Pitch vs. Timbre

Daniel Walden

The Oxford Handbook of Timbre
Edited by Emily Dolan and Alexander Rehding

Subject: Music, Music Theory, Sound Studies Online Publication Date: Oct 2019
DOI: 10.1093/oxfordhb/9780190637224.013.33

Abstract and Keywords

Early comparative musicology habitually ignored, even extinguished, timbre in its single-minded focus on pitch. This chapter traces the broader social, cultural, and political consequences of this framework. It surveys how, at the turn of the twentieth century, John Comfort Fillmore and Benjamin Ives Gilman followed the lead of Alice Fletcher and Alexander Ellis in deploying a broad range of technologies—phonograph, Helmholtz resonator, keyboard, and musical notation—to develop frameworks for analyzing essential similarities and differences between Native American and Western musics. It argues that such scholarship, while ostensibly aimed at salvaging Native American music, also served American efforts to reform and silence indigenous voices. The postscript examines the resonances between their theories and modern frameworks of parametric analysis that construe pitch and timbre as autonomous, and proposes that there may be unrecognized perils in overly articulating the boundaries between pitch and timbre to focus analytical attention exclusively on the measurable quantities of musical sound.

Keywords: pitch-timbre relationship, early recording technology, transcription, keyboard, comparative musicology, ethnocentrism, cultural relativism, Native American music, music perception, parametric analysis

Mere Noise

Alice Cunningham Fletcher opens her landmark ethnography, "A Study of Omaha Indian Music," with a confession. The first time she heard Native American music, she found it disturbing:

> I well remember my first experience in listening to Indian music. Although from habit as a student I had endeavored to divest myself of preconceived ideas, and to rise above prejudice and distaste, I found it difficult to penetrate beneath the noise and hear what the people were trying to express. I think I may safely say that I heard little or nothing of Indian music the first three or four times that I attended dances or festivals, beyond a screaming downward movement that was gashed and torn by the vehemently beaten drum. The sound was distressing, and my interest in this music was not aroused until I perceived that this distress was peculiarly my own, everyone else was so enjoying himself (I was the only one of my race present) that I felt sure something was eluding my ears; it was not rational that human beings

> should scream for hours, looking and acting as did these Indians before me, and the sounds they made not mean something more than mere noise.[1]

This first musical experience took place while she was traveling to Native American reservations to report back her archaeological findings to Frederic Ward Putnam of the Peabody Museum of Archaeology and Ethnology at Harvard University.[2] She revised her opinion a few years later, after she fell ill while administering land allotments on the Omaha Reservation for the Office of Indian Affairs, and her research assistant and community liaison Francis La Flesche brought a group of Omaha singers to sing to her on her sickbed: "They sang softly because I was weak, and there was no drum, and then it was that the distraction of noise and confusion of theory were dispelled, and the sweetness, the beauty and meaning of these songs were revealed to me."[3] That "beauty and meaning," she determined, had been masked by the "distressing" manner in which the songs were customarily performed at ceremonies:

> I therefore began to listen below this noise, much as one must listen to the phonograph, ignoring the sound of the machinery before the registered tones of the voice are caught… . My efforts in listening below the noise were rewarded by my hearing the music, and I discovered that there was in these Indian songs matter worth study and record.[4]

Fletcher believed that the technological imperfections of the early phonograph—surface noise, variations in playback speed, and so forth—required the cultivation of listening techniques that could penetrate beneath superficial imperfections of tonal quality and focus on musical essence: the pitches and rhythms of melody. She argued that ethnographers might apply those techniques to listen "below the noise" of Omaha song, whether it was recorded or live: "It is easy to be caught in the meshes of these external peculiarities of a strange people, but if one would hear Indian music and understand it, one must ignore as he does his manner of singing."[5]

Fletcher's account of Omaha music followed on the heels of another benchmark study: "On the Musical Scales of Various Nations," by Alexander John Ellis, a British scholar of comparative linguistics who had arrived at the study of comparative musicology after decades of work on an English translation with commentary of the German physicist Hermann von Helmholtz's *On the Sensations of Tone*.[6] He followed Helmholtz in defining the musical tone as a perceptual phenomenon distinguished by three distinct components: *pitch*, determined "solely" by the average length of time it takes for the fundamental frequency to complete a single periodic vibration; *quality* or timbre, dependent on the form those periodic vibrations take dependent on the partials present; and *force* or loudness, determined by the collective amplitude of those vibrations. Pitch, he concluded, was the easiest of the three to measure as a single, autonomous datum.[7] Loudness he recognized as dependent upon pitch level, meaning it could not be treated independently; timbre he found impractical on account of the sheer number of partials, the individual strengths of which also changed continually over time. He therefore initiated his studies by focusing on pitch, collecting data on what he believed were the standard pitch collections of every musical system he could find. But he soon discovered that some tuning forks and non-Western instruments featured overtones far stronger than the fundamental, preventing him from quantifying pitch until he could find a way to "extinguish" or "quench" the component partials of timbre.[8] He eventually overcame this obstacle by using Helmholtz resonators, small metal orbs with nozzles that Helmholtz had originally used to investigate timbre by magnifying the component partials of complex tones, to investigate pitch by magnifying the fundamental frequency instead. Sounds that resisted he disregarded as "unmusical."[9]

Fletcher and Ellis, to be sure, took different approaches. Fletcher's insights were earned through fieldwork, and only once she "ceased to trouble about theories of scales, tones, rhythm, and melody."[10] Ellis never left London

even though his musical interests extended as far as the South Pacific, and he troubled himself a great deal with scale theory. Yet both determined they could only begin to study non-Western musical traditions if they first scrubbed timbre from tones to hear pitch. Doing so seemed necessary for comparative musicology to function as a branch of contemporary music theory, which generally construed pitch and timbre as operative within separate realms of musical experience—pitch as pertinent to the eternal and immutable tonal imagination, timbre as an ephemeral and changeable phenomenon—and located the essence of musical expression in pitch alone.[11] Teaching how to "listen below the noise" also seemed beneficial for the development of interracial empathy, because it taught how to disregard features of a foreign musical culture that caused "distress" and focus on its essential beauty.

Eliminating timbre also seemed necessary to Fletcher and Ellis for the development of comparative musicology into a branch of modern science. The measurable quantities of musical sound are those that produce verifiable data and can be dealt with in objective terms: pitch was easy to treat in this way; timbre was not. Pitch and timbre had to be distinguished by analysts as fully autonomous features of musical sound, pitch as a measurable parameter, timbre as a residual category. Technologies like the phonograph, Helmholtz resonators, and the musical keyboard were indispensable for facilitating "parametric listening," which directed the attention of analysts to extracting autonomous measurable quantities from musical sounds. Transcription in staff notation assisted in documenting the results, by representing the measurable parameters of music separately, depicting time on the *x*-axis, pitch on the *y*-axis. These technologies were optimal because they focused the ear on pitch, and because of their *in*ability to translate timbre; their constraints were just as valuable as their affordances. The presumption that pitch could not be known until timbre had been "ignored" or "extinguished" arose from, and contributed to, an epistemological framework that construed these two components of musical sound in opposition: as "pitch vs. timbre."

Even then, theorists worried about the potential shortcomings of this framework. In his 1882 study, *On the Music of the North American Indians*, Theodore Baker confessed that his transcriptions of just the pitches and rhythms of Native American songs captured only a part of their original spirit:

> It is indeed hardly to be expected that these songs, removed as they are from their natural, savage surroundings, should have the same effect here. Similarly, how different is that precious Alpine flower, the edelweiss, when in its free wind-swept native place, from its situation down in the valley among the multi-coloured garden plants, where it can barely maintain its pitiful existence![12]

Scholars who followed Baker in studying Native American music similarly used botanical metaphors in proposing what to do with the songs they had plucked from the field. Two such figures were John Comfort Fillmore and his sometime nemesis, Benjamin Ives Gilman. This chapter tracks how Fillmore, a close collaborator of Fletcher and La Flesche, endeavored to remove the "husk from kernel" by extracting melodic pitches from Native American songs, and then replanting those kernels in Western musical culture, harmonizing them for Western instruments. The next section examines the contrary approach adopted by Gilman, who adapted Alexander Ellis's tonometrical techniques in analyzing pitch from phonographic recordings of Native American music, developing a form of "phonographic transcription" to glean what he called a "*hortus siccus*," named for the collection of dried flowers used in botanical research. Both scholars relied on the technologies of phonograph, keyboard, and notation in striving to articulate what they thought were essential similarities and differences between Native American and Western musics, leading them to "ignore" and "extinguish" timbre at a time when American social and political institutions were actively implicated in the silencing and "reform" of indigenous voices. Retracing this historical record, along with consideration of a growing body of evidence suggesting that pitch and timbre can function as co-pro-

ductive parameters, suggests the perils in over-articulating the boundaries between pitch and timbre and interpreting them as fully autonomous, even oppositional components of musical sound.

Husks, Kernels

Fletcher's determination that it was best to "ignore" the "external peculiarities" of Omaha song led her to discern "a sympathetic chord and even some of the fundamental forms of expression" in common with Western music, and to locate its "divergence … upon the intellectual rather than the emotional plane."[13] But she believed that she required assistance from a musician more technically skilled in Western theory and composition, who could help her analyze the structural principles of pitch, rhythm, articulation, and text. After a brief collaboration with the pianist Sarah Eliot Newman singularly focused on transcribing the vocal parts of the Wawa^{n} Ceremony, as shown in Figure 1, she turned to Fillmore, Director of the Milwaukee Music School and author of several music histories and translations of German music theory, for broader assistance tending her musical "wild flowers that have not yet come under the transforming hand of the gardener."[14]

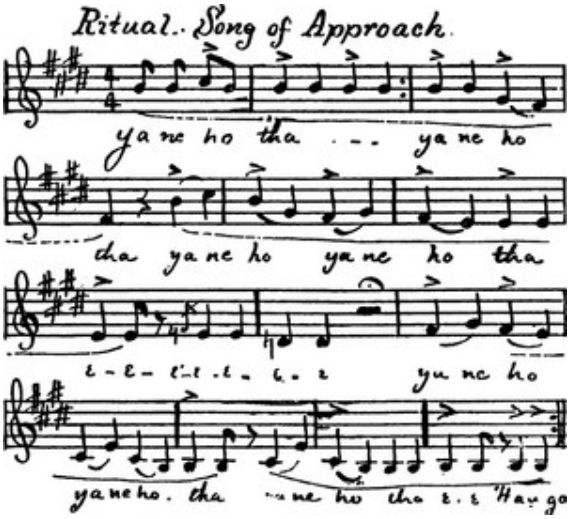

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Figure 1: "Ritual Song of Approach" from the Wawa^{n} Ceremony, transcribed by Sarah Newman with Alice C. Fletcher and Francis La Flesche (Fletcher, Wawan, 315).

