁴

19 Ibid., 3–4.

20 Here Marquet referenced “the great [Friedrich] Hoffmann [1660–1742]”; see François Duchesneau, *La physiologie des lumières: empirisme, modèles et théories* (The Hague: M. Nijhoff, 1982), 32–64.

21 Ibid., 210, referring to Joseph-Guichard Duverney, *Traité de l’organe de l’ouïe: contenant la structure, les usages & les maladies de toutes les parties de l’oreille* (Paris: chez Estienne Michallet, 1683). Regarding Duverney, see Sykes, *Society, Culture and the Auditory Imagination in Modern France*, 27–37; Penelope Gouk and Ingrid Sykes, “Hearing Science in Mid-Eighteenth-Century Britain and France,” *J. Hist. Med. Allied Sci.*, 2011, 66, 507–45.

22 Marquet, *Nouvelle méthode*, 199–200. Marquet also applied his mechanical understanding of the body to advocate the use of music in the treatment of melancholia in his “Oration on the Twenty-Third Aphorism of Hippocrates” (delivered in 1759, the year of his death), in François Nicolas Marquet, *Traité de l’apoplexie, paralysie, et autres affections soporeuses développées par l’expérience* (Paris: Costard, 1770), 198–215.

23 Note that Marquet’s first edition preceded the 1752 original publication of Johann Joachim Quantz, *On Playing the Flute*, trans. Edward R. Reilly (New York: Schirmer Books, 1966). For discussion of issues regarding pulse measurement of tempo, see Peter Pesic, “Thomas Young and Eighteenth Century Tempi,” *Performance Pract. Rev.*, 2013, 18(1), <http://scholarship.claremont.edu/ppr/vol18/iss1/2>.

24 Marquet, *Nouvelle méthode*, 37.



Fig. 1. Marquet's notation of the "natural regular pulse," overlaid against a minuet. Courtesy: University of Kentucky Special Collections Research Center.

Notwithstanding the old cliché that the hearts of waltz-loving Viennese beat in 3/4 time, Marquet was, to the best of my knowledge, the first to suggest that the heart beats to that rhythm, writing more than half a century before the waltz emerged as a well-known dance. His claim that cardiac rhythm should be understood in triple meter (such as 3/4), rather than duple (such as 2/4), is remarkable because the heart's "lub-dub" (to use a modern spelling) does not fall clearly into any simple musical meter. Thus, Marquet could alternatively have used another dance or musical form, such as a march (in 4/4 or another duple meter like 2/4) but seems to have chosen the minuet for musical reasons, probably because it was the primary social dance of his time and hence the most obvious rhythmic pattern for the heartbeat, or at least the most familiar to his audience. His rhetoric implied that anyone who has the least tincture of music would readily be able to call a minuet to mind, or at least feel its tempo, which he seemed to assume his readers would have danced many times.

Marquet himself indicated his awareness of different rhythmic possibilities than the one he called "natural": "If the blood is well conditioned and has a perfect equilibrium between liquids and solids, the pulse will be natural and tempered, will beat equally and have the same force and same interval of time between all the pulsations; on the contrary, if the blood lacks either quantity or quality and if the solid parts are not proportional to the liquids, the pulse will become non-natural."²⁵ Those "of a lively and bilious temperament" have heartbeats sufficiently elevated that they show *six* (rather than five) *tems* between beats; the blood of those who are "pitouitous or melancholic" circulates so slowly that they require six *tems* between beats, thereby manifesting their notably lower vital tempo. He advised physicians to be aware of their patients' temperaments so that they can adjust to their respective "natural" cardiac function, "for they should be counted as natural if they continue in the same *mouvement* [tempo]." He also noted that some physicians consider four heartbeats between regular respirations as "natural," three being "too slow, but this rule is vague and unsure."²⁶ Here too he seems influenced by musical practice, which does not observe breath (controllable by a skillful singer or player) so much as more deeply ingrained rhythms. His judgment of "natural" cardiac function finally rests on a musical judgment that "all kinds of pulse that approach most closely" the pulse of his minuet (fig. 1) "are counted the best." Never before had a dance served as a standard of cardiac rhythm; rather, musicians used resting pulse as a standard of tempo.²⁷

Marquet correlated every degree of physical condition and activity with the respective kind of pulse. Following traditional Galenic lore, he distinguished "strong," "small," "worm-like" pulses, which Marquet notated with whole notes, half notes, and tied half-notes, respectively (fig. 2a). Further musical notations on various lines designated still other kinds of pulse, "elevated" or "superficial." In terms of *tems* between each heart pulsation, "if one counts more or less of these spaces between each beat, the pulse will be irregular or unequal [*inégal*] in movement; if the note is not placed between two parallel lines, it will be unnatural in its force, as well as if it is a whole note, half note, or quarter note."²⁸ Marquet deployed a combination of the traditional mensural notation of music (moving left to right at a certain tempo), along with a temporal microstructure using the pitch-indicating capabilities of the staff, indicating the fine structure of "non-natural" pulsations in the upper register of the output. In this way, Marquet began to notate information about the varying "force" of the pulse.

Marquet asserted that his notations provide "the rules by which one can very easily acquire a knowledge that has been for a long time imperfect, so regulated by the notes of music, which should not be disdained, for one has not yet found more sure methods to imprint strongly the ideas of the pulsations of which one wanted to give knowledge than those that can enter the memory by the most evident signs that one can show the eyes."²⁹ He felt that "there does not remain much to do to perfect this method, by

25 Ibid., 15–16.

26 Ibid., 36–37.

27 For instance, Quantz, *On Playing the Flute*, 283–91.

28 Marquet, *Nouvelle méthode*, 32.

29 Ibid., 32–33.

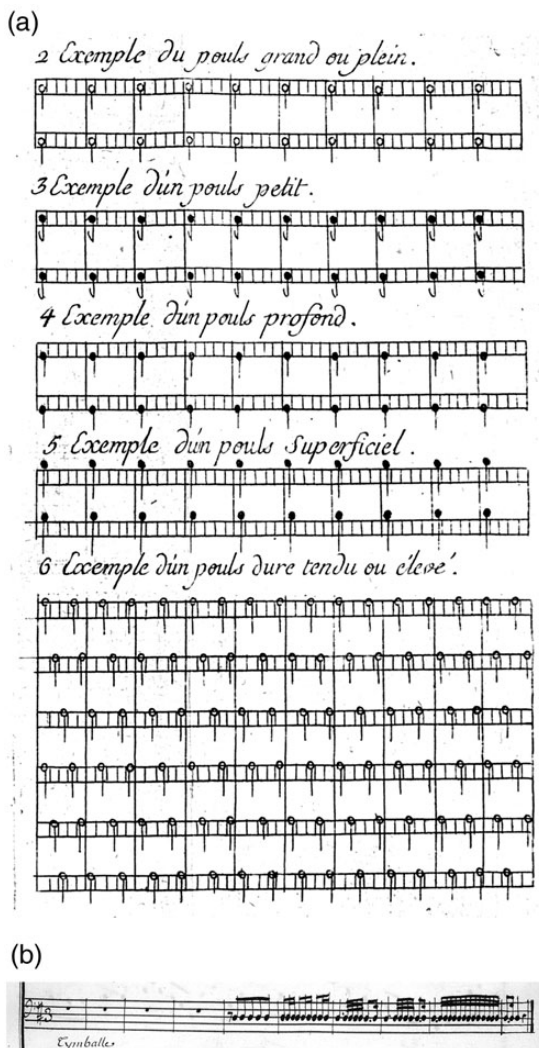


Fig. 2. (a) Marquet's notation of various kinds of pulse; (b) the notation for drum (*tymballe*) from Jean-Philippe Rameau's *Hippolyte et Aricie* (1742 edition), act I, scene 4. Courtesy: University of Kentucky Special Collections Research Center; Bibliothèque nationale.

which one will show clearly to the finger and to the eye all the differences between natural and unnatural pulses." Marquet requires only that "those who wish to be instructed in these procedures have at least some little tincture of music, so that in beating a regular measure they accustom themselves to know the correct cadence of the pulse by comparing it with that of music."³⁰ Marquet seems unaware of anatomical

diseases of the heart, such as had been discussed by Raymond Vieussens (ca. 1635–1715) or Jean-Baptiste Sénac (1693–1770).³¹ Thus, Marquet followed the ancient tradition in which pulse was a measure of fever; his musical notation therefore was a teaching device within that tradition, not a method of cardiac diagnosis.

