Alan Lomax’s Cantometrics Project: A comprehensive review

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Abstract
 Alan Lomax’s Cantometrics Project was arguably both the most ambitious and the most controversial undertaking in music and science that the world has known. Its flagship component, Lomax’s “cantometric” analysis of approximately 1,800 songs from 148 worldwide populations using 36 classificatory features, sparked extensive debate. While Lomax responded to some criticisms, neither his final conclusions nor the evidence on which they were based were ever fully made clear. For decades, neither cantometrics nor Lomax’s related projects involving dance, speech, popular music, digital humanities, pedagogy, and activism were widely adopted by other researchers, but there has been a resurgence of interest since Lomax’s death in 2002. Here, I provide a comprehensive critical review of the Cantometrics Project, focusing on issues regarding the song sample, classification scheme, statistical analyses, interpretation, and ethnocentrism/reductionism. I identify misunderstandings, improvements that were made, and criticisms that remain to be addressed, and distil Lomax’s sometimes-conflicting claims into diagrams summarizing his three primary results: (1) ten regional song-style types, (2) nine musical factors representing intra-musical correlations, and (3) correlations between these musical factors and five factors of social structure. Although Lomax’s interpretations regarding correlations between song style and social structure appear weakly supported, his historical interpretations regarding connections ranging from colonial diaspora to ancient migrations provide a more promising starting point for both research and teaching about the global arts. While Lomax’s attempts to correlate features of social structure such as gender, religion, politics, and economics with stylistic features of musical performance largely failed to gain acceptance, the Cantometrics Project can still provide both inspiration and cautionary lessons for future exploration of relationships between music and culture.

Keywords
Cross-cultural, cultural evolution, ethnomusicology, performance style, science

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Ethnomusicologists will ignore this book [Folk song style and culture] at their own peril. (Merriam, 1969, p. 386)

I have always found cantometrics attractive…So I was surprised that the body of literature which followed, tested, and debated developed only to a narrow trickle. (Nettl, 2006, p. 60)

When Alan Lomax (1915–2002) died, his obituary appeared on the front page of the New York Times (Pareles, 2002). It spoke glowingly of Lomax’s work with famous musicians such as Leadbelly, Pete Seeger, and Bob Dylan, his contribution to the US and European folk revivals, and his passion for “cultural equity: the right of every culture to have equal time on the air and equal time in the classroom”. Yet the 1200-word article barely even mentioned Lomax’s Cantometrics Project, which occupied much of his career and for which he is alternately famous and infamous among academics today.

Beginning in the 1950s, Lomax began constructing the Cantometrics Project (later renamed the “Columbia University Cross-Cultural Study of Expressive Style”), an ambitious, multi-decade, multi-disciplinary, multi-million-dollar project to explore the relationship between music and culture on a global scale. Initially focused on the

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relationship between traditional folk song style and social structure, it gradually grew to encompass dance, human history, speech, popular music, pedagogy and activism (Averill, 2003; Wood, 2018, Forthcoming). Based primarily on data from his Cantometric song-style classification scheme (co-invented with Victor Grauer), Lomax argued that music both reinforced aspects of social structure and could be used to reconstruct histories of human migration and cultural evolution.

The Cantometrics Project initially met with cautious praise from many of the founding figures of the newly emerged field of ethnomusicology (e.g., McAllester, 1981; Merriam, 1969; Nettl, 1970; Titon, 1982). Even the most critical reviewers expressed their hope that Lomax’s study would lead to further research:

After all my quarrel with the method, the selection and application of ethnographic fact, the interpretation, which casually picks the beautiful points and lets the problems rest, after all this I find myself convinced that Lomax has spotted a mechanism by which deep significance is translated systematically into surface significance. One day someone, hopefully Lomax himself (a bit more disciplined and restrained Lomax, less a prophet, more a scholar) will find the rules of this translation and map them so that they will elucidate our understanding of human cultural products... (Maranda, 1970, p. 184)

But although reviewers encouraged “try it, you’ll like it!” (Herndon, 1978, p. 207), as a whole, the ethnomusicological community ultimately appeared neither to try it nor to like it. The published critiques of cantometrics were generally balanced and constructive, pointing out important limitations that deserve to be improved upon (e.g., Dubinskas, 1983). Nevertheless, few have seriously attempted to do so. Lomax’s own writings are somewhat vague and self-contradictory on a number of methodological details, and require careful parsing in their own right. As a result, cantometrics has acquired an underground reputation as “totally wrongheaded” (A. Seeger, 2006, p. 217).