Fillmore assured Fletcher that it was "real music" and she had tapped a great "mine of wealth." He agreed to copy her transcriptions, harmonize them, and work several of them up into an "orchestral poem."[15] On the one hand, he suggested this would complement her efforts at salvage ethnography, preserving records of "rites and ceremonies already becoming obsolete."[16] Both believed the only alternative to extinction of Omaha songs was to allow "their directive emotion [to] hereafter take the lines of our [Western] artistic forms"; thus the Hethúshka Society, whose members met in "citizens' or white man's dress" to "preserve the old historic songs and record of their ancestors," would benefit from assistance developing their historic songs into modern forms that could match their modern dress.[17] On the other hand, Fillmore thought harmonic arrangement would show how the "flowers" of Native American music could be harvested as a natural resource for American Classical musicians seeking to develop a national voice.[18] Fillmore endorsed the symphonic poem, "the culmination of the romantic ideal" based on "true

natural principles," as ideally suited for that purpose, in part because it was the only musical genre in which there was still "room for the originality of genius to assert itself."[19] By 1890 he completed the "Indian Fantasia No. 1" in F minor, as shown in Figure 2, which took a Hethúshka song as the theme for a set of variations designed to demonstrate how the "gashing" drums and "screams" of Omaha music could be adjusted to appeal to ears trained in the Western classical tradition.

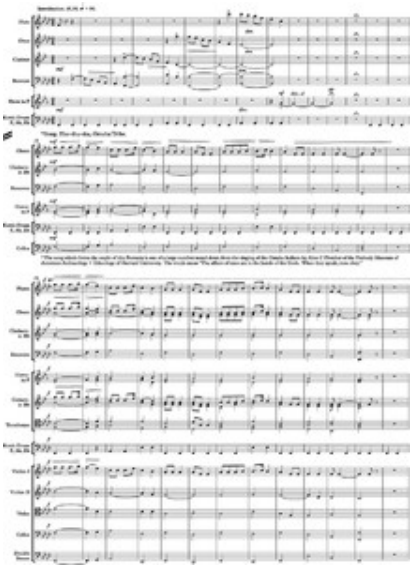

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Figure 2: The introduction and incipit of the main theme from John C. Fillmore's *Indian Fantasia No. 1*. The first variation following the main theme is for *pianissimo* pizzicato strings in homorhythm; next comes a flute cadenza, followed by melodic fragmentation, and a *maestoso* horn chorale; finally, a fugue on the main theme for full orchestra, which subsides in pianissimo F major chords.

Fillmore believed that timbre was the greatest of Omaha "deficiencies and defects" and was convinced that the "evolution" of Omaha music would be stalled until this was addressed.[20] After attending a Hethúshka Dance on July 8, 1891, he reported that "their dance stirred me up immensely and now I feel for the first time that I understand that music."[21] He nonetheless deplored the timbres he heard, remarking in a critical addendum to Fletcher's "Study of Omaha Indian Music":

> Of sensuous beauty of tone I have heard comparatively little in Indian voices. Nor do I see how it could possibly be attained under the ordinary conditions of Indian singing. Take the … Haethuska dances for example… . In the Haethuska dances the men have strings of sleigh-bells on their legs. All of these noises are symbolic and deeply significant to the Indian, but of course serve only to confuse, if not to repel, the musical sense of the casual white visitor. There is more or less noise and confusion in the camp. The wind perhaps blows hard; it generally does on these rolling prairies. Often another company is singing, dancing and drumming at no great distance. The songs are the expression of excited feeling and the singers are stirred up almost to frenzy. Under such conditions the production of a beautiful quality of vocal tone is physically and morally impossible.[22]

"Superficial observers" might "find no melody and no beauty in Indian singing," he wrote, for at times "the sounds we hear bear so much greater resemblance to the yelps and howls of wild beasts that we may be impressed with the feeling that these people, when they are singing at least, have more in common with the lower animals than with us."[23] Omaha songs could achieve broader favor "when given with a beautiful quality of tone, whether by singers or orchestral instruments, or both together."[24] He claimed that recasting them for Western instruments with superior timbre would not threaten their essence: "a tune is a tune, and *the same tune*, whether it is played on a violin, a piano, a flute, a clarionet, an oboe or a trumpet; or sung by a bass, a soprano, a Patti, or a cannibal savage."[25] It was merely winnowing the timbral superficies to "extract the real kernel from the rough husk that surrounds it."[26]

Fillmore's anodyne "fantasy" was unsuccessful in the concert hall. Undaunted, he turned his attention to arranging Fletcher's transcriptions for piano and voice so that anyone with a piano could reproduce Native American songs in a "fine quality of tone" within their own homes.[27] This might even include the Omaha themselves, he believed, enabling them to present their music in a form more palatable for missionaries and Office of Indian Affairs superintendents who previously disparaged indigenous music-making as "savagery."[28] Yet the piano proved as "unsatisfactory to the Indian as his singing can be to our unaccustomed ears," not only because it did not permit sliding tones or vibrato, but because of "the unfamiliar tone-quality of the instrument coupled with the sound of the machinery which always seems to strike them, prevents their recognition of the song."[29] Fletcher proposed an ear training regimen to teach Omaha musicians to "ignore" the piano, just as she had trained herself to "ignore" the extraneous noises of the phonograph:

> Numerous experiments made it evident that, before the Indian could be made to hear the music of our instruments, his ear must be trained to ignore their mechanical sounds. This was accomplished by accompanying the instrument with the voice, and inducing the Indian to join in the singing; thus his ear, hitherto accustomed to the portamento which permits no break between the notes of a melody, was gradually taught to connect the distinct and separate tones of the instrument, and to catch above its noise the familiar cadences of his song.[30]

In this way, Fletcher hoped, Western and Native American musicians could recognize their own music in the Other by listening for pitch. She expected that the piano could prove the ideal meeting ground for musical exchange on account of its relatively neutral timbre.

Fillmore also proposed that collaborations at the piano keyboard would civilize Native American songs by transmuting them into "music." He worked out a step-by-step process for collaborating on how to produce Omaha songs, involving "sing[ing] with [the informant], and afterwards by myself, asking him to correct any errors in my version, of course noting down carefully all variations," and finally, harmonizing the melodies and submitting them to the indigenous singer for approval.[31] This final step was required by his Omaha informants, he explained, because "whenever their songs were played for them on a piano or organ, *they were not satisfied without the addition of chords to the melodies*."[32] Fletcher, who when transcribing herself worked often with La Flesche at the piano, as seen in Figure 3, supposed this might be because it was the best way to restore the harmonic richness of a choral performance: the Omaha ear "misses something it heard in the unison singing of his people, and which the addition of a simple harmonic accompaniment supplies," and that "something" could specifically be the tendency to change vowels when singing in unison in order to activate different parts of the harmonic spectrum.[33] Fillmore had already disregarded any investigations into Omaha timbre, however, and so he proposed an alternative explanation in terms of pitch, clarifying that the predilection for harmonization was simply the natural extension of a "latent harmonic sense which might, unconsciously on their part, be a determining factor in their choice of melody

tones."[34] The indigenous singer, "when he makes music under the impulse of emotional excitement, moves along the line of least resistance … *that line is always a harmonic line*."[35] Classical and Omaha music was thus to his ears the same "from the structural point of view … they are all harmonic or diatonic in character."[36] Although their "ethnological character" was different, such differences were simply "of style and manner, not differences in essential structure."[37] By harmonizing Omaha song, Fillmore believed he was merely accelerating its development along a single evolutionary path, an "unbroken chain from the lowest savages to Bach, Beethoven, and Wagner."[38] In his view, these piano arrangements represented the essence of what the Omaha singer actually *meant* to sing, and could achieve with tutoring and the exercise of emotional restraint.[39]

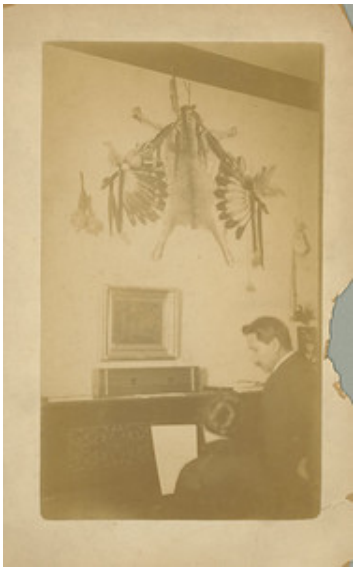

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Figure 3: Alice Fletcher and Francis La Flesche at the piano. Photograph undated.