Though he drew on the conventions of musical staff notation (in which pitch is notated vertically), Marquet indicated more nuances for the pulse than did contemporary musical notation for drums (such as fig. 2b). Nonetheless, there is no evidence he considered the pulse actually to be *heard*, as opposed to felt, despite Ingrid Sykes's claim that Marquet's minuet overlaid "perceived pulse sounds over the form of the dance" so that "by visualizing the *sounds* of the pulse a better diagnosis could be made."³²

Marquet's ensuing topics also looked to musical archetypes. The more rapid pulse of children he considered a fourth higher than that of adults, because the ratio between them, 80:60 beats per minute, respectively, equals the ratio 4:3 (the Pythagorean perfect fourth). Marking the gradual declination into mortality, "from age sixteen, [the pulse] slows more and more as the blood thickens and becomes [less] rapid [sic]; one also becomes aware from time to time of its inequality and of some intermissions," whose awareness had spurred his own studies of the pulse.³³ These regular pulsations, musical and cardiac, form the background against which Marquet then posed his discussions of irregular pulses. The contemporary compositional technique of *notes inégales*—the dotted rhythms so characteristic of contemporary French music—is both notationally and theoretically the obvious correlate of *pouls inégales* (fig. 3a). For instance, the passage in figure 3b shows a typical example of *notes inégales*, familiar in Marquet's period. Though ostensibly using musical notation as a neutral means to represent the heartbeat, Marquet's musical experience shaped his hearing. Rather than taking unquestioningly the notion that the heart beats *notes inégales*, we may more plausibly conclude that the innumerable *notes inégales* he had heard in musical works prepared him to feel this pattern in the heartbeats.

Likewise, when he turned to even more irregular cardiac patterns, we can discern the shapes of familiar rhythms. His notation of "irregular and intercadent" pulses (fig. 4a) had the same pattern of rapid upbeats that characterizes the French *ouverture* (4b). His notation allowed medical practitioners much clearer knowledge of the heartbeats' complex time-structures by referring them to the shared sonic world of French music. Marquet took music as the means by which he gained and conveyed information about the pulse.

THE VITALIST CRITIQUE OF MARQUET

The French reaction to Marquet's work was dominated by the polemic between vitalists and mechanists. An early critical response came from Théophile de Bordeu (1722–76), an eminent Montpellier graduate, advocate of vitalism, and pioneer of glandular

31 Raymond Vieussens, *Traité nouveau de la structure et des causes du mouvement naturel du coeur* (Avignon, 1715).

32 Sykes, *Society, Culture and the Auditory Imagination in Modern France*, 61.

33 Marquet, *Novelle méthode*, 40; note that the "*devient rapide*" in the text is probably a misprint for "*devient [moins] rapide*," "becomes less rapid" on account of the thickening of the blood with age.

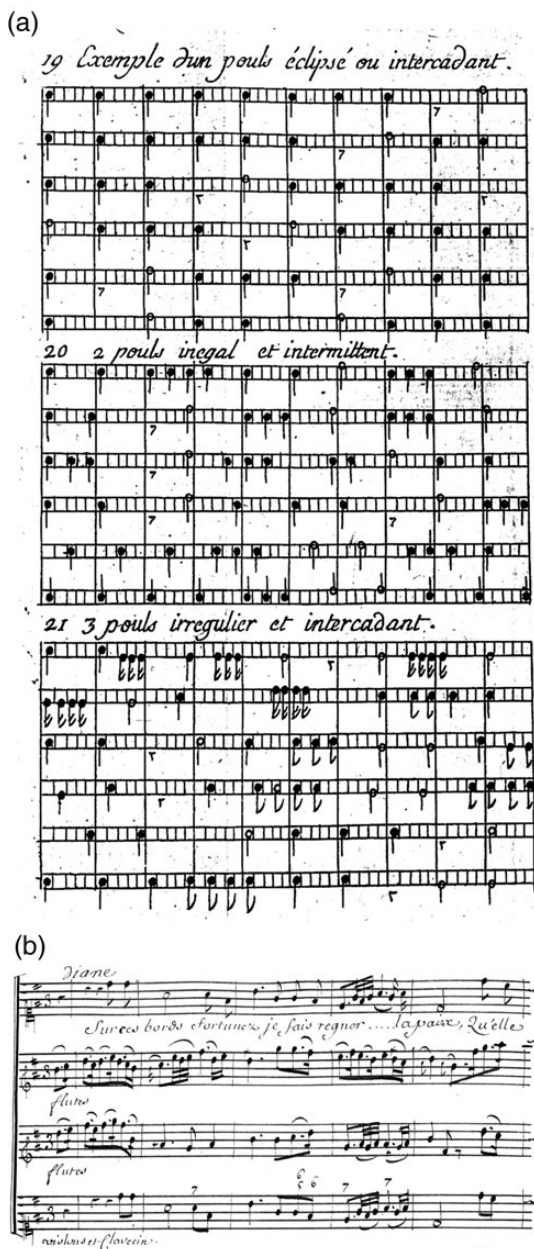


Fig. 3. Marquet's notation of (a) "intercadent," "unequal and intermittent," and "irregular and intercadent" pulses; (b) a passage in *notes inégales* from Rameau, *Hippolyte et Aricie* (1742 edition), Prologue. Courtesy: University of Kentucky Special Collections Research Center; Bibliothèque nationale.

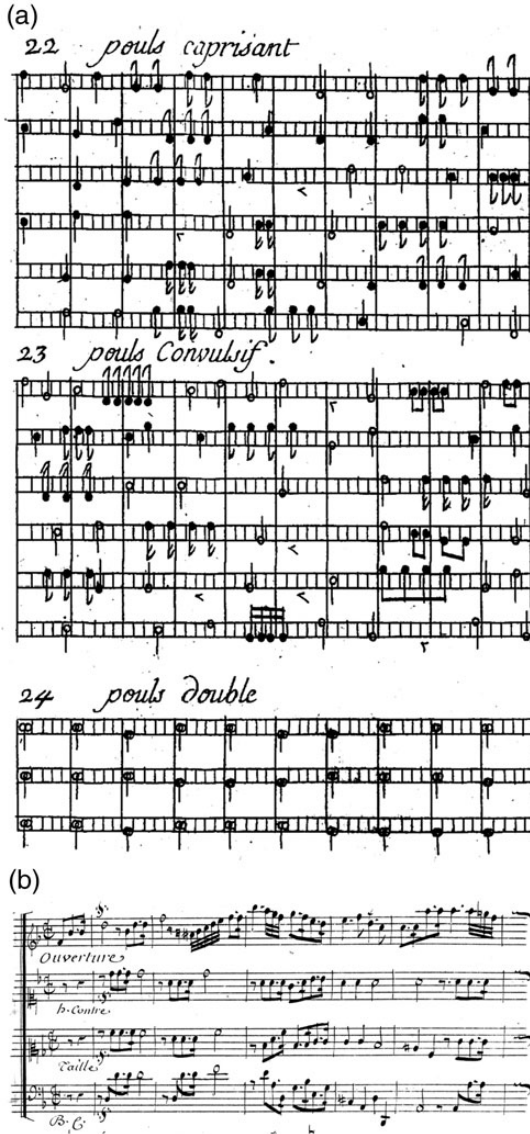


Fig. 4. (a) Marquet's notation of "capering," "convulsive," and "double" pulses; (b) a French *ouverture*, to Rameau, *Hippolyte et Aricie* (1742 edition). Courtesy: University of Kentucky Special Collections Research Center; Bibliothèque nationale.

studies. In his *Recherches sur la pouls* (1756), Bordeu wrote that because "the perfect [*parfait*] pulse of adults is disposed to take all kinds of modifications," depending on various glandular secretions, "it is only in that sense that one could say with Hérophile that the movements of the pulse have some relation to the laws of music; but if one wanted to apply to the pulse the laws of music, as a modern has tried to do, one will not

avoid entering into painful details [*détails pénibles*] that will not be either useful or better founded.”³⁴ Here the anonymous “modern” is clearly Marquet, his approach ascribed to “Hérophile,” its ancient protagonist Herophilus, as if Marquet himself were merely the misguided epigone of a much older view. Bordeu himself classified further types of pulse whose distinctions required much sensitivity he thought went beyond the possibilities of musical notation, but gave no evidence to confirm Sykes’s claim that, for him, “there was no division between pulse sound and medical illness. When a physician observed illness, he also perceived its *sound*.”³⁵ Bordeu’s exquisite distinctions between pulses remained purely tactile.

A second edition (1769) of Marquet’s *Nouvelle méthode* indicated that his views were widely noticed by his peers.³⁶ It included several critiques, such as satirical verse that made fun of the idea that the heart might be reduced to musical rhythms.³⁷ This new edition presented an excerpted version of the section dealing with “the doctrine of the pulse following music” in the article “Pouls” from Diderot’s *Encyclopédie* (1765), written by Joseph-Jacques Ménéret de Chambaud (1739–1815), who wrote many of the medical essays in the later volumes of the *Encyclopédie*.³⁸ This sizable treatment of Marquet’s ideas, part of this important (and widely read) compilation, placed Marquet’s work before a wide audience; much of this material also appeared soon thereafter in Ménéret’s *Nouveau traité de la pouls* (1768).

