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Vocal recognition before recording: techniques of vocal documentation, classification and identification in the long nineteenth century

Josephine Hoegaerts

Department of History, European Studies and Religious Studies, University of Amsterdam, Amsterdam, The Netherlands

ABSTRACT

This paper aims to sketch out a cultural history of documenting, classifying and identifying voices in the nineteenth century. Focusing on a period before technologies like the spectrogram became widely available, I demonstrate that experts in this period already harboured many of the ideas and ambitions that would later drive the development of technologies in speech recognition and the voiceprint. First, the idea that each human voice was unique – and therefore individual – was thoroughly developed in. Secondly, various embodied techniques for the description, comparison and recognition of particular voices were developed throughout the century, mobilising both the human ear and visual aids. Drawing on insights from the fields of voice studies and sound studies, and based on scientific, pedagogical, and musical expertise formulated and circulated in Britain, France, and Germany in the nineteenth century, the paper teases out the trajectory of these techniques, and changing vocabularies of vocal uniqueness. Central to the idea that voices were “as different from each other as faces”, were cultural assumptions about distinctions between different (European) national, cultural, and gendered voices, making the pre-history of speech recognition a cultural history, as much as it is a history of science or technology.

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Good-night, Mister Sherlock Holmes.

There were several people on the pavement at the time, but the greeting appeared to come from a slim youth in an ulster who had hurried by.

“I’ve heard that voice before”, said Holmes, staring down the dimly lit street. “Now, I wonder who the deuce that could have been”. (Conan Doyle 1892, 24)

In *A Scandal in Bohemia*, Sherlock Holmes, master of sensory perception and scientifically grounded detection, is fooled: despite his ability throughout many adventures to recognise criminals by their voices, the sounds of Irene Adler elude him.¹ Perhaps it was the allure of the woman herself, or perhaps it was the lack of widely known scientific methods, at the end of the nineteenth century, to reliably classify voices. Nevertheless, nineteenth-century detectives, fictional or not, depended as much on their ability to recognise voices

as they did on recognising other features of criminals and their activity – and this depended largely on the belief that voices, like fingerprints or faces, were unique. As other contributors to this issue demonstrate, technologies for documenting, reproducing, and identifying unique vocal features would be developed in the twentieth century. Experiments with visible speech began in the 1940s (Bijsterveld 2021), for example, and analogies between the visual nature of the fingerprint and the voiceprint arose during the same period (Braun 2019, 124). This essay aims to provide a prehistory to technologies like that of the voiceprint by narrating the cultural history of voice identification and recognition practices. Li and Mills (2019) have shown that the voiceprint was a modern predecessor to machine methods for speech recognition and speaker identification.

I will argue below that as early as the nineteenth century various vocal experts already harboured ambitions to reliably describe, compare, and recognise human voices – in short to systematically classify them based on their unique features. I use the term “vocal recognition” throughout this text to refer to the human ear’s historically contingent, culturally and socially developed ability (helped and shaped by non-audio technology) to distinguish between voices and recognise their particularities. While I contend that, in time, these ambitions and embodied techniques contributed to the development of technologies of voice identification, throughout the nineteenth century they primarily served to support practices of echoic memory. They are therefore not direct predecessors of the voiceprint but adjacent to its history and closely related through the same kind of analogy that connects the voiceprint to the fingerprint. Or to state it differently, I would argue that the age of the fingerprint was as interested in making vocal sounds recognisable and comparable as it was in creating records of visible measurements, while relying on bodily and scriptural techniques rather than statistics or machines to do so.

The invention of the fingerprint – a widely discussed forensic research tool in the late nineteenth century – was marked by colonial premises about both the trustworthiness of the colonised other and Western inabilities to recognise their facial features (Asen 2016; Cole 2002; Singha 2000). Mired in modern assumptions about individuality and the need for extensive bureaucratic documentation and state control, the fingerprint, before it became tied to the world of professional detectives and crime scenes, came to symbolise a distinctly modern approach to human beings: as both individually unique and as a mere component of a mathematically defined, easily classifiable conglomerate. It might be tempting to conclude that human voices – notoriously slippery and eerie products of embodied performance, culture, and learned behaviour – could not be so easily included in these modern projects of classification, colonisation, and individuation. However, recent research in sound studies has shown that various sounds, including vocal ones, were important focal points of modern scientific projects (See, for example, Bijsterveld 2019; Hui 2013; Tkaczyk 2018). In connection with this attention to different sounds as objects and methods of analysis, connections between modern individuality and uniqueness in vocal practice were also shaped throughout the long nineteenth century and were connected to affective performances as much as they were to physiology. Secondly, the ambition to develop tools to help vocal recognition preceded the development of acoustic technologies.² This suggests, in other words, that the prehistory of the use of spectrograms for voice identification resides in the entangled histories of both vocal culture and acoustics. Various histories of voice and sound have shown that the disciplinary boundaries between what we would now classify as either artistic or scientific

knowledge were profoundly unclear in the nineteenth century (Gillin 2021; Hoegaerts 2019; Tkaczyk 2018). These nineteenth-century sources cannot be easily identified as scientific or artistic, or located exclusively in the field of acoustics or performance: from its ambiguous perch within the human body, the nineteenth-century voice both attracted intense scrutiny and resisted neat categorisation as an object of either beauty or knowledge.

Focusing on those entanglements, rather than on recognisable innovations or scientific disciplines, requires us to think not only about forensic techniques beyond “technology”³ but also, and more importantly, shift our attention to a source base that seems at first sight very far removed from the police records, court files, or expert reports that document forensic practices proper. In this essay, I turn my attention to ideas about vocal recognition and the embodied techniques required to achieve it. In the fragmented fields of vocal knowledge, which would only later solidify into disciplines like laryngology or speech pathology, various practices of listening to, remembering, classifying, and identifying voices converged. Accounts of the goals and results of these practices as well as instructions on how to develop them were documented in scholarly treatises, handbooks, and self-help manuals. Together, these texts not only show a distinctly modern approach to vocal practice and vocal recognition, but also a range of cultural and scriptural techniques to capture and analyse vocal sounds. In what follows, I draw on the scientific and educational material that was available to experts and amateurs alike in nineteenth-century Western Europe. More precisely, this text is based on the collections that were formed in three cities – Paris, London, and Leipzig – where expertise about voices flourished in this era. Each of them boasted musical conservatories but also what used to be known as “schools for the deaf and dumb”, as well as laboratories in phoniatriy, laryngology, and acoustics.⁴