Fillmore construed this process as rigorously music-theoretical, objective, and collaborative throughout: "I should not regard myself as worthy of the name of scientific investigator at all, if I were to import into the Indian songs even the slightest thing which the Indians themselves had not put there, or if I had omitted to record even the least portion of what the Indians intended to sing[.]"[40] He asked La Flesche to accompany him in presenting his arrangements of songs from the Hethúshka and Wawa^{n} Ceremony, including the song set by Newman shown in Figure 1 and the main theme of his "fantasia" shown in Figure 2, in substitution of excerpts from the actual ceremonies at the July 14, 1893 Concert of Folk Songs and National Music at the International Folk-Lore Congress of the World's Columbian Exposition in Chicago. Transcriptions of these excerpts include "Hae-thu-ska Wa-a*n*" as shown in Figure 4 and "Wa-Wa*n* Wa-a*n*—Song of Approach" in Figure 5.[41] Fillmore saw his reformed versions as the most expedient means of persuading a general audience that "Indian music is the true and natural expression of genuine emotion; much of it profound, much of it high and ennobling; and the better it is known the more this will be seen."[42] He wrote to Fletcher that the timbres of the original songs might scare the audience away, but his piano arrangements would enjoy a "howling success."[43]

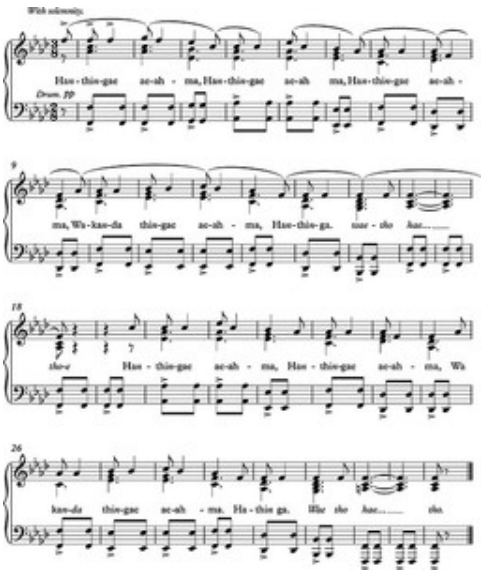

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Figure 4: Fillmore's arrangement, "Hae-thu-ska Wa-a*n*," in Fletcher, *Omaha Music*, no. 21 (95). Note how Fillmore has changed the rhythms from his orchestral setting in Fig. 2.

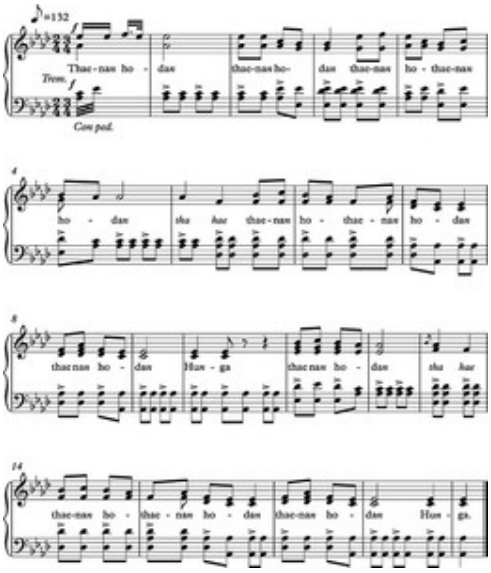

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Figure 5: Fillmore's arrangement "Wa-Wa*n* Wa-a*n*—Song of Approach," in Fletcher, *Omaha Music*, no. 35 (105). Compare with Newman's transcription of "Ritual Song of Approach" (Fig. 1).

Dried Flowers

That presentation at the International Folk-Lore Congress was especially important to Fillmore because of the appearance in 1891 of Gilman's "Zuñi Melodies," a paper analyzing phonographic cylinders of music at Zuni Pueblo collected by Jesse Walter Fewkes during the Hemenway Southwestern Archaeological Expedition.[44] The *curricula vitae* of Gilman and Fillmore were similar: both were music professors who had studied Western theory and aesthetics in Germany and whose engagement with comparative musicology stemmed from contact in 1890 with Harvard-associated anthropologists requiring assistance analyzing their fieldwork materials. But Gilman drew his very different conclusions from Fillmore's by concerning himself with the "precise registry" of the acoustical signal encoded on each cylinder.[45] In his research into Hopi Songs, published in 1908, he disparaged Westernized arrangements and deplored the prospect that indigenous singers would "accept instrumental substitutes from which they delicately and intricately differ."[46] He determined to preserve records of the songs in their original form, collecting them for a musical "*hortus siccus*" whose every specimen would "under the microscope … exchange the aspect of transplanted weeds for that of a native flora."[47] By employing the same technologies of phonograph, keyboard, and notation towards that end, he established himself as Fillmore's rival.

Fillmore swiftly challenged Gilman's "Zuñi Melodies" in two sharply critical reviews.[48] Moreover, he wrote directly to musicological and archaeological authorities—Carl Stumpf, Franz Boas, Frank Hamilton Cushing, and even Jesse Walter Fewkes—to persuade them to support his approach over Fillmore's.[49] Rejecting Fillmore's confidence in drawing the conclusion that all Native American music was diatonic, Gilman countered that the "European ear" might have been conditioned by Western musical culture to round off microtonal intervals to their nearest diatonic equivalent.[50] Part of the problem, he surmised, was that the music went by too quickly for the Western listener to observe it accurately: "[i]n liberal measure the diatonic garb which Pueblo singing wears to the European hearer is woven by his own musical sense. It is a false show due to his inability to divest himself quickly of inveterate prepossessions of the Western ear, or, as we may say, due to the aberration of an instrument unequal to rapid observation."[51] The tendency of Western listeners to construe non-Western music as diatonic constituted for him an "apperceptive illusion" akin to false translinguistic homophones, as when British listeners misheard the French phrases "Ville de Milan" as "Wheel'em along," and "Vive l'Impératrice" as "Beef, brandy, and cheese."[52] The phonograph, keyboard, and transcription could however be deployed to extend the observational process temporally, allowing time to quantify measurable parameters correctly. He hoped in this way to eliminate acoustical bias and gain for comparative musicology the objective distance required to attain "the standing of a branch of science."[53]

Fewkes and Gilman found the phonograph indispensable because it facilitated the recording of linguistic and musical phenomena that could not be transcribed and that Western ears could not recognize from a single hearing. Wax cylinders captured "inflections, accents, and gutturals of Indian languages" that could not be "reduce[d] to writing," as well as musical intervals that seemed to them "at first a lawless cacophony," but upon repeated listening exhibited "an exactness surprising to the European ear in view of their divergence from diatonic norms."[54] Music that previously had "to be studied indirectly" through notation could now be examined through "actual impression[s] of sense," even if the listener had not been present during the recording process.[55] There were two obstacles to accurate registration of musical pitch, but Fewkes and Gilman thought they could overcome both. First, they stabilized the rotational speed of the cylinder by switching the power source from a foot treadle to portable batteries; second, they circumvented the challenges of recording outdoors, and the reticence of their informants to allow direct recording of ceremonies, by inviting those with the "best voice" and "reputation for honesty" to repeat ceremonial songs in their private quarters.[56] Recording timbre, however, proved to be a constant challenge, since they could not avoid the fact that "the phonograph is noticeably deficient in the reproduction of delicate shades of timbre;

> and this shortcoming may easily lead to an underestimate of its possible value as an aid in musical investigation. Purity and variety of tone quality being important sources of pleasure from music, the phonograph may seem at first hearing to reproduce structures of tone with essential elements lacking; or it may be that we argue from this conspicuous imperfection of material to a corresponding distortion of form.[57]

Gilman thought that "music is an art of interval and measure primarily, and of timbre secondarily," which meant that "impurities of tone seriously detract from only the aesthetic, and not the scientific, value of phonographic reproduction."[58] By decomposing timbre and accurately preserving pitch, they believed the phonograph would aid the comparative musicologist by initiating analysis, distinguishing scientific parameters from the residual categories of musical aesthetics, and leaving intact the only material that mattered in systematic investigations.

Gilman found keyboards useful for mechanical calibration and tonometrical assessment of phonographic recordings. Initially, he tested the function of the portable batteries used to power the crank of the phonograph device by recording a constant tone on a just-intonation "Harmonical" designed by Alexander John Ellis.[59] Comparing that recorded tone to the live instrument, he found that the cylinder never deviated by more than "an almost imperceptible fraction of a tone."[60] Once he was certain the instrument was functioning correctly, he sought to measure the cylinders by comparing the pitch of each recorded tone to the nearest pitch on his equal-tempered Mason & Hamlin harmonium, and if it deviated, he estimated by how much.[61] This method convinced him that Hopi song was entirely "adiatonic," created not only without reference to any pre-existing diatonic collection, but without reference to any scale whatsoever.[62] He ventured that Hopi music could be understood as "rote-song," sequences of pitches generated "apparently without guidance by any vanguard of fancied tones at fixed intervals" that indigenous singers learned from their elders and followed generation after generation like "a beaten track of tone."[63] This conclusion suggested that the conventional keyboard could not be used for reproducing indigenous song because it featured a limited and incompatible pitch collection; it could serve only as a sort of acoustical ruler, whose tonal qualities were irrelevant because the focus was exclusively on quantifying pitch.

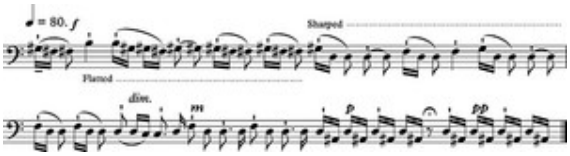

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Figure 6: "Du-me-chim-mee" from Gilman, "Zuñi Melodies," no. 2 (71). Fillmore singled out this transcription as "largely unintelligible" in his notation (Fillmore, "The Zuni Music," 45).