Like several other medical contributors to Diderot’s project, Ménéret was trained at Montpellier and advocated the vitalism prevalent there.³⁹ As had Bordeu, Ménéret’s review of Marquet’s theory begins by ascribing the origin of this theory to Herophilus. Ménéret critiques Marquet’s work as “only an absurd and bizarre [*singulière*] mélange of several dogmas of the Galenists, the mechanists, and the chemists.” Still, Ménéret

34 Théophile de Bordeu, *Recherches sur le pouls, par rapport aux crises* (Paris: De Bure l’aîné, 1756), 451. For Bordeu’s relation to Montpellier, vitalism, and Diderot, see Elizabeth Ann Williams, *The Physical and the Moral: Anthropology, Physiology, and Philosophical Medicine in France, 1750–1850* (Cambridge: Cambridge University Press, 1994), 20–49; Williams, *Medical Vitalism in Enlightenment Montpellier*, 147–62, 215–20. Bordeu’s commentary on Marquet is also helpfully addressed in Sykes, *Society, Culture and the Auditory Imagination in Modern France*, 58–70. See also the helpful discussion in Antoinette Emch-Deriaz, “De l’importance de tater le pouls,” *Can. Bull. Med. Hist.*, 2001, 18, 369–80.

35 Sykes, *Society, Culture and the Auditory Imagination in Modern France*, 67.

36 Its editor, Marquet’s son-in-law Pierre-Joseph Buchoz, included a number of encomia (including his own), but these came preponderantly from physicians from Nancy, hence part of Marquet’s professional circle, perhaps his friends or those who wished to honor his memory, such as “Approbation de Monsieur Grandclas, Conseiller, Médecin du Roi, & Doyen de la Faculté de Médecine de Pont-à-Mousson” (69–70); “Approbation de Monsieur Liabé, Conseiller, premier Médecin de S. A. R. Madame, Duchesse douairière de Lorraine & de Bar . . .” (71–72); “Jugement de Monsiuer de Chevrier, . . . extrait des Mémoires pour servir à l’Histoire des Hommes Illustres de la Lorraine” (72–78); “Extrait de la Bibliothèque Lorraine, par Dom-Calmet” (84–85); “Éloge Historique de M. Marquet” by “M. François, Docteur agrégé au Collège Royal des Médecins de Nancy” (163–66).

37 Ibid., “Jugement de Monsieur le Baron Duhaler sur cet ouvrage” (79–81), answered by “Réponse à l’auteur anonyme, sur sa satire, Contré le Traité du Pouls” (82–83).

38 Buchoz also includes Ménéret’s “Extrait du nouveau Traité du Pouls” (ibid., 86–95), which largely duplicates material in “Exposition en forme de critique, de la Doctrine du Pouls par la Musique, par les Auteur du Dictionnaire Encyclopédique, à l’article Pouls” (142–60). To Buchoz’s credit, he includes the passages most critical of Marquet.

39 See Williams, *Medical Vitalism in Enlightenment Montpellier*, 119–23, 226–30.

devoted a considerable amount of space to the details of Marquet's ideas, even giving fourteen examples in musical notation. After presenting these examples, Ménuret conceded that

one cannot deny that there is a quite sensible connection between the laws of music and the pulse; it is nevertheless no less true that the painful details [*détails pénibles*] into which this author has descended are almost without foundation and utility; at most, this comparison and these figures, if they were indeed really accurate [*bien justes*], could serve to allow conception of that which it is necessary to express, [namely] to give a more palpable idea of the modifications of the pulse by depicting them for the eyes; and if the author had only this object in view, he was not carried far from his goal and his work surely would have been very advantageous, if the system on which it were based conformed less to that of the mechanicians, were less reasoned, and (in a word) were closer to observation.⁴⁰

Thus, Ménuret's objection was not so much to the basic connection between music and pulse but to what he considered the mechanical reductiveness of Marquet's approach. Ménuret, writing a decade after Bordeu, seems to have picked up his phrase *détails pénibles*, with its implications of futility and worthlessness (perhaps caught by the English idiom "gruesome details").⁴¹ The transmission and repetition of this barbed comment shows a clear line of polemic unity connecting these fellow vitalists as they joined forces to reject Marquet.

Ménuret, among others, devoted a great deal of attention to the Chinese pulse theory, which evidently struck many of the *poulistes* as even more detailed and subtle than Western accounts. Indeed, in his *Encyclopédie* article on "Pouls," Ménuret turned to the Chinese theory immediately after his discussion of Marquet.⁴² As Ménuret described it, both theories involve music underlying the pulse because

man, following the Chinese, through his nerves, muscles, veins, and arteries, is a kind of lute or harmonic instrument whose parts give various sounds, or rather have a certain kind of temperament proper to themselves because of their shape, location, and various usages. The different kinds of pulse are like the different sounds and different touches of these instruments, through which one can judge infallibly their disposition, just as a string that is more or less tight, touched in one place or in another, more or less strongly, gives different sounds and allows us to know whether it is too tight or too loose.⁴³

40 Ménuret de Chambaud, "Pouls," ed. Denis Diderot and Jean le Rond d'Alembert, *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers* (Paris: Briasson, 1772, 1751), 13:220–21, also quoted in Marquet, *Nouvelle méthode*, 144, 159.

41 Thus, for instance, Charles Ozanam, *La circulation et le pouls: histoire, physiologie, sémiotique, indications thérapeutiques* (Paris: J.B. Baillière et fils, 1886), 111, after summarizing Marquet's ideas finds that they have "no practical result and in no way advanced the semiotic sciences." I thank Martine Voiret for her expert advice on the eighteenth-century connotations of "*détails pénibles*."

42 Ménuret de Chambaud, "Pouls," 13:221–28.

43 Ibid., 13:225.

Arguably, Ménuret treated this musical approach at far greater length than Marquet's because the Chinese seem far closer to his own vitalist presuppositions; their exquisitely sensitive classification of pulse did not introduce any quantitative measures of the pulse, as had Marquet by measuring its tempo.

Though he commented critically on what he calls the "chaos" of the Chinese description of various pulses, Ménuret expressed respect for the antiquity of their doctrine, only recently received in the West: "I desire that one suspend judgment on things one does not know, that one should not condemn them only after a ripe examination based on repeated observations." His commentary brings forward but does not make explicit the powerful suggestion that the human body "is a kind of lute or harmonic instrument whose parts give various sounds." Ménuret remains at the level of analogy: "the different kinds of pulse are *like* the different sounds and different touches of these instruments," disclosing but not exploring the possibility that the different kinds of pulse *are* the different sounds of the body considered as a musical instrument.

Ménuret indicated other ways in which he wanted to carry further the connection between music and medicine. Besides the eighty medical articles he contributed to the *Encyclopédie*, he also wrote for it an extensive entry on "Musique (effets de la)" in which he discussed the medical uses of music alongside many instances of its mythic powers over soul and body. Regarding these, he quoted the mechanist Herman Boerhaave that "there is reason to presume that the prodigies due to enchantment and the verses used in the cure of maladies ought to be credited to *music*, in which ancient physicians excelled."⁴⁴ Thus, Ménuret instanced Orpheus's use of music in rescuing Eurydice from hell as signifying "the cure of the wound a serpent had made, for which *music* is extremely efficacious."⁴⁵ Ménuret cited the use of music against tarantism and melancholia, as had Marquet, though dismissing Giovanni Battista Porta's "bizarre idea" that music could provide a panacea against all illnesses.⁴⁶

To understand the basis of music's medical effects, Ménuret began by noting that "only considering the human body as an assemblage of more or less stretched fibers and fluids of different natures, an abstraction made from their sensitivity, life, and movement, one will conceive without difficulty that *music* ought to have the same effect on these fibers as it does on the strings of a nearby instrument," through what came to be called sympathetic vibration.⁴⁷ Despite his vitalist training, he shared with Marquet this mechanistic account of the body, to which we will shortly return. Further, Ménuret mentioned that he himself had published findings that music can have curative effect against what he calls *passion hystérique*, a malady then considered specific to women.⁴⁸

44 Ménuret de Chambaud, "Musique, effets de la," *Encyclopédie*, 10:903–9.

45 Ibid., 10:904. A view he ascribes to one "dom Calmet."

46 Throughout, Ménuret cited his friend Joseph-Louis Roger, *Tentamen de vi soni et musices in corporum humanum* (M.D. diss., Montpellier, 1758) (*Treatise on the Power of Sound and Music on the Human Body*).