Delving into these collections, I aim to show that connections between modern individuality and uniqueness were shaped throughout the long nineteenth century and gained practical and political importance long before technologies like the voice-print would make them more tangible or, indeed, marketable. Although this early history of vocal recognition is a decidedly low-tech one, and narrated here as an explicitly cultural history, I argue that it also ties in with histories of technology as its reliance on embodied practices and techniques reframes the human body itself as a technological object – medical and scientific treatises of the time often described the body in consciously mechanical terms or through metaphors of machinery. In addition to its connection to histories of medicine and science, the early story of vocal recognition also dovetails with histories of the self (including techniques of the self) – as evidenced particularly in the first section of this paper – and histories of music and rhetoric.⁵ To follow, I first describe how vocal qualities were used in nineteenth-century scientific, educational, and artistic discourse to support ideas around human uniqueness and the notion of individual personality. Research on vocal physiology and the formulation of hygienic and health-related norms, I argue, helped to lay the groundwork for a measurably and observably “unique” voice in physiologically unique throats. Second, I focus on the development of techniques to describe and compare voices and to capture fleeting vocal sounds by different means in order to analyse and study them outside of their moment of utterance as well. The final section shows how nineteenth-century bodies and embodied techniques, most

notably the ear and memory, aided in the practice of recognising particular voices. These techniques aimed to show individuality and uniqueness but relied strongly on cultural and social norms and practices of classification.

Vocal physiology and the construction of a unique self

The nineteenth century was, as Benjamin Steege has noted “a particularity anxious moment in the history of the voice”, a period marked by “a surge in amateur obsession with various acts of vocalising” and the rise of a vocal culture that was both broadly embraced at a societal level and had significant impact on individual experiences and practices, particularly in the realm of self-observation (Steege 2019, 47). The specificity of the individual voice seems to have been of particular importance to vocal experts in the nineteenth century; whether they focused on artistic or scientific approaches, they were quick to point out that no two voices were the same. In their view, the distinctiveness of the voice was closely connected to its capacity to express highly personal feelings or recognisable character traits. The voice thus functioned as a kind of bridge between one’s inner life and the social world – much like the face, with which voices were often compared in both science and literature. Henry Wadsworth Longfellow’s lyrical description of the human voice provides a vivid example:

O, how wonderful is the human voice! It is indeed the organ of the soul! The intellect of man sits enthroned visibly upon his forehead and his eye; and the heart of man is written upon his countenance. But the soul reveals itself in the voice only. (Longfellow 1839, book III, chap III)

In the late seventeenth century, the French physiognomist Charles Le Brun had published an overview of facial expressions to externalise feeling in a way that was both recognisable and considered as reflective of inner passions (Le Brun 1698; Plamper 2012, 19–20). By the second half of the nineteenth century, various classifications connected to emotion – including overviews of how it could be expressed vocally and understood by a listening audience – began to appear in various manuals and treatises. These manuals concerned professional speakers, like those engaging in declamation – an art form aiming to “transform the affect of the listener” (Dupree 2012, 368) – but also addressed less artistic modes of speech, suggesting that any vocal utterance revealed something about the speaker. According to Theodore Schmauk, a self-taught German-American expert on vocal nature, the voice could “bring the inner states of the self to manifestation” (Schmauk 1890, 25), subjecting otherwise hidden states of mind to scrutiny, with an almost religious fervour:

The magic mirror of the otherwise inexpressible inmost spirit in its intellectual, sympathetic and volitional phases, subtly colored with the finer personal distinctiveness of our own individual manhood or womanhood, is irresistibly attractive. Love sees her sweet or shy self in the tender tones. Hopes gild the tones with sunny brightness. Fear feels her own trembling shadow in them. Joy leaps out in them and make them ring with gladness. The mind and heart, and every phase of all the man, are physically fixed and focused in this instrument. The voice is the only musical instrument that is played on directly by the spiritual personality. No hands touch its keys or modulate its chords. Yet the voice is not a spiritual thing. (Schmauk 1890, 26)

Schmauk's flowery language was one of a kind, but his conviction that a particular colour in the voice both revealed and expressed specific emotions was widely shared (and could even be extended to language itself, as vowels could be heard in an equally colourful manner (Yamaguchi 2020). More prosaic experts gave their readers far more concrete indications on how modulations and shades of sound could express emotion in much the same way as the face could. In a "practical study" for aspiring vocalists, the voice teacher Edmund Myer encouraged his readers to sing the same phrase in four different iterations, vocalising it "with varied feeling, thought and emotion" (Myer 1891, 141). Whether the singer was assumed to actually feel this emotion or to merely express it was left suitably unclear, thus underlining the thin line between feeling and expression.

First: You come with indifference. It matters not to you whether you come or not. The expression of the face and the tone of the voice will be commonplace, indifferent.

Second: You come with gladness, in expectation of pleasure and gaiety. The expression and the tone will be light, bright, gay, but with no depth of feeling or tone, all surface effect.

Third: You come with dignity. You have sent for me and I have come. The expression of face, the attitude, and the tone of voice must indicate your dignified position and self-respect.

Fourth: You come in triumph. There must be a ring and color in the voice that at once indicates your state of feeling – a ring due to forward placing, to open free form and action, and a color and richness which can but be the result of the influence of the low cavities. (Myer 1891, 141)

Given this ability to read emotion from faces and voices, both of which externalised what was otherwise hidden, the two became so closely connected that their training and function became somewhat blurred for vocal experts – especially those involved in artistic training. The imitation of facial movements and vocal sounds were closely intertwined. So much so, in fact, that speakers and singers were encouraged to use mirrors to observe "the exact manipulation of the articulating organism" in order to both develop their voice (Yearsley 1909, 148) and facilitate the imitation of excellent vocalisers. At the same time, the supposedly natural capacity of humans to imitate one another also led to anxieties: Imitation meant changing one's face and voice, but these could also change for the worse. Julien Duquesnois, a teacher at the College de Paris and the author of *Manuel de l'orateur et du lecteur* (Manual for the speaker and reader), emphasised the role of imitation in arriving at the "sublime" effect of grand emotions in public speech and theatre, while noting the potential danger of such practices that "one loses whatever genius one has by trying to take another's" (Duquesnois 1841, 11). As Sharon Marcus has noted in her study of modern celebrity, imitation of theatrical role models was not a "heedless, involuntary reflex" but required insight, skill, and a number of hard to define physical and personal characteristics (Marcus 2019, 151). Given the close connection between these external features and internal feelings, imitation carried serious moral dangers as well. In the end, "Art should perfect nature, not shape it. Outside nature, everything is false, air, voice, gesture, speech, elocution, face. A counterfeit can never be pleasing, nor touching" (Duquesnois 1841, 86).