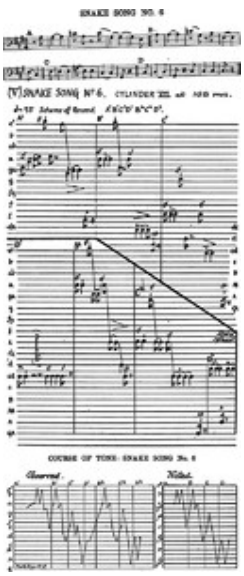

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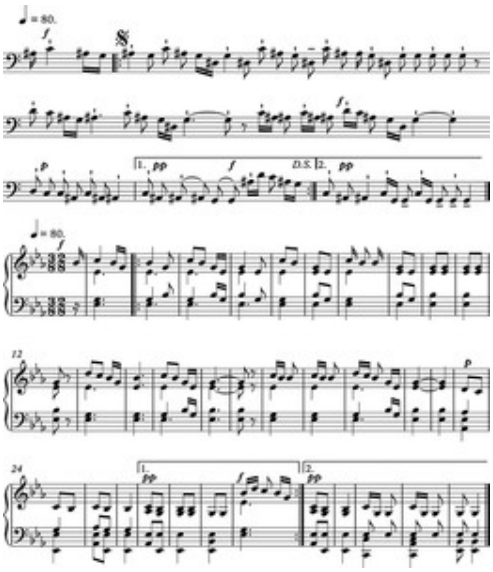
Figure 7: "Snake Song No. 6," transcribed in staff notation, "phonographic notation," and as a chart of the "course of tone." From Gilman, "Hopi Songs," 99–101.

Gilman used transcription as a way to organize and present his autonomous parametric data. He found conventional staff notation inadequate for his purpose because it presumed both a diatonic basis and a limited gamut of pitches, neither of which his data seemed to suggest. In his first study, he added superscripts to indicate deviations from the pitches of the equal-tempered harmonium, as shown in Figure 6; in his final study on Hopi songs, he coupled staff notations with "phonographic notations" and charts of the "course of tone" that jettisoned the five-line staff and replaced it with a modified Cartesian plane, in Figure 7, that placed time on the *x*-axis and pitch height on the *y*-axis. As pure abstractions of pitch and time, never intended for reproduction on a musical instrument, these notations went further than previous methodologies in eliminating timbre from analytical consideration. They also signified "notations of performances and not of pieces of music … no less a distinction than that between facts of observation and theories upon them."[64] Exposing the gulf between his and Fillmore's analytical goals, Gilman construed his notations as a "record of occurrence" not of "purpose," of the "real" as opposed to the "ideal."[65] He also rejected as sentimental any assumption that harmonizing indigenous song could salvage it: "[T]hese wild flowers of fancy, the wanton yield of a naïve delight in the vocal production of interval, will not long survive the spread of European music throughout the Americas." Notating the salient, quantifiable features of musical tone was for him like preserving botanical specimens for research, each commemorating part of a verdant musical landscape that "once lent solemnity to Aztec rites and graced the state of Inca kings."[66] Since the technological commemoration of pitch required the omission of timbre, Gilman did not concern himself with the fact that, in the absence of documentation, the cultural memory of the timbres used in recitation of those melodies would fade like colors from desiccated flowers.

Similarity vs. Difference

Fillmore disparaged Gilman's analyses as portraying a "caricature" of Native American songs.[67] Gilman's first error, Fillmore believed, was in the way that he used phonography, a medium that "at best … represents the song somewhat imperfectly."[68] Not only had Gilman based his study of Zuni songs on recordings powered by a foot treadle instead of a battery, but he had also failed to consider how the presence of the phonograph created "constraint and embarrassment," "hampering conditions" that affected the ability to sing and increased the likelihood of errors in intonation.[69] Treating those "aberrations as intentional" by notating them, as Gilman had done, created an "unwarrantable misrepresentation" of indigenous singers; "phonographic records then need to be supplemented and corrected as far as possible by personal work with the singers of folk-songs in order to eliminate all sources of error."[70] But for Fillmore, Gilman's worst infraction was his manner of transcription, which gave indigenous song an unnecessarily "strange look."[71] According to Fillmore, Gilman's notation of the "Sacred Dance of the Ko-ko," reproduced in Figure 8a, featured sequences of D#, G, and A#, tones that "on the piano keyboard … make the *sound* of the major chord of D#"; by using enharmonic notation to spell a diatonic sequence, Gilman appeared to have "gone deliberately to work with the intention of obscuring the tonality and the harmonic relations of these melodies as much as possible."[72] Fillmore wondered if Gilman "imagined that these songs had no tonality, *i.e.*, were not music at all"—for "music is not music to us, unless its component tones are in relation to a key-note or tonic and to the chord (major or minor) of that tonic."[73] As far as Fillmore was concerned, Gilman's study was "useless," and his cylinders ought to be re-transcribed, and to prove his case, he suggested his own respelling of "Sacred Dance of the Ko-Ko," in Figure 8b, that had been "harmonized and written in correct tonality": E ♭ major.[74] For him, Gilman had erred by treating the analysis of indigenous songs as "merely a problem in acoustics," overlooking the imperative that "such questions as we are at work on have to be solved by *musicians*, not by physicists" and evincing "less musical intelligence than a howling cannibal."[75]



Click to view larger

Figure 8: (a) "Sacred Dance of the Ko-Ko," as transcribed by Gilman (Gilman, "Zuñi Melodies," no. 3, 73). (b) "Sacred Dance of the Ko-Ko" arranged by Fillmore (Fillmore, "The Zuni Music," 44).

Such criticisms point to a further, fundamental distinction between Fillmore's and Gilman's analytical orientations and objectives. Fillmore sought to emphasize the essential *similarity* between indigenous song and Western Classi-

cal music by showing that the pitch collections of both systems were derived from common tonal principles; Gilman sought to amplify their essential *difference* by suggesting that the pitches of indigenous song were determined not by tonality but by "rote." In this way, Fillmore's methods feature characteristics of a cultural current Jon Cruz has termed "ethnosympathy," the construal of indigenous song collection as a humanitarian pursuit, marshalling the spirit of "romantic antimodernism" and "rational science" toward the recognition of indigenous musical practices not as savage noise, but an authentic and intelligible form of expression that could contribute to Western cultural development.[76] In this mindset, collecting Omaha songs and harmonizing them would grant "a new subjectivity" to the Omaha people as sympathetic beings in the eyes of Western audiences, justifying Fillmore's project as a virtuous endeavor.[77] Gilman's approach, by contrast, aligns with the theorists identified by Roland Radano as deploying unconventional key and time signatures, superscripts, and other notational excesses to emphasize the insufficiency of Western musical semiotics and music-theoretical frameworks, thereby "denoting difference" between the musics of "civilized" and "uncivilized" Americans.[78] Even so, to Gilman's thinking, analyzing difference was also virtuous, promoting cultural relativism and pluralism by "compelling us to seek for the standpoint of other minds."[79]

Nevertheless, it was parametric listening assisted by phonograph, keyboard, and notation that conditioned how both theorists made claims about similarity and difference in the first place. Fillmore sought to extinguish the residual obstacle of timbre through musical reform, by promoting the arrangement of indigenous song for Western instruments; Gilman chose simply to ignore timbre in his recordings, allowing for its replacement with silence. For both, this was a necessary preliminary step in service of locating indigenous music on one of the two chronological frameworks that Martin Scherzinger has identified as common ethnomusicological tropes: unilinear developmentalism (or progressivism) in Fillmore's case, and cultural relativism (or multiculturalism) in Gilman's.[80] The two frameworks are "antimonies," but both are "marked by the colonial legacy, and leveraged for colonial governance," and in this way contrasting means to the same ends.[81] Unilinear developmentalism located non-Western cultures at a more primitive stage of development along a universal timeline—the "unbroken chain from the lowest savages to Bach, Beethoven, and Wagner"—and thus served by material, moral, and intellectual guidance from the West. Harmonizing indigenous song as a means for hastening its progress along the "line of least resistance" therefore promised its future survival. By contrast, cultural relativists sought to understand individual cultural groups and their practices on their own terms; yet the practitioners of this framework also frequently resorted to "homogenized relativisms" that restored a non-West/West colonial dialectic.[82] Gilman's suggestion that indigenous adiatonic rote-songs constitute the irreconcilable antithesis of Western diatonic harmony was thus coupled with the implication that the former would, with an irreversible expansion of Western culture, inevitably crumble beneath the latter. Both frameworks, Scherzinger also notes, enjoyed a surprisingly stable afterlife in the post-colonial period of the late-twentieth and twenty-first century. Might one say the same about parametric listening and the epistemological frameworks of parametric autonomy?

Postscript: Divide and Conquer

Ethnomusicologists, music theorists, and composers did not take long to recognize the shortcomings of Fillmore's and Gilman's studies. Fillmore's harmonizations elicited particularly strong reactions in some contemporary reviewers, and his own colleagues soon took a step back.[83] Franz Boas, who initially expressed sympathy for Fillmore's harmonic claims and sought his assistance in transcribing the songs contained in his book *The Social Organization and the Secret Societies of the Kwakiutl Indians*, found that he had to redo a great deal of Fillmore's work

himself.[84] Frances Densmore, who approved Fillmore's presentation at the 1893 World Columbian Exposition, later rejected his theories as "sentimental and superficial" and objected to associations with his work.[85] Even Fletcher and La Flesche eventually opted not to harmonize the new transcriptions they collected for the 1911 publication of their multivolume opus, *The Omaha Tribe*.[86] The work of Carl Stumpf, Géza Révész, Otto Abraham and Erich von Hornbostel, and Franz Brentano also began to confront scholars with the recognition that the perception of "pitch" might be shaped by the overtones and their relative strengths in addition to the fundamental frequency.[87] Recognition of this possibility, coupled with the shifts in aesthetic values that accompanied the rise of cultural relativism, and an upsurge in compositional interest in the structural potentialities of tone color, inspired many scholars to search for ways to adapt technologies of transcription to encode more information about timbre.[88] Acknowledging the "paramount importance" of our ability to make "fine discriminations between musical timbres," Abraham and Hornbostel proposed adapting notation by emending note-heads to indicate exceptional tonal qualities like falsettos and natural harmonics, and their proposals were applied by ethnomusicologists including George Herzog.[89] Carl E. Seashore investigated whether the oscillogram could be used to dissect the timbres in Densmore's recordings of Native American songs, and while he concluded that direct measurement of the original sound source was always preferable, considered that for "some less exacting studies, harmonic analysis of sound waves from extra high-grade recordings will be profitable."[90] The improved fidelity of recording technologies and the development of computational technologies and the spectrogram instigated a slow but inexorable development in theoretical studies of indigenous musics that focused on timbre. Technologies could increasingly allow for the quantification of timbre, upgrading its status from residual category to autonomous parameter and thus allowing for its incorporation into parametric frameworks for analyzing musical sound.