While ethnomusicologists have not generally attempted to replicate or extend Lomax’s work, several groups from the new generation of cultural evolutionary science have become interested in Lomax’s ideas and data. Luca Cavalli-Sforza, a pioneer in both human genetic anthropology (Cavalli-Sforza, Menozzi, & Piazza, 1994) and cultural evolution (Cavalli-Sforza & Feldman, 1981), was fascinated by the potential congruence of Lomax’s musical maps with his own genetic maps and the linguistic maps produced by Joseph Greenberg (Cavalli-Sforza & Feldman, 2003), and wanted to collaborate with Lomax on a multidisciplinary exploration of human genetic and musical diversity (Wood, Forthcoming). Unfortunately, Lomax’s ailing health prevented this goal from being fulfilled. Since Lomax’s death in 2002, however, his daughter Anna Lomax Wood (who took over administration of Lomax’s Association for Cultural Equity [ACE]) and Victor Grauer (co-inventor of cantometrics) have worked toward this goal. This has taken place both independently (Grauer, 2005, 2006, 2007, 2009, 2011; Wood, 2018, Forthcoming) and in tandem or in parallel with a wide variety of scientists, including Sarah Tishkoff’s human genetics lab (Callaway, 2007), Armand Leroi’s evolutionary biology lab (Busby, 2006; Leroi et al., 2015; Leroi & Swire, 2006), Simon Dixon’s music information retrieval lab (Panteli, Benetos, & Dixon, 2016, 2017, 2018; Panteli, Bittner, Bello, & Dixon, 2017), Quentin Atkinson’s Cultural Evolution Lab (Du Toit, 2011; Savage & Atkinson, 2015), Steven Brown’s NeuroArts Lab (Brown et al., 2014; Ellis et al., 2018; Rzeszutek, Savage, & Brown, 2012; Savage, Merritt, Rzeszutek, & Brown, 2012), and my own CompMusLab (Savage & Brown, 2013, 2014; Savage, Brown, Sakai, & Currie, 2015; Savage, Matsumae, et al., 2015). At the same time, others have investigated similar relationships with minimal reference to Lomax’s ideas or methods (Le Bomin, Lecointre, & Heyer, 2016; Mehr, Singh, York, Glowacki, & Krasnow, 2018; Panjiv, Juhász, Zalán, Németh, & Damdin, 2012). Several of these studies have resulted in media coverage in high-profile news outlets such as the New York Times, Nature News, NBC News, and NPR (Callaway, 2007; Doucleff, 2015; Ghose, 2013; Marshall, 2018). However, this recent explosion of cantometric research has dealt with only certain aspects of the overall Cantometrics Project and has yet to produce a comprehensive overview or address many of the important critiques of Lomax’s work.

My goal in this article is to produce such an overview by summarizing Lomax’s own work and its criticisms in light of these recent studies and related developments that have occurred during the half century since Lomax began his work. Because Lomax’s forays into dance (choreometrics) and other domains were less comprehensive and more heavily criticized than his flagship cantometric analysis of traditional folk songs (e.g., Kealiinohomoku, 1974; Williams, 1974; Youngerman, 1974), I will focus the bulk of the article primarily on cantometrics, but I will also suggest possibilities for re-extending the analysis into other domains of art and culture. By understanding why Lomax’s vision of an interdisciplinary, global synthesis of science and art failed to take off half a century ago, we may find ourselves better able to try a new approach in today’s new intellectual climate of revived interest in the digital humanities and cultural evolution.

**Cantometrics Project overview**

Anthony Seeger argues that Lomax deserves to be better recognized as one of the key figures in the history of ethnomusicology, particularly as “a model – however imperfect – of a combination of applied and theoretical ethnomusicology” (2006, p. 218). Since Lomax’s death, several new publications have shed light on the historical development of cantometrics theory and methodology and
At the same time, Lomax was also struck by a second major theme: the idea of music as a functional reinforcer of social structure. During field trips to Spain and Italy to record albums for the World Library, Lomax was struck by the parallels in both countries in the way that free, open singing style and permissive sexual norms characterized the north while harsh, restricted singing styles and restrictions on female sexuality prevailed in the south. Despite potential historical explanations for these parallels (both southern Italy and southern Spain were formerly part of the Islamic empires that included Mediterranean Europe and North Africa), Lomax emphasized the potentially functional Freudian relationship between sexual tension and vocal tension. This was to be a source of much later criticism of the Cantometrics Project.