Most importantly, perhaps, manuals that believed that voices and faces could be trained also implied that such training in expressing (fleeting) emotions would not only have an impact on the audience but could also affect more permanent characteristics – the speaker's temperament, as it were. As the cited Longfellow poem suggests, there is

a long history of connecting the perceived depth of vocal articulation to the “soul” (Bloom 2011). Such ideas of the inner soul lurking in the outer expression of vocal practice persisted in the nineteenth century – both in poetry and scientific parlance, although the “soul” gave way to ideas about the innate characteristics of individuals whose actions and free will were curtailed, or co-defined, by biology or heredity.⁶ In this regard, too, the face and the voice were considered to be closely connected, and practices to train the voice were meant to aid aesthetics, health, and the expression of emotion as well. As the tenor and canto teacher William Shakespeare noted in his 1899 work *Art of Singing*,

Lamperti says the eye is, as it were, the mirror of the voice. If it succeeds in conveying the intended expression, we are singing rightly. Add to this breath-control, and we have yet another sign that the voice is rightly produced. (Shakespeare 1899, 31)

Shakespeare had turned to the old Italian masters, like Lamperti, for ideas about “singing rightly”, but his insistence that breath control and emotional expression were on par and reflective of the singer’s personality, much in the way that the eyes could mirror the soul, was very modern. The audience’s ability to understand the emotive expressions of such a rightly produced voice was taken for granted. As British physician Joseph Farrar pointed out in his “practical vademecum” for vocal production, it was perfectly common to “pass a private mental opinion upon the personal character of a man or woman” merely “by a glance at the passing face” (Farrar 1881, 113).

The growing vocabulary around vocal timbre and quality gave experts and amateurs alike the means to pass similar judgement on individual voices – some did so with great relish. Professors at the *Conservatoire National* in Paris, for example, described voices as hot or cold; metallic or dull; clear and right or weak and bad. Attuned to the particular qualities of voices preparing for the stage, their ears could immediately determine whether a student of declamation or song would be able to portray the young ingenue, the hero, or the concerned father.⁷ These somewhat institutionalised pronouncements on individual voices and their ability to express aspects of their owners’ temperament and moral character, and to have an impact on the audience, show that ideas about the voice’s susceptibility to moral and social judgement was not only a matter of “private mental opinion” but could be shared culturally and socially not least because these were closely entangled with language, and the national concerns that implied (Bergeron 2010). It also showed that the formation of not-so-private opinions could have far-reaching political and social effects – especially when such pronouncements became a matter of conscious classification.

Like so many aspects of nineteenth-century vocal practice and health, ideas about the voice’s uniqueness and its capacity to express individual emotion and character vacillated between strong convictions about given biological impulses and culturally defined norms and expectations. A large range of manuals offered suggestions on how to cultivate what they claimed was an innate ability. It was argued that to externalise a supposedly authentic inner self required a complex set of “learned” cultural skills from both the vocaliser and the audience.⁸ Most authors were careful not to set out excessively rigid classificatory rules about how voices reflected character: there were no mathematically defined tables on pitch or volume, nor were there clear diagnostic instructions. However, their work did support the widespread belief that the voice revealed things about the speaker that they would have liked to hide. A good listener could tell something about a speaker’s character or state of mind by how they sounded. Such beliefs drew upon older,

early modern ideas about the voice's capacity to reveal something of the soul. As the composer William Gardiner noted in his 1849 treatise *The Music of Nature*, although this belief often proved to be misguided, it seemed to have been widely supported:

Blind people have a peculiar method of presenting the ear, and in some cases acquire the power of moving it when much interested. The incessant use they make of it gives them an indescribable quickness: they judge of everything by sound; a soft sonorous voice, with them, is the symbol of beauty; and so nice a discernor is a blind person of the accents of speech, that through the voice he fancies he can see the soul. From this idea they form notions of character that often lead them into erroneous conclusions. (Gardiner 1832, 5)

The highly revelatory character of the voice seems to have been mostly reserved for humans – whose emotions and temperament were understood as both more knowable and important than those of other vocalising creatures. Nevertheless, the work of comparative biologists on parrots, for example, shows the entangled discourses of “natural” vocal developments and conscious cultivation in action as well (Hoegaerts 2018). Humans were set apart by their more sophisticated organs and speech skills – thus their superior capacity for individuality and uniqueness. While, as the German physician and clinician Adolph Kussmaul noted, both “the speech of parrots and that of children is sheer listening reflex” (Kussmaul 1877, 54), the parrot could only express the simple needs all parrots shared along with some learned phrases. The human child, by contrast, would learn to combine nature and culture in a sophisticated blend that would reflect their unique personality.

The individual voice, as it was heard and understood in the nineteenth century, can thus be described as a product of encultured nature: closely related to physiognomy and anatomy (as all voices were produced by bodies and could therefore be assigned a place in biology), but also always a matter of practice (and therefore an intrinsically cultural performance). Histories of the modern individual voice, therefore, can be seen as adjacent to histories of the self (Connor 1996): while rooted in embodied practices that are culturally choreographed and shaped, both refer to imaginations of a highly individuated interiority (Wahrman 2004) as expressions of inner feelings or ideas. Thus, focusing on histories of vocal practice may help to overcome the “gap between ideas and experiences of self” (Hofman 2016, 8) in grappling with the history of the self, particularly by contributing to a study of techniques and regulatory practices of the self.

In the following sections, I will elucidate how this constant interaction between the sociocultural and physical aspects of vocal individuality was understood, constructed, and conjured into being in the nineteenth century. Distinguishing between the practices of observing, capturing, comparing, and recognising voices is by definition an exercise in artifice, as these intersubjective interactions with voice were strongly interdependent and intertwined. They do, however, point to a number of particular contexts, like the histories of science, technology, and politics, where a forensic approach to the human voice began to emerge, providing the basis for ideas like that of the voiceprint.