47 Ménuret de Chambaud, "Musique, effets de la," 10:907. For the connotations of "fibers" in Montequieu, see John C. O'Neal, *Changing Minds: The Shifting Perception of Culture in Eighteenth-Century France* (Newark, Delaware: University of Delaware Press, 2002), 102–5.

48 Ménuret de Chambaud, "Musique, effets de la," 10:908, which mentions that his findings were "read at the Société Royal des Sciences" but does not give a date or further reference.

Ménuret thus was a rival of Marquet in the realm of musical medicine. Though both used mechanistic language to describe the general effect of music on the body, they parted company over the "painful details," the specific quantification that musical notation applies to pulse. Ménuret's critical attitude reflected his adherence to vitalism. Yet close reading of Ménuret's article show that he shared many of Marquet's ideas.

The wide distribution of Bordeu and Ménuret's deprecatory remarks, along with the preeminence of so many Montpellier antimechanist physicians, surely played a large part in the sinking of Marquet's name from sight in subsequent French sources.⁴⁹ Bordeu's work inspired three major works imitating him (including Ménuret's own treatise), a coterie that came to be called the "*poulsistes*" and that advanced a vitalistic philosophy that relied on "natural" curative measures. In accord with their rejection of mechanism and its correlate quantitative bias, Bordeu and his followers considered accurate measurement of pulse rate to be futile and useless.

THE MECHANIST RESPONSE TO MARQUET

Mechanistic physicians were far more receptive to Marquet than were vitalists. His findings found a place in a larger movement to apply quantitative measurements to the pulse. John Floyer (1649–1734) had commissioned a special watch for the timing of the pulse that included the innovation of a second hand, described in *The Physician's Pulse-Watch* (1707), which also included extensive treatment of the complex Chinese approach to the pulse; Marquet showed no awareness of these developments.⁵⁰ Mechanists who continued Floyer's work accumulated data on pulse rates, including Marquet's pulse tempo. In doing so, they were following the lead of Albrecht von Haller (1708–77), who advanced his teacher Herman Boerhaave's view of living tissue as composed of fibers, whether "irritable" (contractile muscles) or "sensible" (nerves).

Where Ménuret had treated them analogically, Haller's detailed laboratory demonstrations gave those fibers physical reality. As the most "irritable" organ in the body, the heart's pulsation was a paramount manifestation of the behavior of its constituent fibers.⁵¹ In his comprehensive *Elementa physiologiae corporis humana* (1757–66), Haller approvingly mentioned Marquet's "reduction of the pulse to musical notes" next to Floyer, who "above all recalled [the pulse] to numbers."⁵² Haller also included Marquet's pulse tempos in his collection of comparative pulse data

49 For instance, Marquet is not mentioned in Roger, "Tentamen de vi soni et musices in corporum humanum," nor in its later translation, Joseph-Louis Roger, *Traité des effets de la musique sur le corps humain*, trans. Etienne-Jules Sainte-Marie (Paris: Brunot, 1803).

50 Sir John Floyer, *The Physician's Pulse-Watch* (London: Samuel Smith & Benj. Walford, 1707); D. D. Gibbs, "The Physician's Pulse Watch," *Med. Hist.*, 1971, 15, 187–90; Denis Gibbs, "The Almshouses of Lichfield: Cradles of Pulse-Timing," *J. Med. Biogr.*, 1994, 2(2), 89–93. The minute hand had first appeared in watches about 1670. For the earlier history, see J. Levett and G. Agarwal, "The First Man/Machine Interaction in Medicine: The Pulsilogium of Sanctorius," *Med. Instrum.*, 1979, 13, 61–63.

51 Roy Porter, *The Cambridge Illustrated History of Medicine* (Cambridge: Cambridge University Press, 2001), 165–66.

52 Albrecht von Haller, *Elementa physiologiae corporis humani* (Venice, 1760), 2:171.

for various ages.⁵³ Citing Haller in this connection, later writers on the pulse continued to refer to Marquet.⁵⁴ In the process, Marquet's specific approach was generally forgotten, subsumed in the larger movement to understand the body in mechanistic terms. Yet Haller acknowledged the closeness between numerical and musical understandings of pulse, a natural connection for fibers whose physical constitution necessarily involves vibration.⁵⁵ By Haller's time, the well-studied physics of vibrating bodies thus opened the way to all kinds of studies of the sound and resonance of living bodies.

AUENBRUGGER AND CORVISART: SOUNDING BODIES

In the overlapping contexts of the mechanistic medicine in which he was trained and his concurrent involvement in music, Auenbrugger took the rather natural step of percussing the human body, evoking from this vibrating body sounds with diagnostic meaning. The son of a hotelkeeper in Graz, Auenbrugger completed his medical training in Vienna under Boerhaave's student Gerard van Swieten (1700–72), who became personal physician to the Empress Maria Theresa and a prominent advocate of reforms in the practice and teaching of medicine; van Swieten played the bass viol, which he recommended along with attendance at the theater.⁵⁶ In addition, Gerard's son Gottfried van Swieten (1733–1803) went on to a distinguished career as a diplomat and librarian in Vienna, where he was an important patron of Haydn, Mozart, and Beethoven, especially noted for his advocacy of the music of J. S. Bach, who at that time was still relatively little known.

Like Haller, Gerard van Swieten's *Commentaria in Hermannii Boerhaave Aphorismos de cognoscendis et curandis morbis* (5 vols, Leiden, 1742–72) continued their teacher's mechanistic approach to medicine based on the two-fold constitution of the body in terms of fluid and fiber, for "of the solid parts of the body, we can conceive none more simple than a fiber," which van Swieten compared to "a mathematical line" in its fundamentality and geometric simplicity.⁵⁷ Commenting on Boerhaave, van Swieten began his encyclopedic treatment with the successive diseases of "a simple solid fibre," "a weak and lax fibre," and "a stiff and elastick fibre."⁵⁸

Thus, van Swieten's reliance on the fundamental status of physiological fibers and fluids made natural his attention to their possible vibrations and the concomitant sonic symptoms. Discussing empyema in the thorax, van Swieten related that

53 Ibid., 2:182.

54 For instance, W. Falconer, *Observations Respecting the Pulse; Intended to Point out with Greater Certainty, the Indications Which It Signifies; Especially in Feverish Complaints* (London, 1796), 17, cites Marquet's value of 60 for adult resting pulse as coming from Haller.

55 This point is also emphasized by Bernardino Fantini, "Forms of Thought between Music and Science," in *The Emotional Power of Music*, ed. Tom Cochrane and Bernardino Fantini (Oxford: Oxford University Press, 2013), 257–70, which discusses Haller on 259–60.

56 Frank T. Brechka, *Gerard Van Swieten and His World 1700–1772* (The Hague: M. Nijhoff, 1970), discusses Van Swieten's reforms in the teaching and practice of medicine (132–42) and his interest in music (114).

57 Gerard van Swieten, *The Commentaries upon the Aphorisms of Dr. Herman Boërhaave* (London, 1754), 1:38.

58 These are discussed in *ibid.*, 1:39–97.

"Diemerbroeck had the care of a merchant of Nimmeguen, in whom he could plainly hear the fluctuation of the matter contained within his breast, upon bending his body backward and forward," matter which the man passed out through his ureters.⁵⁹ In his discussion of pneumonia, van Swieten described the mechanics by which "the air vessels of the lungs are compressed by the distended blood-vessels, therefore the sides of the vesicles in which the bronchia terminate, rub against each other; whence follows an almost continual and irritating slight cough," which can be exacerbated by the formation and accumulation of mucus. Because of this, "generally there is also at the same time a disagreeable rattling in the breast, which arises from the collision of the air against the mucus here collected, or else from the dried vesicles of the lungs rattling like dry parchment, when they are expanded by inspiration."⁶⁰ This description of pulmonary crepitation connected its characteristic sound (audible to the unaided ear) with the underlying physiological mechanics of the afflicted lungs. These examples may be closer to Hippocratic succussion (the intentional "shaking" of a patient); indeed (as Duffin and others have noted) the fundamental techniques of percussion may have long predated Auenbrugger.⁶¹ Erna Lesky has pointed out that van Swieten himself regularly used abdominal percussion to distinguish ascites from tympanites.⁶² In all these cases, attention to the mechanical behavior of fibers and fluids underlay van Swieten's attention to sonic signs.