Lomax first published these ideas in the mid-1950s (Lomax, 1955–1956, 1956), and would spend most of the rest of his life refining and defending them. Upon his return to the US in 1958, he began presenting and publishing these ideas in a variety of academic conferences and journals while searching for collaborators and funding to support his vision of an interdisciplinary science of art (Lomax, 1959, 1962). While some were put off by his style (Wood, Forthcoming), he was able to attract the interest and support of many prominent scholars, including Margaret Mead, Ray Birdwhistell, Edith and George Trager, and Conrad Arensberg. With their support, Lomax was able to secure ultimately over $1 million in grant money from a number of organizations, including the National Institute of Mental Health and the Rockefeller Foundation. Arensberg, a Columbia University anthropologist who first suggested that Lomax explore correlations between his musical data and data on social structure from George Murdock’s (1967) Ethnographic atlas, served as co-director of the Cantometrics Project. Anthropologist Edwin Erickson and programmer Norman Berkowitz were in charge of the statistical analyses. The rest of the interdisciplinary team comprised specialists on various elements of art and culture, all of which were intended to be unified through a series of scientific, behaviour-oriented “-metrics”.

Cantometrics (canto = song, metrics = measure) – the centrepiece and namesake of the Cantometrics Project – was developed in collaboration by Lomax and musicologist Victor Grauer, who along with Roswell Rudd applied it to code several thousand songs from around the world (further details below). Choreologists Irmgard Bartenieff and Forrestine Paulay helped develop a similar model for dance (choreometrics). Similar approaches were explored for speech (parlometrics), vowel use (phonotactics), breathing (minutage), song texts, and instrumentation (reviewed in detail by Wood, 2018). Lomax’s goal was to synthesize these various datasets into a digital interactive “Global Jukebox” that would unify his academic, pedagogical, and activist goals. Despite interest and financial support from Apple and other institutions, Lomax was unable to realize this goal before his death. However, in 2017 a preliminary
version of the Global Jukebox (http://theglobaljukebox.org) was finally launched by ACE (Russonello, 2017).

The Cantometrics Project staff presented their initial findings during a day-long presentation at the 1966 annual meeting of the American Association for the Advancement of Science, and these were published as the edited volume *Folk song style and culture* (hereafter *FSSC*; Lomax, 1968), with the various sub-projects still at different stages of completion. The chapters devoted to cantometrics were based on a sample of 2,527 songs (Lomax, 1968, pp. 329–337), with corresponding samples of 43 choreometric profiles (based on “over 200 films”; Lomax, 1968, p. 225), and 17 folk song texts (Lomax, 1968, p. 276). The cantometric and choreometric samples were later expanded to over 5,000 songs and over 2,000 dances, respectively, including popular music from Lomax’s Urban Strain project, but these analyses were never published, nor were full details for the other “-metrics” (see Table 1). However, Lomax did publish full training tapes for cantometrics (1976) and partial ones for choreometrics (Bishop & Association for Cultural Equity, 2008). While *FSSC* was Lomax’s most-cited publication, he also published a number of increasingly sophisticated revisions to his cantometric analyses (Lomax, 1976, 1980, 1982, 1989; Lomax & Arensberg, 1977; Lomax & Berkowitz, 1972) that appear largely unnoticed. In particular, Lomax’s (1980) publication “Factors of musical style” – on which Lomax’s (1989) final published summary is primarily based – presents a number of important methodological advances that address many of cantometrics’ criticisms.

In 2005, ACE began archiving and digitizing Lomax’s data and collaborating on scientific research with Grauer, Tishkoff, and Leroi. This resulted in the deposition of Lomax’s archives in the American Folklife Center (AFC) at the Library of Congress and several intriguing preliminary reports (Busby, 2006; Callaway, 2007; Grauer, 2007; Leroi & Swire, 2006). The newly released online Global Jukebox includes cantometric codings, audio recordings (excluding some pending copyright/cultural permission), and detailed metadata for almost 6,000 songs as well as choreometric codings for several hundred dances.

### Cantometrics: Methods and results

Before addressing criticisms of cantometrics, it is important to understand what Lomax actually did. Many things changed between Lomax’s first publication of his ideas (Lomax, 1955–1956, 1956), *FSSC* (Lomax, 1968), and his final summary (Lomax, 1989), and these changes are important for interpreting criticisms of cantometrics.