Observing, capturing, and comparing voices

The assumed human superiority in vocally expressing emotion, temperament, and personality was tied to the idea of a developed inner life and the ability to reason but also to the human organs of speech themselves. The nineteenth century saw

a significant rise of interest in (and publications on) the physiology of speech and voices (Rockey 1980; Stark 1999). Early forays into the examination of the throat had been made in the early modern period, particularly in the form of anatomical research (Richards 2019). In the first half of the nineteenth century, the German physiologist and comparative anatomist Johannes Müller reported extensively on his experiments with dead human larynges – commenting, for example, on the different tones that could be elicited from male and female voice boxes and their resemblance to those of animals, including frogs and alligators (Müller 1839, 1848). Research like Müller’s led to an increasingly precise exploration of the mechanism of the human voice as well as how voices differed from one another. As observers with anatomical and physiological expertise became increasingly convinced that the voice was, indeed, a material product of corporeal practice, the bodies producing voices came under increasing scrutiny (Davies 2014, 66–92).

Arguments arose over how such differences could be accounted for as various experts debated how exactly the voice was produced. Competing narratives insisting that vocal production could be likened to string or wind instruments drew attention to the different parts of the body involved in vocal production – meaning that not only the larynx and vocal cords counted as organs of speech but that the lungs and diaphragm, for example, also contributed to the distinctive sounds individuals could produce. As Claudia Schweitzer (2020) has shown, these debates over the nature of voice production as the result of physiological processes of either vibration or pneumatics arose in the seventeenth century and continued well into the nineteenth century. In 1833, for example, the *orthophoniste* (speech therapist) Marc Colombat de l’Isère concluded that vocal sound production could be likened to neither a violin nor a trumpet but most resembled a trombone (Colombat de l’Isère 1833). In the decades that followed, experts across Europe and the United States increasingly approximated a more holistic understanding of the human body as a sounding body in its entirety – or at least one comprised of many vocal organs. Kate and Emile Behnke, a couple with a background in theatre, would become central figures in the rising field of speech therapy. In the late nineteenth century, they concluded that the lungs provided the “bellows” or manual power for the voice (Behnke 1897, 9), which could be seen as a wind instrument composed of

BELLOWS, represented by the lungs.

THE WINDPIPE

THE VOICEBOX, or, LARYNX, and

THE (Behnke 1882, 9).

As a result of such consistent comparisons of the human voice to musical instruments, the constituent parts of the physiology of vocal production became the object of minute attention and targeted exercises to encourage “healthy”, socially acceptable practice. The Behnkes even provided photographic examples of the physical exercises they had designed to train the lungs, muscles, and diaphragm for improved vocal health (Image 1).

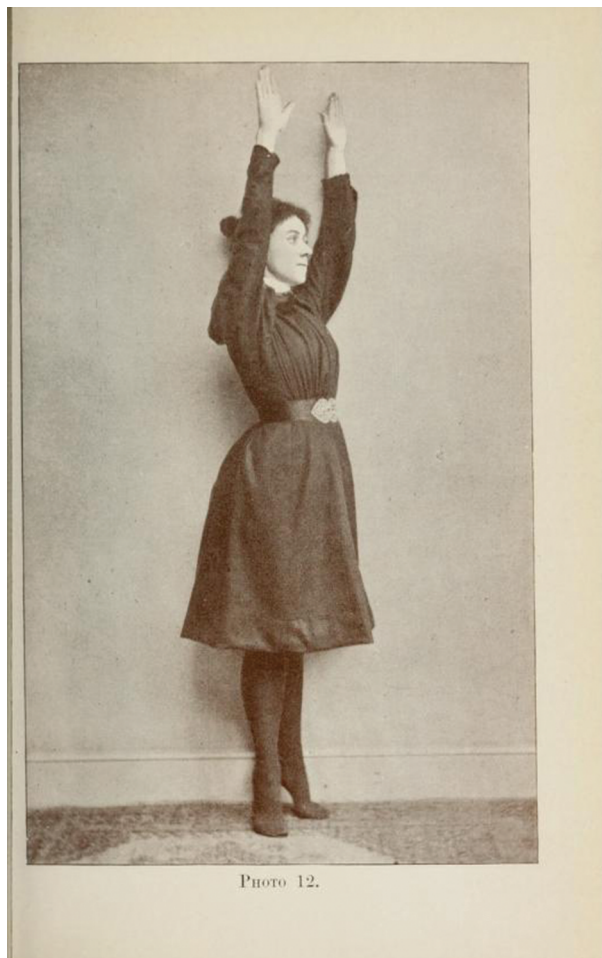


Image 1. Breathing exercises suggested by Kate and Emil Behnke in *The Speaking Voice: Its development and preservation*, 1897, p.63, courtesy of the University of Toronto Library.

In the mid-nineteenth century, the laryngoscopic mirror came into use, allowing experts to observe individual voices in action.⁹ This represented a significant shift in thinking about the voice as a physically produced object. Earlier observations had all been based by necessity on experiments with larynges extracted after dissection: the voice box retained a certain air of mystery largely because it was “hidden” in the throat (Hoegaerts 2020), and any examination of it was invasive. The laryngoscopic mirror could be introduced without hampering vocal production too much, allowing the examiner to observe the voice in action. In other words, it promised to reveal the mysteries of how physiology (described by anatomists and physiologists) and cultivated practice (understood as actions that lay outside the throat proper) worked together to produce the unique voices that fascinated researchers so much. Observed by the laryngoscope, the voice was neither a simple externalisation of the soul nor a straightforward product of the organs. It was produced “in practice” – a curious mixture of conscious and unconscious cultivation of the natural means that each individual possessed. Medical observers laid bare a number of pathologies, suggesting that certain peculiarities of vocal production directly resulted

from illness or faulty physiology while acknowledging the significance of practice in the production of a singular voice.

Increasingly, laryngoscopic research contributed to the development of systematic representations of vocal diversity and individuality: pictorial representations of the larynx and vocal cords (first drawn then photographed) provided budding experts with an overview of the different pathologies and particularities established in the interwoven practices of observation and cultural normalisation of the mid-nineteenth century. Images of the throat produced with the help of the laryngoscope showed physically different larynges – of women, men, and children, both pathological and healthy – as well as voice boxes in the process of producing sound. The pioneering laryngoscopist Morrell Mackenzie, for example, kept photographs of “an alto singing Fis” or a “tenor singing falsetto” next to photographs of throats exhibiting signs of disease (Hoegaerts 2018).