Nevertheless, many components of the epistemological frameworks Fillmore and Gilman developed for separating pitch from timbre proved tenacious. The predilection for collecting and harmonizing indigenous songs persisted among composer-theorists like Frederick Russell Burton, who harmonized Ojibwe songs in order to make the "attractive melody available for paleface singers."[91] In Europe, Béla Bartók harmonized the peasant folk songs he collected on wax cylinders into arrangements Joshua Walden has called "rural miniatures," a new popular genre that hybridized ethnographic findings with modernist aesthetics in the search of expressing authenticity.[92] Ethnomusicologists also continued to apply transcriptional technologies toward ends similar to those of Fillmore and Gilman, even as they sought to proclaim their distance. Densmore, for instance, described in her 1910 study *Chippewa Music* how she repeatedly duplicated recordings in order to degrade the "harshness" and isolate "a kernel of tone on true pitch."[93] Several decades later, in partnering with Seashore on the development of "phonophotographic" techniques for analyzing recordings of "primitive music," she contributed to efforts to refine Gilman's techniques for plotting "tone movement in exact detail" by representing fluctuations in pitch and intensity against a time scale.[94]

Also persistent is the analytical tendency to construe pitch and timbre as fully autonomous parameters of musical sound. Studies that reveal this tendency often proceed with the assumption that the most efficient way to investigate the perceptual, music-theoretical, and formal properties of timbre is to start by flipping the analytical procedures first articulated by Fletcher and Ellis on their heads: to "extinguish" or "ignore" pitch in order to focus on timbre. David Temperley renders these terms explicit in his reflections on the potential structural functions of timbre in African and rock musics, explaining that, "in exploring timbre from a perceptual viewpoint, it is useful to focus on non-pitched sounds: this allows us to devote our full attention to timbre."[95] Fred Lerdahl, in his examination into the possibilities of "timbral hierarchies" and "prolongational structures," acknowledges that "practitioners of computer music are aware of how easy it is to blur the boundary of two"—suggesting that the perceptual boundaries between both parameters are highly permeable—but in his own research produces acoustical samples that

hold pitch and amplitude constant, with changes to the harmonic and inharmonic spectra constituting the only variable.[96] These authors construe a new timbre-centricity in response to pitch-centricity, one that preserves many of the analytical constructs of the latter (that is, hierarchies, prolongation) and slots timbre into its place.

One of the earliest contributors to this perspective may be Hornbostel and Abraham's suggestion that, in transcribing percussion music, differences in timbre can be notated exactly like differences in pitch, simply by changing the reference of the *y*-axis to tone colors ranging from "dark" to "bright," instead of from low to high frequencies.[97] The two-dimensionality of this notational framework precludes the possibility that both pitch *and* timbre could be transcribed at the same time, even though percussion instruments are very often "tuned" to each other with attention to both parameters.[98] David Temperley adopts a version of this transcriptional approach in his own analyses by adapting his preferred "piano-roll" method of notation, which modifies conventional notation slightly by representing pitches as line segments whose length corresponds to the duration of the event, by switching out the pitch for timbre on the *y*-axis. His notations thus preclude representing how pitch *and* timbre might both be organized contrapuntally within a single integrative schema, directing him then to focus his attention alternately on music that is supposedly "non-pitched," like African music, or "with little timbre differentiation," like solo piano and string quartet music.[99] This approach runs the risk of suggesting a new "homogenized relativism" of the sort Scherzinger describes, one that construes the existence of musics that are either "pitch-centered" or "timbre-centered," and maps Western Classical music onto the former and non-Western/popular music onto the latter.

Lerdahl and Temperley both acknowledge that it might theoretically be possible for pitch and timbre to operate in conjunction.[100] Yet for both of these theorists, such investigations would necessarily follow a clear demarcation of the boundaries between the two parameters, and the development of a logic that closes off consideration to one ("ignores," "extinguishes,") while it turns its attention to the other. This is also how the modern music-theoretical framework of parametric analysis construes the relationship between pitch and timbre. Parametric analysis, as outlined by Leonard B. Meyer, James Tenney, and Eugene Narmour among others, posits musical perception as the result of a complex interaction between independent musical parameters, such as pitch, timbre, loudness, duration, and so forth—the final menu depending on the preferences of the theorist.[101] These parameters can operate "congruently" or "non-congruently," which means that one can foster closure while others remain "open and mobile."[102]

Narmour, who proposes reducing musical sound into as many as twenty-six discrete parameters, acknowledges that, acoustically speaking, "parameters, of course, do not exist by themselves—pitch always has duration." The musical analyst ought nevertheless, he continues, to "conceptualize them separately (each with its own syntactic parametric scale) in order to hypothesize rules governing their interaction."[103] This is because it helps to facilitate an analytical approach to musical sound he calls "divide-and-conquer techniques of multiple dissociations."[104] Musical "divide-and-conquer" methods operate equivalently by "dividing" the complex tone into autonomous parameters that can be "conquered" individually, then connecting the results of that conquest so as to model the complexities of musical systems. This process necessarily separates pitch and timbre into autonomous parameters, so that each can be conquered in its turn. Narmour justifies his approach by citing "very strong psychological evidence" that the musical parameters he presents are processed by different neural patterns, sometimes in separate hemispheres of the brain.[105] This move naturalizes parametric listening as a universal function of musical cognition; it is no longer an analytical strategy for boosting music-theoretical and scientific rigor, but an objective fact about how all listeners perceive all musical sounds.

Naomi Cumming has argued that this approach "excludes me as a subject listening to music, and replaces my 'I' with a cognising brain," meaning it is not designed for compatibility with the work of any "theorist who clings to the value of conscious musical experience within a learned culture as the context in which analytical decisions are made"—as, say, an ethnomusicologist might.[106] Another cause for concern is that Narmour over-articulates the boundaries between parameters like pitch and timbre despite an ever-growing body of literature in the fields of psychoacoustics, performance practice, and ethnomusicology that presents evidence of the two frequently operating as co-productive parameters, each determining how the other is perceived.[107]

There are perils in taking the analytical constructs that Western music theory developed as a heuristic for understanding Western music as the basis for universalist models of musical perception and ontology. Attempts to naturalize parametric analysis and listening as cognitive universals overlook the extent to which it is also, in part, a culturally specific framework. The principle of parametric autonomy is a Western music-theoretical and scientific construct designed to optimize the extraction of individual, quantifiable strands from musical tones. As a culturally constructed form of listening, parametric analysis cannot be exempt from the historical fluctuations of socio-political values. In nineteenth-century America, parametric listening involved "ignoring" timbre and contributing to the reformation and silencing of indigenous musical culture. We might ask ourselves: what do contemporary practices of parametric analysis and listening "ignore," and at what cost?

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Notes:

(1.) Alice C. Fletcher, "A Study of Omaha Indian Music," aided by Francis La Flesche, *Archaeological and Ethnological Papers of the Peabody Museum* 1, no. 5 (1893), 7. See also Alice C. Fletcher, "Indian Songs: Personal Studies of Indian Life," *Century Magazine* 47 no. 3 (Jan 1894), 422–423.

(2.) For more on Fletcher's background, her relationship to Francis La Flesche, and her cultural background see Nancy Oesterich Lurie, "Women in Early American Anthropology," in *Pioneers of American Anthropology: The Uses of Biography*, ed. June Helm (Seattle: University of Washington Press, 1966), 29–82, and Joan Mark, *A Stranger in her Native Land: Alice Fletcher and the American Indians* (Lincoln: University of Nebraska Press, 1988).

(3.) Fletcher, "A Study," 8. The disastrous aftermath of the land allotments Fletcher was associated with are analyzed in Judith A. Boughter, *Betraying the Omaha Nation, 1790–1916* (Norman: University of Oklahoma Press, 1998), and Nicole Tonkovich, *The Allotment Plot: Alice C. Fletcher, E. Jane Gay, and Nez Perce Survivance* (Lincoln: University of Nebraska Press, 2012).

(4.) Ibid., 7–8.

(5.) Ibid., 152. Fletcher's relationship to phonography is further discussed and contextualized in Erika Brady, *A Spiral Way: How the Phonograph Changed Ethnography* (Jackson: University Press of Mississippi, 1999), 89–126; and Jonathan Sterne, *The Audible Past: Cultural Origins of Sound Production* (Durham, NC: Duke University Press, 2003), 311–333.

(6.) Alexander J. Ellis, "On the Musical Scales of Various Nations," *Journal of the Society of Arts* 33, no. 1688 (1885), 485–532. For more on Ellis see Jonathan P. J. Stock, "Alexander J. Ellis and His Place in the History of Ethnomusicology," *Ethnomusicology* 51, no. 2 (2007), 306–325; and Benjamin Steege, *Helmholtz and the Modern Listener* (Cambridge: Cambridge University Press, 2012), 193–205.

(7.) Hermann von Helmholtz, *On the Sensations of Tone as a Physiological Basis for the Theory of Music*, trans. and comment. by Alexander J. Ellis (London: Longmans, Green, and Company, 1875), 16–37.