#### Song sample

Lomax often stated that his cantometric analyses were based on “over four thousand songs from more than four hundred cultures” (Lomax, 1989, p. 230) from “a minimum of ten songs per society” (Lomax, 1968, p. 214). Most have accepted this claim at face value, as in Steven Feld’s influential critique in which he describes Lomax’s sample as “ten songs from four hundred cultures” (Feld, 1984, p. 384). However, Lomax often did not make clear the difference between the data he had available and the data actually used in his analyses, and it appears that even careful curation by ACE was not able to determine exactly which songs were used in which analyses (Wood, Forthcoming). Nevertheless, examination of the appendix data averaged by region (Lomax, 1968, pp. 329–337) gives a sample of only 2,527 songs, with only 19 songs from the “Tribal India” region consisting of two populations (i.e., Lomax’s stated use of “a minimum of ten songs per society” cannot be technically correct). It appears that rather than adding songs, subsequent analyses (including the final world song-style map presented in Lomax, 1989, p. 233) were actually based on a sub-sample of his 1968 data consisting of 148 of the original 233 populations (Lomax, 1976, 1980; Lomax & Berkowitz, 1972). Analysis of ACE’s digitzed song counts per population provided by Victor Grauer (personal communication, 2009) suggests that these 148 populations were represented by ~1,800 songs. Thus, these numbers (1,800 songs from 148 populations) seem like the best available estimate of the actual sample underlying Lomax’s final published findings.

Lomax was much clearer about the populations included in his study. Initially, he a priori grouped 233 populations into 56 culture areas based mostly on Murdock’s *Atlas* and used these 56 culture areas as the basic units of his analysis. In later studies, he restricted his analyses to 148 populations (see Figure 1) with matching data in Murdock’s *Atlas* and used these 148 populations as his basic units without constraining them to be grouped in any culture area.

### Table 1. Names and sample sizes of the different components of Alan Lomax’s Cantometrics Project (adapted from Lomax, 1968, 1980, 1989; and Wood, 2018, Forthcoming).

| Performance style analysis system | Sample size(s) |
|-----------------------------------|----------------|
| Cantometrics                      | 1,800 songs (from 148 cultures; Lomax, 1989) |
| Choreometrics                     | 43 dance profiles (Lomax, 1968) |
| Global Jukebox                    | 5,899 songs (from >1,000 cultures); 500 dances (http://theglobaljukebox.org) |
| Urban Strain (popular music)      | 321 songs, 100 dances (unpublished) |
| Minutage (breathing)              | 678 songs (sub-sample from cantometrics; unpublished) |
| Parlametrics (conversation)       | 156 languages (unpublished) |
| Folk song texts                   | 17 folk song texts (Lomax, 1968) |
| Phonotactics (vowels)             | ? (unpublished) |
| Instruments                       | ? (unpublished) |
| Orchestration                     | ? (unpublished) |
Figure 1. Lomax’s cantometric map of world song style (adapted from Lomax, 1980, pp. 34–36 – refer here for specific names of each sampled population). The 148 populations are classified as part of 10 “song-style regions” or four isolates based on factor analysis of modal profiles constructed from cantometric codings of 1,800 traditional folk songs. (See Table 2 for musical characteristics of the 10 song-styles and example recordings). This map was created using the “maps” package in R V3.4.2 (R Core Team, 2017; source code and data to recreate this map are available at https://github.com/pesavage/cantometrics).
The cantometric sample consisted of audio recordings of traditional folk songs, which Lomax deemed most amenable to cross-cultural comparison. Lomax never provided full details regarding which songs were included in his analysis, but did provide many of the recording sources (Lomax, 1976, pp. 237–256). Most of these recordings are also now accessible at the Global Jukebox. The largest suppliers of recordings were Moses Asch at Folkway Records and Hugh Tracey at the International Library of African Music. Lomax relied for these sources on the recommendations of leading scholars around the world, such as Alan Merriam, David McAllester, Jose Maceda, and many others (acknowledged individually in Lomax, 1968, pp. xv–xvii, and in the “Credits” section of the Global Jukebox website).