This context underlies his student Auenbrugger's *Inventum novum ex percussione thoracis humani interni pectoris morbos detegendi* (*New Discovery to Detect Diseases within the Chest from Percussion of the Human Thorax*, 1761), in which the only authority he cites is "the commentaries of the very illustrious Baron [Gerard] van Swieten because there the true observer finds resolved in every respect everything one could ever desire."⁶³ A much-repeated story connects Auenbrugger's early experience with testing the levels in wine casks through knocking on them with his discovery of the diagnostic value of percussion, as if the thorax were akin to a cask. Yet Max Neuburger, the historian who put forward this story, also noted that it lacked any documentary evidence.⁶⁴ Auenbrugger's training in the behavior of bodily fibers and his musical abilities may have been far more germane, for in his own *Inventum novum*, he initially described the sonic qualities of the thorax in terms of drums and their variable timbral possibilities, only later mentioning the analogy with a cask.⁶⁵

59 Ibid., 11:478–79, section 1191.

60 Ibid., 8:241, section 826.

61 Duffin, "Jodocus Lommus's Little Golden Book and the History of Diagnostic Semeiology," 269–70, especially 269n78.

62 Erna Lesky, "Leopold Auenbrugger—Schüler van Swietens," *Dtsch. Med. Wochenschr.*, 1959, 84, 717–25.

63 For convenience, I will cite from the original text and translation given in Leopold Auenbrugger, *Nouvelle méthode pour reconnaître les maladies internes de la poitrine par la percussion de cette cavité*, trans. Jean Nicolas Corvisart des Marets (Paris: Chez Méquignon-Marvis, 1808), xxi.

64 Max Neuburger, *Leopold Auenbrugger und sein Inventum Novum: eine historische Skizze* (Vienna: M. Salzer, 1922), 11.

65 Auenbrugger's only mention of casks is *Nouvelle méthode*, 46–47. I will bring forward evidence confirming the suggestion that "Auenbrugger's musical abilities may have contributed to his discovery of thoracic percussion" given in Saul Jarcho, "Auenbrugger, Laennec, and John Keats," *Med. Hist.*, 1961, 5, 169. George

Auenbrugger's musical background went far beyond the rather high standards of familiarity and education expected of a *Kulturträger* in his milieu. He wrote the libretto for an opera by Antonio Salieri, *Der Rauchfangkehrer* (*The Chimney-Sweep*), performed repeatedly in Vienna and elsewhere during 1781–88, whose text Wolfgang Amadeus Mozart described as “a miserable original piece.”⁶⁶ Auenbrugger knew Salieri well enough to be the witness for his wedding in 1775. Further, Auenbrugger maintained his connections with the van Swietens in Vienna, including Gottfried. Auenbrugger was also a friend of the Mozart family, to whom they turned when the Archbishop Colloredo (Wolfgang's irascible employer in Salzburg) traveled in 1773 to Vienna, where the Mozarts sought a new life.⁶⁷

Auenbrugger's daughters Marianna and Katharina were both distinguished keyboard players, to whom Joseph Haydn dedicated six piano sonatas (Hob. XVI:3–59, 20), writing in 1780 that “the approval of the *Demoiselles* von Auenbrugger . . . is most important to me, for their way of playing and genuine insight into music equal those of the greatest masters. Both deserve to be known throughout Europe through the public newspapers.” Leopold Mozart also noted “the daughter of Dr. Auenbrugger . . . who . . . play[s] extraordinarily well and [is] thoroughly musical.”⁶⁸ Marianna also studied composition with Salieri; her *Sonata per il clavicembalo o forte piano* (ca. 1781), her “first and last work” (as its title page proclaimed), was published along with an ode by Salieri, who signed himself “a friend and admirer of her rare virtues.”⁶⁹

All these connections, both Auenbrugger's own and those of his daughters, embedded him strongly in Viennese musical culture. His *Inventum novum* used precise musical terminology to describe various thoracic sounds. After noting that “the healthy human thorax sounds, if it is struck,” he added that “the sound the thorax gives is observed to be such as in drums [*tympanis*] when they are covered by a cloth or by another fabric made of thick wool.”⁷⁰ Auenbrugger's description showed close knowledge of contemporary drum technique, including the use of muting cloths called *coperti*, used to muffle the sound of the timpani. This practice was long familiar by the 1750s, when he began his clinical studies of percussion; such muffled drums were customary in military music to achieve a funereal effect and also were used by Mozart in *Idomeneo* (1781) and *Die Zauberflöte* (1791) and then by Haydn in his Symphony no. 102 (1794).⁷¹

Dock, “Roziere de La Chassagne and the Early History of Percussion of the Thorax,” *Ann. Med. Hist.*, 1935, 7, 447, also thinks that Auenbrugger's musical training “must have influenced his choice of words.”

66 For the score of the opera, see Antonio Salieri and Leopold Auenbrugger, *Der Rauchfangkehrer* (New York: Garland, 1986); the editor's introduction provides useful commentary on the context of the work in the development of German Singspiel. For the printed libretto, see Christian Friedrich Schwan et al., *Librettos IV* (New York: Garland, 1986). Mozart's comment comes in his letter of December 10, 1783.

67 Hermann Abert, *W. A. Mozart*, ed. Cliff Eisen, trans. Stewart Spencer (New Haven: Yale University Press, 2007), 258.

68 Sylvia Glickman, “Auenbrugger, Marianna von,” *Grove Music Online*, n.d.

69 This work was rediscovered and included in Barbara Harbach et al., *Women Composers for the Harpsichord* (Bryn Mawr, Pennsylvania: Elkan-Vogel, 1986).

70 Auenbrugger, *Nouvelle méthode*, 2, 4.

71 James Blades and Edmund A. Bowles, “Timpani,” *Grove Music Online*, n.d.; James Blades, *Percussion Instruments and Their History* (New York: Frederick A. Praeger, 1970), 263. Given his close association with the composer, Auenbrugger probably was aware of Salieri's innovative use of timpani with unusual tunings in

Auenbrugger justified his comparison with a drum by emphasizing its utility in this case, in which "we lack the specific notions that express the character of the thing conceived": in this unfamiliar realm of sonic phenomena evoked by thoracic percussion, music seemed to be the sole source of precise description.

Auenbrugger's work remained largely unknown until translated and published in 1808 with extensive commentary by Jean-Nicolas Corvisart (1755–1821), who had been Napoleon's personal physician since 1804 and whose advocacy of percussion brought that technique to the forefront of medical attention.⁷² Corvisart emphasized the significance of Auenbrugger's musical terminology, especially its nuances of timbre, remarking that this comparison with a drum is "quite ingenious and above all quite accurate to express the sound one perceives from a struck human thorax," whereas "a metaphysical definition would have nothing to offer to fix the understanding."⁷³ Though admitting that all such efforts "have always been vain or enormously insufficient," nevertheless, "in order to give birth to the idea of the things sought, it is necessary to make a comparison offered to the competent organ . . . How to depict musical sounds, the song of birds, other than by ear?" By justifying the competence of the ear, Corvisart affirmed its legitimacy for cardiac diagnosis in general and also in the specific cases for which Auenbrugger provides even more detailed sonic descriptions.⁷⁴

To establish the range of variability of the slightly muffled drum-note sounded by the percussion of a "completely healthy" person's chest, Auenbrugger noted the need for careful sonic training to adjust for differences in the fat, muscle, and general constitution of each individual, for which he advocated first of all self-percussion, then examination of other healthy subjects. Even within the same subject, percussion of different locations will educe various sounds, to which the practitioner needs careful attunement. Auenbrugger classified those sounds as "higher, or deeper, or clearer, or more obscure, and sometimes almost completely suffocated [*vel altior, vel profundior, vel clarior, vel obscurior, vel quandoquē propē suffocatus*]"; Corvisart glossed Auenbrugger's Latin in terms of his own French auditory vocabulary, in which timbre seems even more important than absolute pitch. Thus, instead of Auenbrugger's "higher" (*altior*) rendered as *élevé* (higher in pitch) in its first (1770) French translation, Corvisart chose "more superficial" (*superficiel*), by which he specified a sound quality like that heard "through a thin wall," suggesting the close proximity of the sounding organ, such as he would hear when percussing thin people. This shift from relying on pitch to including timbre implied new dimensions of sonic awareness that could then be correlated with more refined cardiac findings.

Corvisart thereby continued the direction of Auenbrugger's own investigations, which went from the range of "normal" muffled sounds heard on percussing a healthy chest toward a spectrum of pathological tones. In general, Auenbrugger

operas written in 1772 and 1785, though these postdated Auenbrugger's clinical work of the 1750s and his ensuing 1761 publication detailing his discovery of diagnostic percussion.

72 For the relation between Corvisart and Auenbrugger's work, see John C. O'Neal, "Auenbrugger, Corvisart, and the Perception of Disease," *Eighteenth-Century Stud.*, 1998, 31, 473–89; O'Neal, *Changing Minds*, 165–85.