(8.) Alexander J. Ellis, *Trial of Tuning in Equal Temperament*, October 12, 1883. Manuscript. From British Library, Hipkins Papers, MS 41367 fol. 41. "AJE had unfortunately not thought of bringing his resonance jars which would have extinguished the upper partials of the forks + have rendered the counting much easier." See also

Alexander J. Ellis, "Notes of Observations on Musical Beats," *Proceedings of the Royal Society of London* 30 (1880), 521.

(9.) Ellis, "On the Musical Scales," 509. Ellis's discomfort with "boorish" vocal timbres and "nasal 'twangs'" is discussed in Grant Olwage, "The Class and Colour of Tone: An Essay on the Social History of Vocal Timbre," *Ethnomusicology Forum* 13, no. 2 (November 2004), 214–215.

(10.) Fletcher, "A Study," 9.

(11.) See, for instance, Hugo Riemann, "Ideas for a Study 'On the Imagination of Tone,' [Ideen zu einer 'Lehre von den Tonvorstellungen']'" trans. Robert W. Wason and Elizabeth West Marvin, *Journal of Music Theory* 36:1 (Spring 1992), 91–92. "The high aesthetic value of string quartet music rests, in undisputed measure, on the renunciation of the course dynamic effects and the contrasting timbres of the orchestra in favor of the refinement of design and the enrichment of melodic and harmonic details. Conversely, the threat to our good taste that lies in military music and also in music of the modern opera orchestra rests on the diversion of interest from the inward and intimate to the superficial and voluptuous."

(12.) Theodore Baker, *Über die Musik der nordamerikanischen Wilden* (Leipzig: Breitkopf & Härtel, 1882), 28. "Es ist wohl kaum zu erwarten, dass diese Lieder, ihrer natürlichen, wilden Umgebung entrissen, hier denselben Eindruck machen sollten wie dort. Wie anders aber erscheint jene edle Alpenblume, das Edelweiss, in ihrer freien, luftigen Heimath, als wenn sie, unten im Thale, unter bunten Gartengewächsen ihr kümmerliches Dasein fristet!" Translation reproduced from Theodore Baker, *On the Music of the North American Indians*, trans. Ann Buckley (Buren: F. Knuf, 1976), 79.

(13.) Fletcher, "A Study," 56.

(14.) Alice C. Fletcher, *Indian Story and Song from North America* (Boston: Small, Maynard & Company, 1900), ix. Fletcher's collaboration with Newman resulted in her first musicological text: Alice Fletcher, "The 'Wawan,' or Pipe Dance of the Omahas," in *Reports of the Trustees of the Peabody Museum of American Archaeology and Ethnology* 3 (1887), 308–333. Fillmore's texts include: *Pianoforte Music* (Chicago: Townsend MacCoun, 1883); *Lessons in Musical History* (Philadelphia: Theodore Presser, 1888); *New Lessons in Harmony* (Philadelphia: Theodore Presser, 1887). The last of these works includes a translation of Hugo Riemann's *Die Natur der Harmonik* (Leipzig: Breitkopf & Härtel, 1882). Fillmore's biography and works are summarized in Jacob Hardesty, "'Incommensurable Standards': Academics' Responses to Classical Arrangements of Native American Songs," *American Educational History Journal* 39, no. 2 (2012), 503–514; James C. McNutt, "John Comfort Fillmore: A Student of Indian Music Reconsidered," *American Music* 2, no. 1 (1984), 61–70; and Hewitt Pantaleoni, "A Reconsideration of Fillmore Reconsidered," *American Music* 3, no. 2 (1985), 217–228.

(15.) Letter from Alice C. Fletcher to Frederic W. Putnam, 1 April 1890. From Harvard University, Peabody Museum Archives, Frederic Ward Putnam Director Records, 2019.1.17.

(16.) Fletcher, "Wawan," 308.

(17.) Fletcher, "A Study," 57; Alice Fletcher, "Hae-thu-ska Society of the Omaha Tribe," *The Journal of American Folk-lore* 5, no. 17 (1892), 144. "It is an interesting fact that to-day, when the Omaha Indians are within the fold of United States citizens, and are exercising all the rights and privileges that belong to that class … that, among the most progressive and industrious of the men, there should have been a revival of the Hae-thu-ska Society, because

of a wish to preserve the old historic songs and record of their ancestors. The Leader no longer is chosen because of his skill in aggressive warfare; nor does he paint himself in the old symbolic manner; nor do the members appear in the ancient undress. On the contrary in citizens' or white man's dress, these Omaha farmers meet during the winter evenings in an old earth lodge … with almost nothing to remind them of the spectator of the days when the people dwelt in tents pitched according to the laws of Hoo-thu-ga, or tribal circle."

(18.) Fletcher's efforts to promote Native American songs as an "available" resource for American composers are assessed in Michael V. Pisani, *Imagining Native America in Music* (New Haven, CT: Yale University Press, 2008), 170–210. See also Hazel Gertrude Kinscella, "Preserving the Music of a Vanishing Race," *Musical America* 24, no. 8 (1916): 3–4, 8.

(19.) Fillmore, *Lessons*, 152, 166.

(20.) Fillmore, "Report on the Structural Peculiarities of the Music," in Alice C. Fletcher, "A Study of Omaha Indian Music," with Francis La Flesche, *Archaeological and Ethnological Papers of the Peabody Museum* 1, no. 5 (1893), 74; John Comfort Fillmore, "The Harmonic Structure of Indian Music," *American Anthropologist*, n.s. 1 (1899), 298.

(21.) Letter from John Fillmore to Alice Fletcher, 9 July 1891, fol. 1–2. From Smithsonian Institution, National Anthropological Archives, Alice Cunningham Fletcher and Francis La Flesche Papers, Series 1 Box 1, Incoming Correspondence.

(22.) Fillmore, "Report," 69–70.

(23.) Ibid., 71; Fillmore, "The Harmonic Structure," 298.

(24.) Fillmore, "Report," 71–72.

(25.) Letter from John Fillmore to Alice Fletcher, February 26, 1894, fol. 3. Emphasized section underlined in original. From Smithsonian Institution, National Anthropological Archives, Alice Cunningham Fletcher and Francis La Flesche Papers, Series 1 Box 1, Incoming Correspondence.

(26.) Fillmore, "Report," 71.

(27.) John C. Fillmore, "A Woman's Song of the Kwakiutl Indians," *The Journal of American Folk-lore* 6, no.23 (1893), 285. See also Alexander Rehding, "Wax Cylinder Revolutions," *The Musical Quarterly* 88 (2005), 138–146, which examines the phenomenon of "domesticating" non-Western music by arranging it for performances at home.

(28.) See John W. Troutman, *Indian Blues: American Indians and the Politics of Music 1879–1934* (Norman: University of Oklahoma Press, 2009). La Flesche recalled how he had once been discouraged from singing Omaha songs after presenting them before a government agent, school superintendent, and other guests to his school: "There was some hesitancy, but suddenly a loud clear voice close to me broke into a Victory song; before a bar was sung another voice took up the song from the beginning, as is the custom among the Indians, then the whole school fell in, and we made the room ring. We understood the song, and knew the emotion of which it was the expression. We felt, as we sang, the patriotic thrill of a victorious people who had vanquished their enemies; but the men shook their heads, and one of them said, 'That's savage, that's savage! They must be taught music.'" (Francis

La Flesche, *The Middle Five* (Boston: Small, Maynard & Company, 1901), 146–147; also cited in Troutman, *Indian Blues*, 147.)

(29.) John C. Fillmore, "A Study of Indian Music," *The Century Illustrated Monthly Magazine* 47, no.4 (1893), 622; J. C. Fillmore, "Preliminary Report on the Kwakiutl Songs," fol. 4. Typescript. From Harvard University, Peabody Museum Archives, Frederic Ward Putnam Papers, 38–22 VII 8.7 (n.d.): fol. 4. See also Alice C. Fletcher, "Music as Found in Certain North American Indian Tribes," *Music* 4 (1893), 461.

(30.) Alice C. Fletcher, "Indian Songs and Music," *The Journal of American Folk-lore* 11, no. 41 (1898), 92. See also Rehding, "Wax Cylinder," 140. "Fletcher's recollection makes a very important general point: the concept of music cannot be assumed to be limited to discrete pitches and rhythms, which was invariably what the earliest researchers concentrated on, in analogy to the analytical study of Western music."

(31.) John Comfort Fillmore, "What do Indians Mean to Do When They Sing and How Far Do They Succeed?" *Journal of American Folk-lore* 8, no. 29 (1895), 139.

(32.) Fillmore, "Report," 61. Italics in original.

(33.) Fletcher, *Indian Story*, 1900. Fillmore also explains: "Miss Fletcher once remarked to me that she had observed a change in the overtones when the Indians changed vowels on a single tone; she thought that the Indians themselves perceived a marked change in tone-quality due to the change in the preponderance of certain overtones when the vowels were changed, and that they made use of different unmeaning syllables employing different vowels for the sake of the variety of harmonic effect. The avowed object of the change was euphony; but the very essence of the euphonic changes consisted in alterations of tone-quality, which every acoustician knows to be due to a shifting of the relative preponderance of the overtones." (John C. Fillmore, "Bibliographical Notes. *Primitive Music: An Inquiry into the Origin and Development of Music* by Richard Wallascheck [sic]," *The Journal of American Folk-lore* 7, no. 25 (1894), 165–169; see also Ter Ellingson, "Transcription," in Helen Myers, *Ethnomusicology: An Introduction* (New York: W.W. Norton and Company, 1992), 122.)

(34.) Fletcher, *Indian Story*, 61.

(35.) Fillmore, "The Harmonic Structure," 311, n. 1.

(36.) Ibid., 304.

(37.) Ibid., 308.

(38.) Fillmore, "Two Tigua Folk-Songs," 273–274. See also Fillmore, "Music as Found," 467.

(39.) Pisani, *Imagining Native America*, 214–222, pursues detailed analysis of Fillmore's arrangements.