**Classification scheme**

Lomax wanted to replace the traditional musicological emphasis on specialized terminology and Western staff notation with a performance-oriented system that could be used by anyone. After exploring technologies such as sonograms for automated analysis of singing and finding them inferior to the human ear, Lomax recruited musicologist Victor Grauer to help create a universally-applicable song classification scheme in a similar style to Murdock’s *Atlas*. Lomax dubbed this system “cantometrics”, which he somewhat confusingly defined as “the measure of song, or song as a measure of culture” (Lomax, 1989, p. 230). This scheme was designed to allow any rater who had gone through a relatively brief training procedure to classify a given song by ear on many different features in approximately 15 minutes. In *FSSC*, this scheme consisted of 37 features (or “characters” in taxonomic terminology) each containing between 3 and 13 different states to choose from (“character-states”). Lomax (1976, 1980, 1989) revised this several times, ultimately arriving at 36 characters each containing between three and six character-states (see Figure 2). One character-state was generally coded per character, but multi-coding of several states was allowed when necessary to capture variability within songs. These characters can be broadly grouped into the domains of vocal performance (ornamentation, blend, tension, dynamics), structure (pitch, rhythm, text, texture, form), and instrumentation (Savage et al., 2012). In general, these characters were structured in a Likert-scale ordinal format and arranged to reflect correlations along an individual–group continuum. For example, interval size could be coded from 1 (small) to 3 (large), while rhythmic blend could be coded from 1 (individualized) to 5 (unified). However, in some cases the format is strictly not ordinal (ordered) but rather nominal (unordered; Stevens, 1946). For example, melodic shape can be classified as (a) arched, (b) terraced, (c) undulating, or (d) descending, and although Lomax arranged them in this order, there is no obvious reason to do so. I have used numbers vs. letters in Figure 2 to distinguish between ordinal vs. nominal features, respectively.

Inter-rater reliability of the scheme was tested preliminarily on 13 characters by Markel on his students at the University of Florida with varying levels of musical training, resulting in a fairly high Ebel’s inter-rater reliability coefficient of .847 (Lomax, Halifax, & Markel, 1968, p. 112). Later this testing was expanded to encompass 34 features rated on “20 to 50 examples similar to [consensus] tape VIIA” by Markel’s group and those at three other US universities by Roswell Rudd, Bess Lomax Hawes, and Jeff Titon, with group sizes “averaging 6–11 students” (Lomax, 1976, p. 270). These gave an average value of .864. Lomax later cited average reliability as 82% without specifying further details (Lomax, 1980, p. 32).

**Statistical analyses**

Statistical analyses of the cantometric data produced three major results: a regional clustering of the populations, internal correlations among the musical characters, and correlations between musical and cultural characters. The statistical analyses were highly complex, changed often, and rarely fully explained. In *FSSC*, they were carried out by Berkowitz and Erickson using data from all 2,527 songs, condensed into percentage values for each of the 56 culture areas. Lomax, however, preferred to present the results in the form of “modal profiles” (on Margaret Mead’s recommendation) that reduced internal variability within a population by combining the most common coding(s) for each feature into a single, idealized “favored song style” (Lomax, 1968, p. 133). In later analyses, he used only these modal profiles when performing a “Berkowitz–Lomax form of adaptation of factor analysis” (Lomax, 1980, p. 34), the details of which were never fully explained.

**Regional clustering of 10 song types.** One of Lomax’s major goals was to group the musics of the world into larger historical/geographic groupings, as linguists have done with language families. In *FSSC*, the 56 culture areas were grouped into six regions – South America, North America, Insular Pacific, Africa, Europe, and Old High Culture (a pan-Eurasian group roughly corresponding to empires connected by the Silk Road[s]) – and three “troublesome but interesting isolates” (Lomax, 1968, p. 80): Australia, Arctic Asia, and Tribal India. Later reanalysis grouped the 148 populations into one of 10 “song-style regions” and four unique isolates (Lomax, 1980; see Figure 1 above). Each song-style region was characterized as possessing a different primary stylistic song type. Cantometric profiles for each type are given in Lomax (1976, pp. 232–236), while verbal descriptions interspersed with various historical and functional interpretations are given in Lomax (1976, pp. 37–47). The key descriptions for each type are quoted in Table 2, accompanied by archetypal examples selected from Lomax’s training tapes.
Figure 2. Summary of features of song style and social structure classified by Lomax. Thirty-six musical characters from cantometrics (left) and 15 social structure characters mostly from Murdock's (1967) Ethnographic atlas (right) were used. Only extreme values of the character-states are shown, using numbers for ordinal characters and letters for nominal characters. Brackets show grouping of musical and social features into factors through factor analysis, and arrows show correlations between musical and social factors (adapted from Lomax, 1980, supplemented when necessary using Lomax, 1968, 1976, 1989 and Lomax & Berkowitz, 1972). Dashed lines represent connections suggested elsewhere but not found in Lomax (1980).
metrics was to explore relationships between music and culture. This was carried out by examining correlations between the cantometric data and data on social structure. Most of the social structure data were derived from Murdock’s (1967) *Ethnographic atlas*, but in many cases they were reordered, combined, or otherwise modified, and in some cases new variables were added based on Udy’s (1959) analyses of work teams and Ayres’ (1968) analyses of child-rearing. It is not clear exactly how many features were explored in *FSSC*, but there appear to have been at least 20 features (including 3-point, 5-point, 7-point, and 18-point versions of the primary scale of economic subsistence type). “Every conceivable match of song style and culture feature” was evaluated through “several thousand correlation tests” (Lomax, 1968, p. 120). Erickson designed several sub-samples to reduce the effect of Galton’s