73 Auenbrugger, *Nouvelle méthode*, 4.

74 Corvisart also emphasized the tactile aspects of percussion; see O. R. McCarthy, "Getting a Feel for Percussion," *Vesalius*, 1999, 5, 3–10.

asserted that “if a sonorous part of the chest, struck with the same intensity, yields a sound more superficial [*altior*] than natural, disease exists in that part” and likewise for a sound that is “duller [*obscurior*]” than normal. Corvisart agreed that “in fact, this result is invariable and never deceives.”⁷⁵ He noted further that in such case, percussion goes far beyond other clinical signs because often such patients show no other symptoms of disease; through sonic percussion, the physician can diagnose illnesses that may have *no other clinical manifestation* but nonetheless be very grave.

Corvisart instanced the case history of a forty-five-year-old Parisian laborer being treated for lead poisoning, whom Corvisart percussed and found “an absence of natural sounds under the sternum, in the region occupied by the heart,” which he diagnosed as an aneurism. The workman had experienced no palpitations or pains but died of his aneurism eighteen months later, just as Corvisart’s percussion had diagnosed. Thus, sonic cardiology was not merely an adjunct to preexisting modes of diagnosis but could discern illness far beyond the abilities of any other known medical tool. Going far beyond pulse observations or scrutiny of such manifest signs as stool, urine, or the visual appearance of the skin, percussion treated the body as a musical instrument capable of producing deeply revealing sounds, for the first time allowing the prediction of disease in the absence of any other symptoms.

As befits a diagnostic tool of such unprecedented scope, Auenbrugger detailed and refined the differential signs evoked by percussion toward more specific sonic signals. He used the change in percussed sound when the patient took a deep breath to judge how deeply the disease extended into the chest cavity. He graded the various qualities and timbres of struck sound: “The duller the sound and the more nearly approaching that of a fleshy limb struck, the more severe is the disease.”⁷⁶ This and other signs (as well as studies of autopsies) convinced him that these sounds emanated from greater or lesser masses of fluids effused within the body as part of the disease process. Therefore, “the more extensive the space over which the morbid sound is perceived, the more certain is the danger from the disease.”⁷⁷ Because they indicated wide-ranging or especially dangerous masses of fluid, among the most alarming sonic indicators was the total “destitution of sound” in regions of the lungs or heart, which Auenbrugger diagnosed as fatal. So great is the power of sonic diagnosis that the *absence* of percussive sound was, in many cases, the truly fatal sign.⁷⁸

LAENNEC’S MUSICAL BACKGROUND

Laennec’s clinical innovations took place in a notably musical context, as well as in the mechanistic physiology in which he was trained.⁷⁹ From youth, he sang, played the

75 Auenbrugger, *Nouvelle méthode*, 37–42 at 41.

76 *Ibid.*, 132.

77 *Ibid.*, 133.

78 Perhaps this is the ultimate source of the famous “dog that does not bark” invoked by Sherlock Holmes, influenced by his physician-creator, Arthur Conan Doyle.

79 Among the most useful studies, see Stanley Joel Reiser, *Medicine and the Reign of Technology* (Cambridge: Cambridge University Press, 1978), 23–44; Sterne, *The Audible Past*, 99–136; Duffin, *To See with a Better Eye*.

flute, and took private dance lessons.⁸⁰ The eminent literary critic C. A. Sainte-Beuve, who studied medicine under Laennec, recalled "exciting encounters" in which Laennec played the flute while the musicologist C.-C. Fauriel sang Breton songs: "Fauriel knew the words, but Laennec knew all the tunes, tunes learned in his childhood never to be forgotten. He brought his flute (and you have to have seen Laennec to really imagine him cast as Lycidas) and while his friend recalled the words, he tried to jot them down."⁸¹ Laennec studied the Breton language, made contact with Celtic scholars in Britain, and advocated the merits of Breton-speaking clergy.

During his medical studies under Corvisart, Laennec became aware of the diagnostic value of percussion, which in his later work became a model of the kind of objective evidence that could lead to his chosen goal of a new "pathological anatomy," an explanation of disease in terms of anatomically locatable physical lesions. Having formed this goal by 1804, the sonic modalities of percussion seem directly connected to his subsequent discovery of mediate auscultation. Though Corvisart described heart sounds so loud that they could be heard "very close" to the patient's chest, Laennec asserted that his teacher had "never" put his ear directly to the chest; after his close friend and colleague Gaspard-Laurent Bayle (1774–1816) actually did so, Laennec tried this technique.⁸²

As he pushed forward the clinical practice of diagnostic listening, Laennec drew on the terminology introduced by his friend Matthieu-François-Régis Buisson (1776–1804) in his 1802 thesis, which distinguished passive hearing ("audition") from active ("auscultation").⁸³ In these terms, Corvisart practiced audition, not auscultation, which Laennec believed Bayle and he had pioneered. Both approaches sought *sonic* evidence of underlying physiological and anatomical conditions, which auscultation probed actively and more deeply. Though he may have begun with "immediate" auscultation as pioneered by Bayle, placing his ear directly on the patient's chest, about 1817 Laennec began practicing "mediate" auscultation, using a stick to transmit the vibrations from the chest to his ear.

As Laennec himself noted (and has often been repeated), he was moved to do so by factors of modesty (in the case of female patients) but also because many of his patients' bodies were "disgusting," sweaty, ill-smelling, lice-ridden, or too fat. Though undeniable, these factors all were less significant than the need to hear the internal sounds more clearly than immediate auscultation would allow. In both cases, though, the heightened activity of auscultation bespeaks the kind of acute, engaged, critical hearing that was already familiar to Laennec from his musical interests.

His "stick" metamorphosed into what he at first called a *cylindre*, a simple roll of paper that developed into a funnel-shaped wooden tube he turned on his home lathe (fig. 5). Devoted to studies of ancient medicine and skilled in classical Greek, Laennec came to prefer the name "stethoscope" (literally "looking into the chest") to other contemporary appellations he found "improper" or "barbarous," such as *sonomètre* or *pectoriloque*, but which also included *cornet médicale*.⁸⁴ This term ("medical

80 Duffin, *To See with a Better Eye*, 17, 20, 80–82.

81 Ibid., 252.

82 Ibid., 124; for Bayle, see Reiser, *Medicine and the Reign of Technology*, 25.

83 Duffin, *To See with a Better Eye*, 42.

84 Ibid., 129.

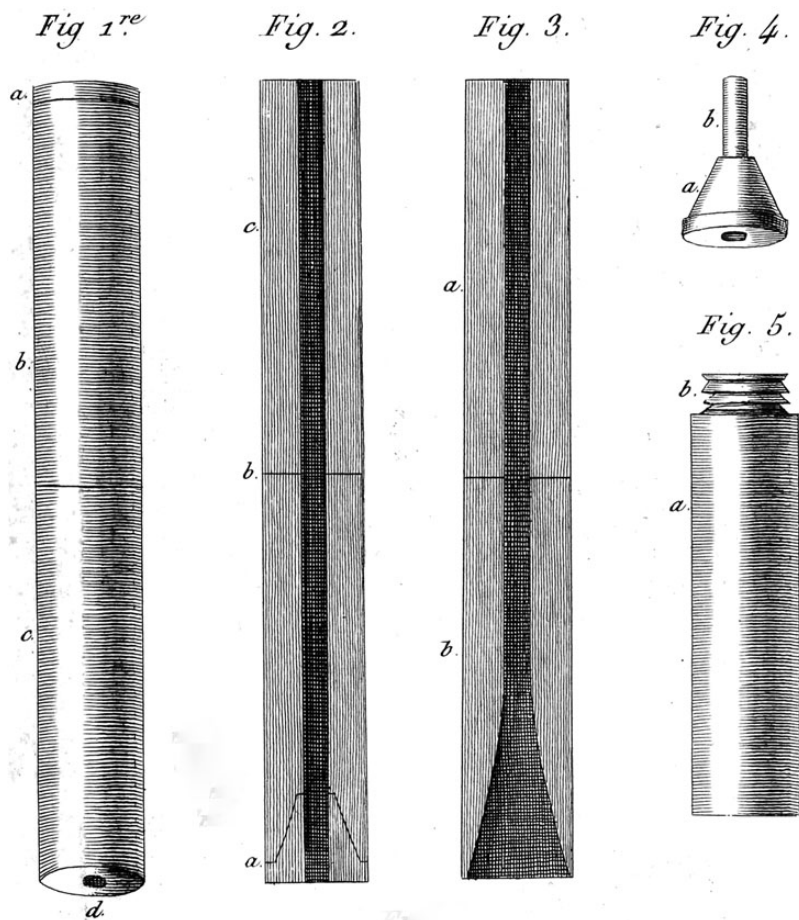


Fig. 5. Laennec's original stethoscope, from his *Traité de l'auscultation médiate* (1826).

trumpet") reflects the cylinder's likeness to a musical instrument, whereas the more dignified "stethoscope" subsumes these musical, auditory references under the aegis of visual perception, as when Corvisart had urged physicians to develop diagnostic means "to see with a better eye."⁸⁵ Such appeals to what seemed a higher court of visibility bespoke a certain unease with the status of purely auditory evidence, as had already plagued the reception of Auenbrugger's percussion: the epistemic claims of seeing versus hearing remained at issue.