(40.) Fillmore, "Preliminary Report," 1. Bruno Nettl and Pisani suggest Fillmore's informants may simply have consented to his arrangements to "please him," without sharing his scientific values: see Bruno Nettl, *Music in Primitive Culture* (Cambridge, MA: Harvard University Press, 1956), 33; and Pisani, *Imagining Native America*, 215.

(41.) Letter from John Fillmore to Alice Fletcher, 20 May 1893. From Smithsonian Institution, National Anthropological Archives, Alice Cunningham Fletcher and Francis La Flesche Papers, Series 1 Box 1, Incoming Correspon-

dence. The full program is listed in Helen Wheeler Bassett and Frederick Starr, eds., *The International Folk-Lore Congress of the World's Columbian Exposition*, vol. 1 (Chicago: Charles H. Sergel, 1898), 432.

(42.) Fillmore, "Report," 71.

(43.) Letter from John Fillmore to Alice Fletcher, May 11, 1893, fol. 2. From Smithsonian Institution, National Anthropological Archives, Alice Cunningham Fletcher and Francis La Flesche Papers, Series 1 Box 1, Incoming Correspondence. See also Melissa Rinehart, "To Hell with the Wigs! Native American Representation and Resistance at the World's Columbian Exposition," *American Indian Quarterly* 36, no. 4 (2012), 403–442.

(44.) Benjamin Ives Gilman, "Zuñi Melodies" *Journal of American Ethnology and Archaeology* 1 (1891), 63–92.

(45.) Benjamin Ives Gilman, "The Science of Exotic Music," *Science*, n.s. 30, no. 772 (1909), 532.

(46.) Benjamin Ives Gilman, "Hopi Songs," *Journal of American Ethnology and Archaeology* 5 (1908), 21.

(47.) Ibid. See also Béla Bartók, "Some Problems of Folk Music Research in East Europe," in *Essays*, ed. Benjamin Suchoff (Lincoln: University of Nebraska Press, 1976), 175, who imagines a "micro-acoustic" analysis facilitated by phonography that involves replaying cylinders at half-speed, and transcribing the "slight details … entirely unnoticeable when played in the ordinary way … different kinds of trills, vibrations, clucking sounds, glissandos, which are perhaps important characteristics of certain districts," worth examining "with the greatest care."

(48.) John Comfort Fillmore, "The Zuni Music as Translated by Mr Benjamin Ives Gilman," *Music* 5 (1893), 39–46; John Comfort Fillmore, "Professor Stumpf on Mr. Gilman's Transcription of the Zuni Songs," *Music* 5 (1894), 649–652. Fillmore's second review builds on the critical observations of Carl Stumpf, "Phonographirte Indianermelodien," *Vierteljahrsschrift für Musikwissenschaft* 8 (1892), 127–144.

(49.) Letter from John Fillmore to Alice Fletcher, October 18, 1893. From Smithsonian Institution, National Anthropological Archives, Alice Cunningham Fletcher and Francis La Flesche Papers, Series 1 Box 1, Incoming Correspondence. Fillmore sought to bolster his appeal to these anthropologists by including a positive review of his work by Calvin B. Cady, "Reviews. Books. A Study of Omaha Indian Music," *Music Review* 3, no. 1 (1893), 53–57.

(50.) Gilman, "Hopi," 5.

(51.) Ibid., 7.

(52.) Ibid., 8–11.

(53.) Gilman, "The Science," 533.

(54.) J. Walter Fewkes, "A Contribution to Passamaquoddy Folk-Lore," *The Journal of American Folk-lore* 3, no.11 (1890), 257; Gilman, "Hopi Songs," 5. See also Brian Hochman, *Savage Preservation: The Ethnographic Origins of Modern Media Technology* (Minneapolis: University of Minnesota Press, 2014), 73–114; Rehding, "Wax Cylinder Revolutions," and Friedrich Kittler, *Gramophone, Film, Typewriter*, trans. and introd. Geoffrey Winthrop-Young and Michael Wutz (Stanford, CA: Stanford University Press, 1999), 21–114. Kittler notes that the gramophone is the storage technology of the real, capable of capturing acoustical phenomena prior to the imposition of semiotic or linguistic order—freeing patients to "babble" (ibid., 16).

(55.) Gilman, “Hopi,” vii. See also Jonathan Sterne on phonography and the “ethos of preservation” in *The Audible Past*, 311–333.

(56.) Gilman, “Zuñi Melodies,” 67–70, analyzes how the foot treadle Fewkes used in his recordings of Passamaquoddy and Zuni songs produced erratic “rapid pulsation[s] of intensity,” “a slight wavering or tremulousness of intonation,” “quickening in the time,” and pitch deviations of much as a quarter tone. Fewkes describes his recording process in J. Walter Fewkes, “A Few Summer Ceremonials at Zuñi Pueblo,” *A Journal of American Ethnology and Archaeology* 1 (1891), 57–58; J. Walter Fewkes, “The Snake Ceremonials at Walpi,” *A Journal of American Ethnology and Archaeology* 4 (1894), 99.

(57.) Gilman, “Hopi,” 28.

(58.) Ibid., 28; Benjamin Ives Gilman, “On Some Aspects of the Chinese Musical System,” *Philosophical Review* 1, no. 1 (1892), 54–78; 1, no. 2 (1892), 176.

(59.) The “Harmonical” was adapted by Ellis especially for acoustical experimentations and demonstrations: see Helmholtz, *On the Sensations of Tone*, 466–469.

(60.) Gilman, “Chinese,” 176.

(61.) Gilman, “Chinese,” 175–178. Gilman confirmed the results of this haphazard method by performing another test, in which he recorded a sequence of tones on a “Harmonical,” estimated their size by comparison of the recorded sequence to his harmonium, then measured how far off his estimations were by comparing the Harmonical and harmonium directly; he was generally correct within fifteen cents, but sometimes off by as much as thirty-one.

(62.) Gilman, “Hopi,” 5.

(63.) Ibid., 3–5.

(64.) Ibid., 26.

(65.) Ibid., 8. “The curious dress of the following phonographic notations is a development from the attempt at an impartial record of Zuñi melodies, and still more plainly signifies that the writing of music has entered upon a new phase. The extent of the departure of both from the customary staff notation may easily be underestimated. The step taken is no other than that separating the indicative from the imperative mood, the real from the ideal. Written music as otherwise known is not a record of occurrence but of purpose. It expresses a scheme of pitch, time, and stress at which, in the case of music observed, we assume a performer to have aimed, and toward which we direct future performers.”

(66.) Ibid., 21.

(67.) Fillmore, “What do Indians Mean,” 139.

(68.) Ibid., 138.

(69.) Fillmore, “Preliminary Report,” 2–3. Fillmore, “What do Indians Mean,” 141. “Why must we assume that, although the very best of our own singers fail to realize their own intentions, the untaught savage, with infinitely less to guide his ear and voice than we have, always invariably realizes his?”

(70.) Fillmore, "What do Indians Mean," 142; Fillmore, "Preliminary Report," 3–4. Fillmore began to work from wax cylinder recordings as early as 1893 and eventually amassed a small collection that ended up in Fletcher's possession: see letter from L. H. Fillmore to Alice C. Fletcher, September 17, 1897. From Smithsonian Institution, National Anthropological Archives, Alice Cunningham Fletcher and Francis La Flesche Papers, Series 1 Box 1, Incoming Correspondence. Fletcher and La Flesche eventually amassed their own large collection of recordings: see Dorothy Sara Lee and Maria La Vigna, eds., *Omaha Indian Music: Historical Recordings from the Fletcher/La Flesche Collection*, American Folklife Center in Cooperation with the Omaha Tribal Council, Library of Congress, AFC L71, 1985, LP. Fillmore nevertheless maintained that "personal intercourse with the singer, the singing with him and after him under his criticism, forms a most valuable if not indispensable supplement to a phonographic record," and eschewed harmonizing unless he could find a collaborator (Fillmore, "Professor Stumpf," 652).

(71.) Fillmore, "The Zuni Music," 41.

(72.) Ibid., 43–45. Italics in original.

(73.) Ibid., 40–41.

(74.) Ibid., 44.

(75.) Ibid., 41. Letter from John Fillmore to Alice Fletcher, February 26, 1894, fol. 1–3. Emphasized passage underlined in original. From Smithsonian Institution, National Anthropological Archives, Alice Cunningham Fletcher and Francis La Flesche Papers, Series 1 Box 1, Incoming Correspondence.

(76.) Jon Cruz, *Culture on the Margins: The Black Spiritual and the Rise of American Cultural Interpretation* (Princeton: Princeton University Press, 1999), 3–18.

(77.) Ibid., 4.

(78.) Ronald Radano, "Denoting Difference: The Writing of the Slave Spirituals," *Critical Inquiry* 22, no. 3 (1996), 506–544.

(79.) Gilman, "The Science," 535. "Besides its frequent high refinement and artificiality, non-European music has an artistic rank of which it is hard for us to convince ourselves. Rank to its makers, be it added at once; and herein lies the widest lesson of the whole inquiry. This may be described in a phrase as the discovery of how great a part is played by the mind in apprehending a work of art; and how little of the veritable creation can often be grasped by an alien… . It is our own ears that are oftenest at fault when we hear in exotic music only a strident monotony or a dismal uproar to be avoided and forgotten. To most non-Europeans their music is as passionate and sacred as ours to us and among many it is an equally elaborate and all-pervading art." See also Alexander Ellis's conclusion in "On the Scales of Various Nations": "The musical scale is not one, not 'natural,' not even founded necessarily on the laws of the constitution of musical sound so beautifully worked out by Helmholtz, but very diverse, very artificial, and very capricious." (Ellis, "On the Scales," 526.)

(80.) Martin Scherzinger, "Temporalities," in *Oxford Handbook of Critical Concepts in Music Theory*, ed. Alexander Rehding and Steven Rings, http://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780190454746.001.0001/oxfordhb-9780190454746-e-13

(81.) Ibid.