### Table 2. Descriptions and example songs from each of Lomax’s 10 regional song styles shown in Figure 1.

| Song-style description | Example song (ID no.) |
|------------------------|----------------------|
| 1) African gatherer: “group singing is not only contrapuntal but polyrhythmic, a playful weaving of four and more strands of short, flowing, canon-like melodies (each voice imitating the melody of the others), sounding wordless streams of vowels in clear, bell-like yodelling voices” (Lomax, 1976, p. 38) | “Alima” (Mbuti initiation song; T5618R03) |
| 2) Proto-Melanesia: “a low-energy, diffuse, harmonizing style” (Lomax, 1976, p. 40) | “We Wa” (Lele song; T5428R37) |
| 3) Siberian: “A guttural, raspy, punchy, slurred, nonsense-syllable kind of soloizing in extremely uneven phrases” (Lomax, 1976, p. 38) | “Song of Comforting a Child” (Ainu lullaby; T5410R30) |
| 4) Circum-Pacific: “individualized and unison singing organization” (Lomax, 1972, p. 234) | “The Corn Dance” (Haudenosaunee [Iroquois] corn dance song; T5406R65) |
| 5) Nuclear America: “diffuse, highly individualized choralizing...use of polyphony that often veers toward vocal heterophony. Frequency of irregular and one-beat meters, wide melodic intervals, and guttural vocalizing link the Nuclear American style with that of the Sibero-American hunters—but a pattern of soft, nonraspy, high-pitched delivery points in another direction” (Lomax, 1976, p. 39) | “Round Dance” (Shuar [Jivaro] tsantsa [shrunken head] dance; T5402R35) |
| 6) Tropical Gardeners: “wide-voiced, superbly cohesive, polyphonic choralizing found among tropical village gardeners from Nigeria to the South Pacific island of Pukapuka” (Lomax, 1976, p. 41) | “Congassa” (Baulé dance song; T9534R59) |
| 7) Malayo-Polynesia: “social unison with an unsurpassed cohesiveness, in spite of the fact that their complex culture and their concern with genealogies motivate them to sing long, complexly textured poems in precise enunciation. Many of these chants are restrained within a narrow compass of notes, are dominated by free or irregular meters, and have a drone harmonic structure (i.e., a melody sung against a long, sustained note)” (Lomax, 1976, p. 40) | “Waiata Aroha by Puhiwahine” (Māori love song; T5429R04) |
| 8) Central Asia: “in the bardic vein—where extremely virtuosic solo singers, employing superbly clear voices, accompanying themselves on various kind of lutes in free rhythm, perform miracles of ornamentation that add color to their great epics and elaborate lyrics” (Lomax, 1976, p. 42) | “Uhanai Dulaanda” (Buryat drinking song; T5412R39) |
| 9) Old High Culture: “flowery textual style and...long, through-composed (nonstrophic) melodies that are elaborately enunciated and heavily ornamented with passing notes, quavers, glottal shakes, melismata (many notes to one syllable), glides, and rhythmic variation...the vocal delivery tends to be tense, high-pitched, and nasal...solo bardic performances...Sometimes singing without accompaniment, more often accompanied by one heterophonically related instrument or by a large and elaborate orchestra...” (Lomax, 1976, p. 46) | “Kembang Mas” (Javanese gamelan song; T5424R43) |
| 10) Western Europe: “unaccompanied solo narrative song...The core of this tradition is compact strophes (stanzas) composed of 3–8 diatonic phrases of moderate length” (Lomax, 1976, pp. 44–45) | “As I Walked Through Dublin City” (Irish ballad; T5586R01) |