The laryngoscope would become one of the most important technologies in establishing discourses around the knowability of the voice and the possibility to study the connection between individual sounds and individual bodies. It also strengthened the connection between knowledge about physical bodies and sounds in a more general sense: nineteenth-century manuals and scientific treatises on the voice combined knowledge of physiology with that of physics, and more specifically, acoustics. In the early nineteenth century, these aspects of sound production appear somewhat disjointed, in separate chapters – and also as partly hypothetical, exploring how the vocal organs might be involved in the production of particular soundwaves. Laryngoscopic examination allowed the study of vocal organs in action rather than on the dissection table; it also enabled more integrated understandings of acoustics and the material production of sound in the body because it could show the actual working of the vocal mechanism at play. It therefore gained in popularity far beyond the confines of vocal physiology expertise. The laryngoscopic mirror became part of the arsenal of voice teachers, for example, even if not everybody was happy about this development. Take Mackenzie, who lamented that

a new school has arisen of late years, which demands that an exact and profound acquaintance with the anatomy and physiology of the vocal organs gained by dissection of the dead, and laryngoscopic examination of the living body, familiarity with the mysteries of acoustics, pneumatics, and hydrostatics, together with some added tincture of metaphysical lore, shall form part of the equipment of the unhappy wight who wishes to take up the profession of a singing master. (Mackenzie 1886, 99)

A seminal figure in the development of laryngoscopy, Mackenzie was keenly aware of the instrument’s impact beyond his direct sphere of influence and quite protective of its status as a precise scientific instrument. In the hands of the right expert (a status not conferred to most singing teachers), it could effectively identify the distinguishing features of individual voices – revealing pathologies of physiology and of practice as well as the movements of distinctively brilliant or healthy voices and changes in vocal practice and health over time.

The laryngoscope did not exist in a vacuum, of course, and was part of a more broadly conceived technological apparatus to capture and study human voices in the nineteenth century. Many were concerned with the thorny issue of the ambiguous nature of voices and their ability to both reveal and obscure their owner’s identity, personality, and unique features. New techniques to minutely observe and describe voices worked in tandem with innovations that fixed voices on the page, allowing experts to compare and classify

them. Along with visual representations of the throat's inner workings, the latter half of the century saw the rise of numerous inventions that made the sound of the voice observable in novel ways. As Tobias Wilke has demonstrated, in the nineteenth century "the bodily dynamic of articulation became defined as an epistemic object that could be addressed by experimental means" (Wilke 2022, 43) which led, among other things, to the development of numerous inventions that "enabled researchers [...] to approach speech in a manner equivalent to other recordable bodily processes", while also creating a "cross-over from the audible to the visible, from speech to notation, from body to trace and/or sign" (Wilke 2022, 4, 1). Not all of these technologies were equally systematic; as was the case for the study of vocal sounds, the visualisation of their effects and vibrations was a matter of both knowledge and aesthetics (Brain 2015). Take, for example, the tonograph, as described by the Metropolitan Opera House's voice therapist, Henry Holbrook-Curtis:

A metal tube with a bell-shaped cup at the end at right angles to the tube, over the rim of which was stretched a thin rubber membrane, the so-called rubber dam of the dentist. By sprinkling a certain mixture of emery and common salt upon the disc and singing a tone into the open end of the tube, it was found that every note of the octave produced a beautiful and intricate geometric form, the lines of which represented the fundamental note and the overtones of the voice. (Holbrook-Curtis 1909, 233)

Images produced by the tonograph lacked the falsifiability that would later come to be expected of any scientific exploration, but they bear witness to the belief that the individuality of the voice itself could be visualised, and that the connection between "body and trace and/or sign" noted by Wilke was recognised as offering possibilities beyond the realm of poetry or linguistics. Produced by an instrument inspired by Ernst Chladni's sound figures and the eidophone – which also relied on the translation of vibrations into the movement of paint or iron filings as patterns – these images were approached as geometric visual representations of acoustic phenomena and thus appeared to be mathematically and scientifically precise as well as visually pleasing. They were read as representations of unique sounds, product of both the pitch and particular timbre of a unique voice. The shapes of the patterns were interpreted as signs of an individual tone's "purity"; in its evocation of mathematical precision, the beauty of the geometric form converged with ideas about the mathematical clarity of acoustics.

The imagery produced by instruments like the eidophone, the tonograph, or early vocal photography¹⁰ did not quite take off in the same way as that created by the laryngoscope; nevertheless, it exerted considerable influence on how sound – especially vocal sound – was studied in the twentieth century. As René Marage, who taught a course on new scientific approaches to vocal physiology in early-twentieth-century Paris pointed out, "It is often said that in matters of tastes and colours, there can be no disputes, but debating about sound is even more difficult" (Marage 1911, 76). Visual representations, however experimental, were thought to be better candidates to develop systematic understandings of vocal health and even vocal aesthetics. They also supported the authority of experts in newly minted fields, like phonology, for example. "The linguist, elocutionist, and musician can no longer be accepted as authorities upon vocal science", one of its proponents, the composer William Arthur Aikin (1910, 5), noted. "The phonologist must, therefore, be ready to accept the responsibility of that position". Doing so resulted in, among other things, a new way to systematically visualise the relation between vocal range and operatic roles (Image 2). The influence of such visual representations of sound beyond a rather small field of experts