(82.) Ibid.

(83.) Charles K. Wead, "Recent Outlooks Upon Music," *Science*, n.s. 11, no. 267 (1900): 213. "[N]o one thing so hinders the study of non-European music as the wide prevalence of views similar to … those of which Mr. Fillmore is so able a defender." Quoted in McNutt, "John Comfort Fillmore," 68.

(84.) In his 1894 review of "A Study of Omaha Music," Boas noted that he was "perfectly satisfied that Mr. Fillmore's interpretation" that "Indians have a deficient intonation and do not sing the intervals they *want*" was "correct," and that Fillmore had demonstrated his theories to him directly (Franz Boas, "Reviewed Work. A Study of Omaha Indian Music by Francis La Flesche, John Comfort Fillmore, and Alice C. Fletcher," *The Journal of American Folk-lore* 7, no. 25 (1894): 169–171). That same year, Fillmore wrote for Boas a "Preliminary Report on the Kwakiutl Songs"; he also provided him with transcriptions for his later publication, *The Social Organization and the Secret Societies of the Kwakiutl Indians* (Washington, DC: Government Printing Office, 1897). By 1927, Boas thought differently. See Franz Boas, *Primitive Art* (Oslo: H. Aschehoug, 1927), 342: "a safe method has not yet been found that would enable us to tell definitely what people *want* to sing among whom there is no theory of music, as it exists among ourselves or the civilized people of Asia, and who have no exactly constructed instruments." Boas's rewriting of the transcriptions is quoted in Pantaleoni, "A Reconsideration," 226. See also Steven Feld, "A Sweet Lullaby for World Music," *Public Culture* 12, no. 1 (2000), 165–166, who summarizes contemporary reactions to Fillmore's work and relates his arrangements to modern samplings and remixes of ethnographic recordings like the 1992 hit album *Deep Forest*.

(85.) Letter of Frances Densmore to Charles Hofmann, July 16, 1945, quoted in in Michelle Wick Patterson, "She Always Said, 'I Heard an Indian Drum,'" in *Travels with Frances Densmore*, ed. Joan M. Jensen and Michelle Wick Patterson (Lincoln: University of Nebraska Press), 58 n. 6. See also Ellingson, "Transcription," 123.

(86.) Alice C. Fletcher and Francis La Flesche, *The Omaha Tribe* (Lincoln: University of Nebraska Press, 1992). Fletcher and La Flesche nevertheless did include several harmonizations from Fillmore's initial collection, so they were far from offering a complete disavowal.

(87.) Albrecht Schneider, "Psychological Theory and Comparative Musicology," in *Comparative Musicology and Anthropology of Music*, ed. Bruno Nettl and Philip V. Bohlman (Chicago: University of Chicago Press, 1991), 293–317. Schneider suggests that the technologies embraced by early comparative musicologists for "singl[ing] out one component designated as 'pitch' has heretofore often produced erroneous results or given way to misinterpretation" (305). On Stumpf and his circle see also Sebastian Klotz's chapter in this volume.

(88.) See, for instance, Arnold Schoenberg, *Theory of Harmony*, trans. Roy E. Carter (Berkeley and Los Angeles: University of California Press, 2010), 421–422. Schoenberg's theories are discussed more in the contributions of Joseph Auner, Isabella van Elferen, Gavin Williams, Jonathan de Souza, and Alexander Rehding to this volume.

(89.) Otto Abraham and Erich M. von Hornbostel, "Vorschläge für die Transkription exotischer Melodien," *Sammelbände der Internationalen Musikgesellschaft* 11, no.1 (1909): 7. "Obwohl unsere Empfindung für Klangfarben sehr fein differenziert ist und gerade dieses Moment in ästhetischer Hinsicht von überagender Bedeutung ist …" Ellingson sees Hornbostel and Abraham's paradigm as an attempt to resolve the "apparent paradox that Fillmore's transcriptions were musically clear and comprehensible but distorted musical truth, while Gilman's were precise and objective, but obscured musicality by their complexity" (Ellingson, "Transcription," 125). See also George

Herzog, "The Yuman Musical Style," *The Journal of American Folk-lore* 41 (1928), 183–231; George Herzog, "A Comparison of Pueblo and Pima Musical Styles," *The Journal of American Folk-lore* 49 (1936), 283–417.

(90.) Carl E. and Harold Seashore, "The Place of Phonophotography in the Study of Primitive Music," *Science*, n.s. 79, no. 2056 (1934), 486.

(91.) Frederick Russell Burton, *American Primitive Music* (New York; Moffat, Yard, 1909), 151. Also cited in Victoria Lindsay Levine, ed. *Writing American Indian Music: Historic Transcriptions, Notations, and Arrangements* (Middleton, WI: A-R Editions, 2002), 62.

(92.) Joshua S. Walden, *Sounding Authentic: The Rural Miniature and Musical Modernism* (New York: Oxford University Press, 2014), discussing the rural miniatures of Bartók and early twentieth-century Jewish and Spanish composers. Bartók, "Some Problems," 174, acknowledges that ethnographic notation does not always capture timbre; Walden describes how violinists like Joseph Szigeti and Jascha Heifetz would interpolate "rough," folksy timbres *back* into the arrangements in order to make them sound more "authentic."

(93.) Frances Densmore, *Chippewa Music* (Washington, DC: Government Printing Office, 1910), 4. "The phonograph record of an extremely harsh song was selected and duplicated on an electric recording machine, producing a record much softer in that much of the harshness was eliminated, and showing a melody approaching accuracy of pitch. Another discordant song was duplicated on a second phonograph, another record made from this, and so on to the seventh record, which was so clear and melodic as to be easily transcribed."

(94.) Seashore, "The Place of Phonophotography," 486.

(95.) David Temperley, *The Musical Language of Rock* (New York: Oxford University Press, 2018), 113; see also David Temperley, *The Cognition of Basic Musical Structures* (Cambridge, MA: MIT Press, 2001), 256–257.

(96.) Fred Lerdahl, "Timbral hierarchies," *Contemporary Music Review* 2, no. 1 (1987), 143.

(97.) Abraham and Hornbostel, "Vorschläge," 8.

(98.) Research on percussion tunings has suggested as much: see, for instance, Schneider, "Psychological Theory," William Sethares, *Tuning, Timbre, Spectrum, Scale* (London: Springer, 2005), 199–220, and the contribution of Michael Tenzer to this volume.

(99.) Temperley, *Cognition*, 114; see also 10 and 265–267.

(100.) Ibid., 114.

(101.) See, for instance, Leonard B. Meyer, *Explaining Music: Essays and Explorations* (Berkeley and Los Angeles: University of California Press, 1973); James Tenney, *From Scratch: Writings in Music Theory*, ed. Larry Polansky et al. (Chicago: University of Illinois Press, 2015), esp. "Meta + Hodos," 13–96, and "META Meta + Hodos," 166–179; Eugene Narmour, *The Analysis and Cognition of Basic Melodic Structures* (Chicago: University of Chicago Press, 1990); Eugene Narmour, "Toward a Unified Theory of the I-R Model (Part 1): Parametric Scales and Their Analogically Isomorphic Structures," *Music Perception* 33:1 (Sep 2015), 32–69. For more on the development of parametric thinking in compositional theory, see also Jonathan de Souza, "Reassessing the Emergence of Indeterminate Music," *British Postgraduate Musicology* 9 (2008), http://britishpostgraduatemusicology.org/bpm9/desouza.html

(102.) Meyer, *Explaining Music*, 81.

(103.) Narmour, *Analysis and Cognition*, xi.

(104.) Narmour, "Toward a Unified Theory," 32. Narmour draws the concept of "divide and conquer" from the field of neuroscience, where it is used in relation to sorting out the data resulting from functional magnetic resonance imaging (fMRI) techniques that capture information pertaining to blood flow differences in the brain correspondent to neuronal activity; it is also, more broadly speaking, the name of an algorithm design paradigm that operates by breaking down computational problems into simpler, smaller sub-problems, then connecting the results to generate a solution.

(105.) Narmour, *Analysis and Cognition*, 60.

(106.) Naomi Cumming, "Eugene Narmour's Theory of Melody," *Music Analysis* 11, nos. 2–3 (1992), 355.

(107.) Changes in pitch perception of up to 15 or 20 cents can be induced by adjustments to timbre alone: see Allan Vurma, Marju Raju, and Annika Kuuda, "Does Timbre Affect Pitch?: Estimations by Musicians and Non-musicians," *Psychology of Music* 39, no. 3 (2011), 291–306. Manipulating timbre can also produce the effect of "dissonant octaves," or intervals between two tones whose fundamentals stand in perfect consonance at a ratio of 2:1, yet sound dissonant because of collisions between their overtones: see Sethares, *Tuning*, 1–10. String players also make slight adjustments to intonation in order to convey the illusion of brighter or darker timbres: Mieko Kanno, "Thoughts on How to Play in Tune: Pitch and Intonation," *Contemporary Music Review* 22, nos.1–2 (2003), 35–52. And vocalists recognize that "register influences timbre and vowel changes alter pitch," indicating that the coproductivity of pitch and timbre is also implicit knowledge for many musicians: see Olwage, "The Class and Colour of Tone," 205. Other studies along these lines include Punita G. Singh and Ira J. Hirsh, "Influence of spectral locus and F0 changes on the pitch and timbre of complex tones," *The Journal of the Acoustical Society of America* 92, no. 5 (1992): 2650–2661; Catherine M. Warrier and Robert J. Zatorre, "Influence of tonal context and timbral variation on perception of pitch," *Perception and Psychophysics* 64, no. 2 (2002): 198–207; Allan Vurma, "Timbre-induced Pitch Shift from the Perspective of Signal Detection Theory: The Impact of Musical Expertise, Silence Interval, and Pitch Region," *Frontiers in Psychology* 5, no. 44 (2014): 1–13.

Daniel Walden

Department of Music, Harvard University