No amount of visual imagery, though, could conceal the essentially auditory character of mediate auscultation and stethoscopic technique, of which Laennec was both discoverer and first virtuoso. His remarkable abilities were clearly enabled by his acute

85 Jean Nicolas Corvisart des Marets, *An Essay on the Organic Diseases and Lesions of the Heart and Great Vessels*, trans. Carleton B. Chapman (Boston: Bradford & Read, 1812), 19.

sense of hearing, which he tried to impart to his readers in the detailed auditory imagery he provided in his *Treatise of Mediate Auscultation* (first published 1819), in which "one is impressed by the frequency of musical references," as Saul Jarcho noted.⁸⁶ Laennec developed a whole new sonic vocabulary to describe and differentiate the vast variety of crackles, rumbles, whistles, and rattles (*râles*) need to make adequate differential diagnoses from stethoscopic evidence. His *Treatise* is an extended guide to this new world of sound and of acoustic medicine, every page presenting some new facet of sonic diagnosis, sensitizing its practitioners to ever more subtle gradations of timbre, pitch, and volume as well as to startlingly new sounds.⁸⁷

In some ways, this new sonic world was distinctly apart from contemporary musical practice because it involved subtle gradations of sound and novel sonic objects; even a trained musical ear would struggle to discern stethoscopic crackles and fizzles that (to use anachronistic terms) sound more like twentieth-century *musique concrète* or artificially synthesized sounds than anything remotely considered "music" during the nineteenth century. The ordinary study of melody or harmony did not prepare the physician to cope with the noises of the body, even if amplified and made more accessible for investigation. Laennec's *Treatise* is a fascinating exercise in awakening and expressing whole new realms of sonic awareness and timbre. Though he developed a new vocabulary to describe "unmusical" sounds with greater precision, at many points the shaping force of previous musical and sonic experience seemed to guide his choices.

Laennec referred to familiar sounds as he made his first steps into the bizarre world of thoracic sounds, which otherwise could have been dismissed as a *mélange* of insignificant noises. Because of the amplifying effect of the stethoscope, its user enters into a world of microsound, suddenly rendered equal in volume to normal environmental sound.⁸⁸ A meaningful diagnostic "signal" is embedded in the chaos of other, unrelated sounds; to this day, medical students struggle to distinguish subtle heart or lung sounds from noisy breathing. For decades, they relied on recorded examples, but until the availability of such recordings (and even after then), the primary source was direct instruction by someone versed in stethoscopic listening. No less than learning the subtleties of the "medical gaze" by working with an experienced practitioner, learning to hear the body was, since Laennec's time, very much like learning a musical instrument, requiring practice guided by a master artist.⁸⁹

Laennec had to teach himself this art, through prolonged trials and interactions with many patients, colleagues, and students. Though he began with cardiac sounds, his first breakthrough to realizing the full potential of stethoscopy seems to have come with his

86 Jarcho, "Auenbrugger, Laennec, and Keats," 169.

87 For an insightful discussion of the growing significance of timbre in music, see Emily I. Dolan, *The Orchestral Revolution: Haydn and the Technologies of Timbre* (Cambridge: Cambridge University Press, 2013).

88 For the evocation of microsound in nineteenth-century music, see Francesca Brittan, "On Microscopic Hearing: Fairy Magic, Natural Science, and the Scherzo Fantastique," *J. Am. Musicol. Soc.*, 2011, 64, 527–600.

89 For a detailed account of his work in cardiology, see Jacalyn M. Duffin, "The Cardiology of R. T. H. Laennec," *Med. Hist.*, 1989, 42–71; Duffin, *To See with a Better Eye*, chap. 8.

discovery of what he called “pectoriloquy,” literally “the chest speaks” (as “ventriloquy” means “the stomach speaks”).⁹⁰ In such cases, Laennec noticed that the patient’s voice was markedly intensified when heard through a stethoscope positioned at a certain well-defined site on the chest. He associated this striking acoustic finding with a cavity in the underlying lung. His insight depended on the recognition of *voice* as a primal sonic phenomenon, here remarkably magnified but still recognizable by comparison with the ordinary experience of the voice or its more muffled rendition as heard stethoscopically elsewhere on the chest. The vocal localization of the site guided Laennec to the underlying lesion in the lung. But the startling intensity of “chest speaking” seemed to be a revelation of the nature of the primal voice itself, heard now even more directly than when ordinarily emitted through the mouth.

In petoriloquy, the primordial phenomenon of *voix humaine* seemed to guide Laennec’s initial forays into the new territory of stethoscopic hearing. In general, Laennec connected a phenomenologically vivid sign (here the intensified voice sounds) with deductions of the likely underlying physical causes (the underlying cavity due to tubercles). In doing so, he carried forward his quest for *physical* lesions or conditions that would reasonably explain their attendant sonic manifestations through simple considerations of the behavior of fluids in various configurations and spaces. In the case of what he called “egophony,” Laennec encountered a distinctively nasalized quality of the human voice heard stethoscopically through the chest wall overlying a collection of fluid in the thoracic space and named it after the bleating voice of a goat (in Greek, *aïgon*). But much of what he heard was alien; about the nuances of *râles*, he confessed that “often I lack words to express them, or at least it will be difficult for me to describe them in way sufficiently exact to give a fair idea to someone who had never heard them.”⁹¹

Laennec tended to use the word *bruits*, noises, rather than *sons*, in the more neutral sense of “sounds.” Searching for descriptions that would make these noises recognizable to his students and colleagues, Laennec often drew on terms from craftwork and the soundscape of his Parisian milieu. He began with the sounds of the craft-shop in which he himself worked, a hospital ward; thus, in describing the stethoscopic sound of a *râle*, he noted as its most common meaning the death-rattle, the sterterous, labored breathing of those in extremis.⁹² This ominous sound would have been all too familiar in Parisian hospital wards, where the mortality rate was commonly around 20 percent; by connecting stethoscopic rattles with the sounds made by those approaching death, Laennec noted a kind of sonic prefiguration or thematic recurrence. Those with pulmonary complaints were emitting microacoustic death-rattles and for precisely analogous reasons: as dying breaths rattled through fluid-filled lungs, those in earlier stages of pulmonary disease might emit micro-rattles from their fluid-compromised lungs. Based on this basic picture of the fluid mechanics of the lungs, Laennec went on to

90 Mirko D. Grmek, “L’invention de l’auscultation médiate, retouches à un cliché historique,” *Revue du Palais de la Découverte*, 1981, 22, 107–16; Duffin, *To See with a Better Eye*, 134–38.

91 R. T. H. Laennec, *Traité de l’auscultation médiate et des maladies des poumons et du coeur* (Paris: Chaudé, 1826), 1:95.

92 Ibid., 1:95 ff.

distinguish a considerable variety of *râles*, encompassing more or less dry rattling, gargling, whistling, or snoring.

In each case, he drew the specific name and significance of the stethoscopic sign from the sounds of various kinds of agonized and suffocated catarrhs heard audibly from his more advanced patients. In this variety of alarming sounds, Laennec recognized a "trembling very much analogous to what the voice itself produces on the thoracic wall." Extreme *râles* can be felt by the hand on the chest, not just the ear, "and in some cases is even much more sensible" than the voice itself; in such cases, the diseased body itself begins to "speak" directly and more loudly than its vocal tract. In one case of particularly advanced tuberculosis, Laennec heard "a tinkling like a little bell that had just finished ringing or a fly buzzing in a porcelain vase."⁹³ In his ward, he must often have witnessed priests coming to the ward bearing the last sacraments for the dying, according to custom accompanied by the sound of "a little bell."

Then too, Laennec's hospital practice was populated with lower-class craftsmen and workers (among which metal-workers were only outnumbered by dressmakers and female domestics).⁹⁴ Thus, he described a certain characteristic "metallic tinkling [*tintement métallique*]" he heard stethoscopically by evoking an eerily diminutive craft-scene, hearing "a noise perfectly like a blow struck on metal, glass, or porcelain, which one strikes lightly with a nail or on which one drops a grain of sand."⁹⁵ Sounds on this scale tend to be deceptive; at first, he thought this tinkling, with its artificial character, was somehow produced by the stethoscope itself, only gradually concluding that it was independent of the material of the instrument. Connecting this curious noise with its physiological source required further effort, absent ordinary links between environmental sounds and the visible behavior of objects. He began by noting its association with the patient's breathing, talking, or coughing, then gradually connected the metallic tinkling with what he deduced as its physical cause, a kind of echo in the chest due to pneumothorax with a small quantity of fluid or alternatively with a cavity in the lung.