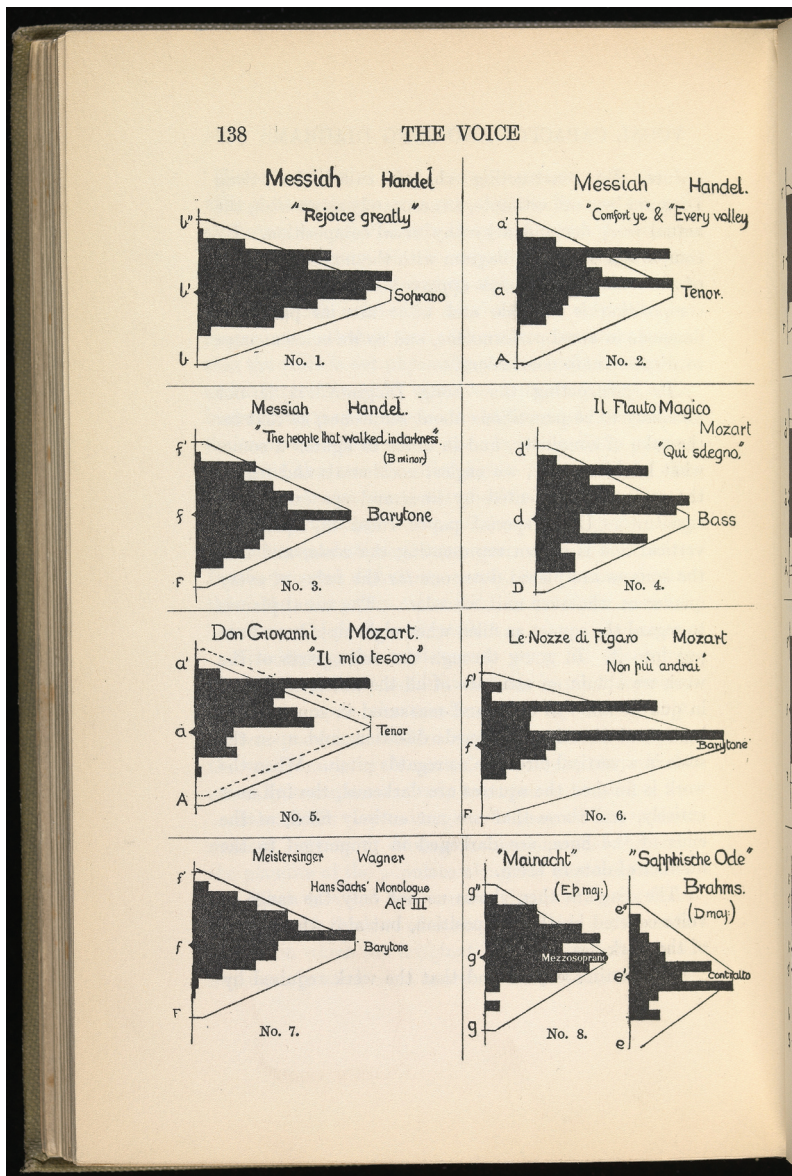


Image 2. "Song diagrams" visualising the vocal amplitude needed for different operatic roles, W.A Aikin, *vocal capacity and song diagrams*, 1910 p. 138, courtesy of the Wellcome Collection.

appears to have been limited, however. Despite the potential of the tonograph and eidophone to animate public demonstrations, there is little sign that these instruments were overwhelmingly successful. This is all the more surprising since the very similar figures produced by Chladni's experiments in the late eighteenth century travelled so well (Gillin 2021, 57–63). H. Holbrook-Curtis exerted quite some effort to make the tonograph known to the public by disseminating a photograph of the great Enrico Caruso lending his voice to the instrument (Image 3). However, by the 1920s, other technologies to capture and measure sound had taken over. The idea of a single image capturing a voice's qualities and character would become the subject of spectrography.



Image 3. Enrico Caruso singing in the tonograph. H. Holbrook Curtis, *Voice building and tone placing: Showing a new method of relieving injured vocal cords by tone exercises*, 1909, p.237, courtesy of the British Library.

In fact, by the twentieth century, even the laryngoscope was losing some of its allure. As recording technology rapidly developed, vocal amateurs and experts shifted their attention away from the voice's physical origins and visibility, which were no longer the only means to capture voices and make them available beyond the time and place of their production. As Karin Martensen has shown, the entertainment value of new technologies like the gramophone exerted a powerful influence around the turn of the twentieth century (Martensen 2019). While visual representations of sound by no means disappeared, they now vied with sounding modes of replay for the attention of experts as well as consumers. Perhaps the rapidly changing horizon of sound technologies partially account for the relative obscurity of the voiceprint's early predecessors. Additionally, I would argue, the need for such technologies was perhaps not felt quite so acutely in a society that relied on a very different set of embodied auditory techniques before the idea of acoustic recordings became a concrete technological possibility. As research on, for example, the intersection of poetics and acoustics (Butler 2015; Yamaguchi 2020) or stenography (Morat 2017) has shown, the practice of capturing the voice by observing it and distinguishing its unique features was generally thought to be a very human, intersubjective skill, rather than a merely technical one: it required understanding more than mechanic accuracy. The work of countless professional and casual listeners, like

journalists, stenographers, professors of song, and judges, shows a range of auditory techniques that drew on practiced ears and memories rather than the visualisation or reproduction of vocal sounds. While they, too, used a range of (epistolary) technologies to capture and represent vocal sounds, these technologies were focused on memory and interpretation – as a way to translate an experience from one listener to the next – rather than the capture of the sound of a voice itself. Although the idea of the voice’s individuality, uniqueness, and ability to express a distinct personality gained traction in the nineteenth century, it mainly served a social function: to gauge the impact of a unique individual on their peers. In that capacity, it had an important political function, mirrored in the amount of attention political columnists lavished on “famous” public voices.

Recognizing voices: a period ear

Aside from transcription, nineteenth-century listeners also relied on description to capture voices on the page. Such practices of description often relied on metaphor and the ability of readers (and listeners) to recognise and classify vocal sounds. Specific voices could be likened to musical instruments, sounds of nature, or other (more famous) vocal sounds. The British political columnist Henry Lucy, for example, developed an evocative style that relied on political knowledge. He likened the voices of individual representatives to those of their fathers or peers with longer or more illustrious careers in parliament or on the platform. But his descriptions also drew upon the same metaphors and material understandings of vocal sounds as those present in scientific literature. On the liberal representative and celebrated orator John Bright, he wrote, for example:

Nature has gifted him with a fine presence and a voice the like of which has but rarely rung through the rafters of St. Stephen’s. “Like a bell” is the illustration usually employed in the endeavour to convey by words an impression of its music. I think it were better to say “like a peal of bells”, for a single one could not produce the varied tones in which Mr. Bright suits his expressions to his theorem. (Lucy 1919, 35)

While such descriptions were based on the notion that general aspects of vocalisation (and their reception) were shared by many, their particular iterations had the effect of bringing forth a unique individual sound on the page. And although experts like journalists or critics often employed a sophisticated vocabulary to write about voices, their reading audience most likely understood enough of it to make acoustic sense of the descriptions they read.