At times, Laennec's investigations went beyond metaphor to a direct encounter with stethoscopic music emerging from the body. On March 13, 1824, he examined a lady "in whom I found a few signs of pulmonary phthisis" and heard stethoscopically a "moderately loud bellows-sound [*bruit de soufflet*]" near the subclavian artery. This kind of sound, with its associations of the blacksmith's forge or even the domestic hearth, was common enough in his experience, but on this occasion

I wanted to see if this sound also was above the carotid [artery]. I was strangely surprised to hear, in place of the bellows-sound, the sound of a musical instrument playing a rather monotonous song, but quite distinct and capable of being notated. I thought at first that someone was making music in the apartment below. I prepared my ear attentively; I put my stethoscope at other points,

93 Ibid., 1:667; more generally about this phenomenon, see Duffin, *To See with a Better Eye*, 141–44.

94 Duffin, *To See with a Better Eye*, 112–13.

95 Laennec, *Traité*, 1:168–9.

but heard nothing. After assuring myself that the sound came from the artery, I studied the song: it rolled through three notes forming nearly a major third; the highest note was *out of tune* and a little low, though not sufficiently to be able to mark it as a [semitone] flat. With respect to the *length* or duration, these notes were quite equal between them. Only the *tonic* was prolonged, from time to time, and formed a *hold* [*tenue*], whose length varied. Consequently, I notated the song as follows:



The sound was weak, as if coming from far away, a little shrill [*aigre*] and much like the sound of a *guimbarde* ["Jew's harp"], with the difference that that rustic instrument can only produce staccato notes [*notes pointées*] and that here all the notes were slurred. The passage from one note to another was evidently determined by the arterial diastole, which in the holds themselves, perfectly rendered the light jerks that musicians call *coulé-pointé* [dotted rhythm in a flowing style, a variant of *notes inégales*]. The weakness of the sound made me believe at first that it was passing away into the distance, but by listening attentively and touching a finger to the artery I recognized that the sound was linked to a slight quivering of the artery that, in diastole, seemed in vibrating to come to rub the end of the stethoscope. From time to time the *melody* would suddenly cease and give way to the very loud noise of a rasp. At the risk of using an odd comparison, I can only give an idea of the effect of this alternation by comparing it to a military march in which the sounds of the martial instruments are interrupted from time to time by the rustic noise of a drum.⁹⁶

Laennec's "ear" and pitch sense were manifestly acute; musical terminology sprang immediately to his mind. Most of all, he grasped the auditory passage as a *melody*, not just a series of pitches. His reference to the rustic *guimbarde* and *tambour* brings to mind his keen knowledge of Breton tunes, as noted by Sainte-Beuve. Consider, in comparison, the Breton song "Alan al louarn" ("Alan the fox," fig. 6).⁹⁷

Though this Breton melody is not identical with what Laennec notated from his patient's carotid, both begin with repeating permutations of C, D, E and have the recognizable *melos* of folk song, supported by his suggested "orchestration" with a *guimbarde*. Laennec's rendition of the arterial melody strongly suggests that he assimilated it to folk song, perhaps even the Breton songs he knew so well.

Certainly, Laennec was startled to hear this literal music of the body; after listening for more than five minutes, he asked his medical colleague at the bedside to join him.

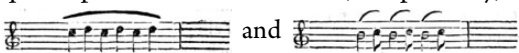
96 Ibid., 2:424–5.

97 Théodore Hersart La Villemarqué, *Barzaz Breiz; chants populaires de la Bretagne*, 6th ed. (Paris: Didier, 1867), viii (music); 120–22 (text). The English common term "Jew's harp" has been described as a distortion of the French word *jeu*.



Fig. 6. The Breton song "Alan al louarn" ("Alan the fox"), from Théodore Hersart La Villemarqué, *Barzaz-Breiz, Chants populaires de la Bretagne* (1867). Text: "The bearded fox yaps, yaps, yaps in the woods; woe to foreign rabbits! His eyes are two sharp blades! Sharp are his teeth and rapid his feet; his nails red with blood. Alan the fox yaps, yaps, yaps: war! war!"

When they listened again, they only heard the bellows-sound; the mysterious melody had fallen silent. Laennec noted his patient's pulse, a regular eighty-four beats per minute; she had coughed for months, bringing up blood, and was subject to marked attacks of nervous agitation. Laennec gives the musical scores of two subsequent patients whose arteries, respectively, whistled (*sifflaient*) the melodies



and Another lady, with a particularly nervous constitution, at times emitted a sibilant bellows-sound "analogous to the sound of an octave." Incongruously, this most primal consonance emerged from a patient in a notably dissonant physical state.

Laennec's investigations into the causes of these sounds led him to consider experiments by Paul Erman and William Wollaston that provided possible physical explanations for the bellows-sound based on the noises made by the heart valves.⁹⁸ According to them, the bellows-sound might be the overall impression of a rapid series of

98 Laennec is somewhat unclear on Erman, whom he also calls "Hermann" and identified only as secretary of the Academy in Berlin with whom he corresponded in 1820; in fact, the papers in question are Paul Erman,

intermittent valve noises, on the model of rapid pulsations of a thumb striking a wooden rod. Laennec analyzed this model using musical data, estimating the most rapid notes a musician could execute in arpeggios or ornaments (*agréments*) like the *port de voix* (familiar in vocal music from the baroque period). He calculated the speed of such rhythms and concluded that Erman and Wollaston's suggestion seemed finally void of justification; other physical arguments lead him to prefer the hypothesis that the bellows-sound "is due to a true spasmodic contraction, whether of the heart or of the arteries."⁹⁹ Such rapid vibrations, he noted, "seem to announce a phenomenon that is dependent on an anomaly of nervous influx."

Laennec thus implied a link between the extreme nervousness of some patients, their cardiac disease, and the rapid vibrations heard from their circulatory systems. "When the bellows-sound exists in the aorta, the carotids, or in the arterial trunks of the members, the patient is in a state of anguish and extreme anxiety. If the heart and the greater part of the arteries present the same phenomenon, life is in peril; however, it is very rare for the patient to succumb if there is not at the same time organic affections of the heart."¹⁰⁰ Over all this, the question of the mysterious arterial melodies remained suspended, with the implication that they might be heightened or even more rapid states of vibration than the bellows-sound. If so, the strange melodies Laennec heard from within his cardiac patients were indeed their swan-songs.¹⁰¹

THE "SONIC TURN" IN MEDICAL DIAGNOSIS

The work of Marquet, Auenbrugger, and Laennec stands at different points along a "sonic turn" that unfolded over the intervening years. Before Marquet, the examination of pulse was a purely tactile exercise; the rhythms were felt, not heard. By notating them musically, Marquet directed attention to the larger context of those rhythms; his "natural pulse" was instantiated in an audible minuet, not just a series of abstract beats. His novel notation for various pulse rhythms drew on the conventions of pitch but fell short of considering them to be actual sounds, rather than felt rhythms. Nor did his vitalist critics Bordeu and Ménuret take further the concept (which they ascribed to the Chinese) that the body could be considered a musical instrument capable of diagnostically significant sounds.

In contrast, Haller and van Swieten directed attention to the physical behavior of fibers and fluids, in the process taking up Marquet's musical data into their much larger mechanistic project. Taking a larger view, the physics of vibrating bodies converged

"Einige Bemerkungen über Muskular-Contraction," *Ann. Phys.*, 1812, 40, 1–30; Wil. L. Hyde Wollaston, "Ueber die Wirkungsart der Muskeln," *Ann. Phys.*, 1812, 40, 31–47.

99 Laennec, *Traité*, 2:429–48 at 440.

100 *Ibid.*, 2:442.

101 Some of Laennec's editors saw fit to omit these coronary melodies as "mere curiosities." For example, the notated melody was omitted with this editorial footnote in R. T. H. Laennec, *A Treatise on the Diseases of the Chest and on Mediate Auscultation*, ed. John Forbes (New York: Samuel Wood & Sons, 1830), 567. Laennec's musical description is described as "the most disarming passage in his entire opus" by Duffin, *To See with a Better Eye*, 192, which also cites Cruveilhier's reaction and discusses the reception of Laennec's treatment of the heart on 174–206. For this and other reactions to stethoscopy, see Reiser, *Medicine and the Reign of Technology*, 30–44, at 34–35.

with the sonic awareness schooled by musical sensitivity, both these approaches paying close attention to the sounds bodies could emit and therefore ready to consider their diagnostic significance. Educated both in this mechanistic physiology and in music, Auenbrugger and Laennec thus were well situated to exploit the overlap between them through which they set forth a new sonic diagnostics using percussion and auscultation.

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