The techniques of vocal recognition that developed in the latter half of the nineteenth century – unlike later, more precisely defined practices of speaker identification proper – relied on embodied practices of listening, visualisation, and memory. Thus, they have more in common with what a musicologist might call a period ear (Burstyn 1997) – a culturally defined set of habits and skills, partly developed unconsciously and not tied to any particular technology – than they do with the “sonic skills” that would later be required for the application of tools and technologies of voice identification (Bijsterveld 2019). They were also not entirely comprised of a practice of “listening”, although various actions that could be termed “audile techniques” (Sterne 2003) come into play for nineteenth-century vocal recognition.¹¹ The period ear is, in a sense, less conscious: it hears, and sometimes listens, in a chronologically and contextually specific manner. In other

words, the nineteenth-century ear interpreted voices and their characteristics in keeping with ideas of health, aesthetics and assumptions about the uniqueness of individual voices. Rather than a technically specific practice, the actions of the period ear are to perform “cultural work” – to give meaning to (in this case) human sounds through an extended and embodied range of practices. Beyond the cultural and analytical work of a trained period ear, the techniques of vocal recognition endeavoured to *share* insights about individual voices as well. They were not confined to the ear, nor were they entirely focused on a particular field of knowledge or expertise. Like the enquiries about vocal health and aesthetics emerging from the entangled fields of music, acoustics, and physiology, budding forensic approaches to voice recognition emerged from a site where well-developed skills encountered not-yet-achieved technological ambitions. Insights about voices heard through this prism emerged from a combination of the aforementioned transcriptions and visualisations as well as – perhaps more importantly – a creative use of language evidenced in, for example, journalism and satire (Marionneau and Hoegaerts 2021).

It is safe to assume that the newspaper reading audience (or a broader public in general) used similar techniques and simple technologies in their daily lives to observe, compare, recognise, and describe individual voices of importance to them. At a time when a businessman’s “word” could carry significant value, the ability to assess voices was as important as the ability to speak well.¹² The rather common image of the earwitness in Victorian tabloids, providing prime evidence of the identity and actions of adulterers and criminals, refers to a similarly accepted set of skills. Most indicative, perhaps, of the long-lasting influence of embodied auditory techniques, even as newly developed technological aids started to become available, is their presence in detective stories. Sherlock Holmes was continually identifying disguised criminals by their voices, though he rarely used any of the newly available acoustic technologies, despite his creator’s fascination with forensic methods like fingerprints and shoeprints.¹³ Other fictional detectives of that era proved equally reliant on their practiced ears. Margaret Oliphant’s *A Story of a Voice* (Oliphant 1863) features a somewhat hapless witness-turned-detective who very confidently identifies a murderer by voice alone. Ernest Bramah’s blind detective, Max Carrados, owed much of his prowess as well to his remarkable powers of sensorial observation. His first appearance in *The Coin of Dionysius* establishes his remarkable skills when he recognises a former fellow student the moment he opens his mouth.

“Surely my man has got your name wrong?” he exclaimed. “Isn’t it Louis Calling?” [. . .]

“Extraordinary thing meeting like this”, said his visitor, dropping into a chair and staring hard at Mr Carrados. “I have changed more than my name. How did you recognize me?”

“The voice”, replied Carrados. “It took me back to that little smoke-dried attic den of yours where we——”. (Bramah Smith [1913] 1975, 7)

Bramah made a point of demonstrating his character’s unique skills; on the pages of *The Strand*, Carrados often superseded Holmes both in popularity and in observational powers, developing a systematic mode of sensorial observation closely related to police practices of that time. While voiceprints (unlike fingerprints and footprints) were beyond the imagination of Doyle, Bramah, and Oliphant, the uniqueness of the human voice and its forensic potential often took centre stage in their works. In fact, this had a historical

precedent: the eighteenth-century magistrate John Fielding, nicknamed the “Blind Beak”, rumoured to be able to identify over 3,000 criminals by the sound of their voices. His approach to policing showed how nascent forensic methods could be applied practically: he was also involved with the police gazette, which published among other things photographs and descriptions of known criminals, thus encouraging members of the force to think of detection as an exercise in distinguishing and recognising particular humans. While he supported the development of methods that relied on visual clues, his visual impairment led him to favour other modes of distinction. Like that of the fictional Carrados character, Fielding’s blindness was thought to contribute to his aural precision. Master listeners like Fielding and Carrados were exceptional cases but revealed the potential of paying attention to voices in police and detective work. It would take until the twentieth century for recognisable technologies to be mobilised for vocal recognition in policing – wiretapping was used by US law enforcement from 1895 onwards, for example (Hochman 2022), and research on the psychology of voice recognition and its potential use in policing arose in the 1930’s (Bull 1981). However, the use of a cultivated and practiced ear was part of the daily practice of policing and prosecution throughout the eighteenth and nineteenth century. Arlette Farge’s work on the police archives in Paris has revealed the importance of the policeman’s ear in deciding which disturbances required intervention, or which witnesses could be believed (Farge 2009). Likewise, multiple linguistic legislative practices relied not only on evidence that had been (over) heard by witnesses, but also on vocal performances in the courtroom (Meisel 2001, 167–222; Schnädelbach 2018) The “Old Bailey Voices” project has recently thrown light on the extent to which audibility and sound could influence court proceedings.¹⁴ So while individual voices could not be recorded and replayed or analysed spectrographically in the nineteenth century, they were regularly scrutinised, recognised, described, interpreted and compared to others in multiple contexts of criminal prosecution. The embodied techniques mobilised by nosy neighbours, policemen, court clerks and notaries of the nineteenth century relied on the same three assumptions that underpinned later technology for forensic voice recognition (Li and Mills 2019): the human voice is (mostly) unique, vocal characteristics can be measured and compared, and identifying and recognising voices requires memory and recall – either by a gifted human or one assisted by technology.

Encultured nature, attuned ears: conclusion

The two centuries between the “Blind Beak of Bow Street”, and the development of the acoustic technology that allowed voiceprints to become a reality, were characterised by enormous leaps in acoustic knowledge and technology. Nevertheless, practices of vocal recognition remained firmly tied to culturally moulded human skills throughout most of the period. Despite the taste for visualisations of sound and of increasingly systematic modes of measuring or assessing sound, the accultured ear – or period ear – was entrusted with the task of recognising individual voices until well into the twentieth century. The embodied expertise this ear was expected to demonstrate was supported by new scientific insights as well as countless more traditional techniques of audition and recall. The circuitous timeline of the development of recording technology, particularly its promise to transport a singer

or speaker “through the ether” to a listening ear, no doubt had an influence on these modes of recall and recognition. But, as this paper has aimed to show, the continued reliance on the individual ear to recognise an individual voice was shaped by cultural beliefs about the voice’s affective powers as well. Until well into the nineteenth century, experts across different disciplines would continue to refer to the human voice as intimately connected to the soul. Such references to the spiritual plane were mostly poetic or metaphoric, rather than explanatory, but served to remind readers (and vocalists) of the exalted position that divine and human voices continued to occupy, even in modern scientific and pedagogical contexts. In the more prosaic contexts of politics and policing, these beliefs contributed to an understanding of human voices that – unlike their animal counterparts – constituted a unique identifier for a particular body and personality: the two were inseparable in nineteenth-century understandings of encultured nature. In short, despite their notorious capacity to trick unsuspecting listeners, voices had a revelatory function for those whose ears were well attuned.

Notes

1. I want to express my thanks to Karin Bijsterveld and Anna Kvicalova for their substantial work in eliciting and helping to shape this article. I am also grateful for Willemijn Ruberg’s and Mike Mopas’ helpful suggestions to improve on the first draft, and for Nataliia Odnosum’s and Jan Schroeder’s suggestions on detective fiction. Research for this paper was made possible through funding by the European Research Council (ERC StG 2017, CALLIOPE).
2. In the context of this essay, vocal recognition tools, in fact, precede both technologies to study and measure sound vibrations and to record and reproduce them.
3. As, for example, the work of Willemijn Ruberg has shown, cultural entanglements of embodied identities played as important a role in the development of forensic science as the cultivation of particular techniques or tools – for instance, in performances of expertise or in the resilience of cultural symbolic meanings attached to bodily features and functions (Ruberg 2019).
4. The collections are now held in the Wellcome Library, the libraries of the Royal College and Royal Conservatory of Music, the Bibliothèque nationale, the Samuel Heinicke Library, and the Library for the Hochschule Felix Mendelssohn. Although the collections roughly represent expertise formed and published in Britain, France, and the German Lands, respectively, they also contain work from further afield – for example, southern Europe and the United States – as local experts consulted this work (sometimes in translation) as well.
5. In its overlap with histories of science and technology, this study also leans heavily on insights from sound studies that have been concerned with histories of acoustics and mediated sounds (e.g. Sterne 2003), although its main points of reference are interdisciplinary approaches that traverse sound studies, voice studies, and musicology (e.g. Eidsheim 2019; Jarman 2013; Stoeber 2016).
6. This turn towards biological ideas surrounding the temperaments of singers and speakers arose out of earlier ethnicised ideas on the sounds of cultural diversity (see e.g. Solanki 2022) and more or less coincided with the rise of ideas on heredity in criminal anthropology. Although biological determinism did not entirely prevail in either field, the influence of eugenicist and determinist ideas is palpable throughout the second half of the nineteenth century. See Gibson (2002).
7. See also Hoegaerts (2021), research based on Archives nationales (Pierrefitte), AJ/37/84.
8. Historians of emotions have likewise noted that practices of experiencing and understanding or perceiving “inner” feelings are culturally modulated and (thus) historically contingent. In

this text, I focus exclusively on practices of vocal articulations of individuality rather than the affective and emotional charge of the self, but I lean on the insights of historians of emotion and interiority like Fay Bound Alberti (2010), Rob Boddice (2017), and Monique Scheer (2012).

9. The history of the laryngoscope is somewhat contested, but the introduction of the laryngoscopic mirror is usually dated around 1860, with several musical and medical experts claiming to be its “inventor”. Historical narratives reconstructed by practitioners of otorhinolaryngology have focused largely on the history of the laryngoscope as either a competition between its inventors or a story of scientific progress (e.g. Bailey 1996; Cooper 2004; Lapeña 2013).
10. An application of photography proposed by René Marage, in which vocal vibrations would be transmitted to a rubber band, shown in a mirror, and photographed in quick succession (Marage 1911, 88).
11. A thorough overview of the rich methodological tapestry developed within sound studies to understand the cultural (Erlmann 2014), media (Sterne 2014), music-educational (Ochoa Gautier 2014), medical (Rice 2013), and scientific (Bijsterveld 2019) histories of listening is beyond the scope of this article. The histories of describing, comparing, and recognising voices is, of course, entangled with practices of listening, but not, I would argue, identical to it: the focus of the latter is precisely to wrestle understandings of the voice away from the (individual) ear and into the realm of the social (or at the very least the anthropometric). This is why the period ear – which is essentially just the historically contextual ear “of its time”, rather than a specifically or technically trained one – is important to keep in mind here, as it channels the social and cultural context that underpinned normative ideas about vocal production and individuality at the time.
12. This is illustrated, for example, by the suspicious attitude towards ventriloquised voices (Connor 2000).
13. As noted by a large range of works, including popular historical ones, Sherlock Holmes is often described as a “pioneer” of forensic science, a characteristic of the fictional detective primarily connected to his creator’s expertise in medicine (See, e.g. King 2020; O’Brien 2014, 2017).
14. Using text mining and big data techniques in combination with text-to-speech technology as well as a reconstruction of the room, the project illuminates a number of practical as well as discursive realities of the (sonic) practices of the courtroom: <https://oldbaileyvoices.org/>.

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Notes on contributor

Josephine Hoegaerts is professor of European Culture after 1800, at the capacity group European Studies where she teaches on questions of diversity, identity and political culture. She leads the project CALLIOPE: Vocal Articulations of Parliamentary Identity and Empire (ERC StG 2017). Her research focuses on the history of the human voice, cultural practices and politics of vocalisation, and the different discourses and meanings attached to speech and song. Recently, she authored “Voices that Matter: Methods for Historians Attending to the Voices of the Past,” *Historical Reflections* (2021). She has co-edited several issues on sound, music, and silence for the *International Journal for Modernity, History and Culture*; *Journal for Interdisciplinary Voice Studies*; and *DiGeST*, among others.

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