Examples were chosen from Lomax’s (1976) training tapes. Full audio recordings, Cantometric codings, and metadata can be found at http://theglobbaljukebox.org.
problem (i.e., historical relationships between populations creating spurious correlations). Thirty-eight correlations remained significant (chi-squared $P < .05$, uncorrected) in these sub-samples (Lomax, 1968, p. 326, 1976, pp. 260–269) although statistical significance was never corrected to control for the multiple comparisons (Dowling & Harwood, 1986).

Later, Lomax applied the same factor analysis techniques he used to account for correlations among musical variables to account for correlations among cultural ones (Lomax & Berkowitz, 1972). He then explored correlations between these aggregated musical factors and cultural factors (Lomax, 1980, p. 45, 1989, pp. 231–233; see Figure 2). In two earlier publications focused less on music and more on a general “evolutionary taxonomy of culture”, the musical and cultural factor analyses were not treated separately but analysed together as a single factor analysis (Lomax & Arensberg, 1977; Lomax & Berkowitz, 1972).

**Interpretation**

Since his first letters in the 1950s, Lomax had two primary hypotheses to explain the world’s musical diversity: historical and functional. These interpretations were stated clearly at the opening of FSSC:

The main findings of this study are two. First, the geography of song styles traces the main paths of human migration and maps the known historical distributions of culture. Second, some traits of song performance show a powerful relationship to features of social structure that regulate interaction in all cultures. (Lomax, 1968, p. 3)

These interpretations clearly correspond to the ethnomusicalogical paradigms that Stone (2008) labelled “cultural evolutionist/diffusionist” and “structuralist-functionalist”, respectively (although Stone only cites Lomax in her chapter on structuralism-functionalism).

**Historical (cultural evolutionist/diffusionist).** Lomax’s historical interpretation followed an interpretive framework assuming progressive evolution from simple to complex societies, using “living cultures as illustrative of stages in human productive development” (Lomax & Arensberg, 1977, p. 660). He believed that two contrasting contemporary song styles – “African Gatherer” and “Siberian” – represented the ancestral styles at the roots of the cultural evolutionary tree of human music, with the other styles evolving progressively from these over time (see Figure 3a).

This tree of performance style appears to have two roots: (1) in Siberia and (2) among African Gatherers. The Siberian root has two branches: one into the Circum-Pacific and Nuclear America, thence into Oceania through Melanesia and into East Africa, the second branch to Central Asia and thence into Europe and Asian High Culture . . . The African Gatherer continuum into Early Agriculture is, by contrast, and on the whole, feminized, polyvoiced, regular in rhythm, repetitious, melodically brief, cohesive, well-integrated, with rhythmically oriented orchestras . . . West Europe and Oceania, flowering late on the borders of these two ancient specializations, show kinship to both. (Lomax, 1980, pp. 39–40)

In his later publications, Lomax de-emphasized the evolutionary angle and emphasized the diffusionist one in which music traced the historical migrations of various peoples and their cultures:

The resulting regional style map [see Figure 1] presents a layered historical geography of song style and culture. Regional styles 1 and 2 link the multipart singing of the African gatherers to isolated pockets of similar style in Australia [proto-Melanesia] and South America. Region 3 defines the Siberian homeland of the glottalized solo style of the prehistoric big-game hunters, which turns up again in Patagonia at the terminus of their American migration. Style region 4 comprises the Circum-Pacific, peopled in the last glacial age, when North America, Melanesia, and Australia were linked to Asia by land bridges. Regional style 5, Nuclear America, outlines the zone in which agricultural civilizations arose in Middle America and the Andes. In region 6, the tropical gardener style, characterized by cohesive, polyphonic chorusing, runs all the way from Oceania to black Africa. The text-heavy choral styles of region 7, the Malayo-Polynesian cluster, appear to trace the spread of Malay culture from Southeast Asia into the Pacific and its merger there with style 6. Regional style 8 was Old High Culture because its solo, ornamented, heavily orchestrated style links together all the zones shaped by ancient urban civilization, from East Asia to the Mediterranean. Region 9, Central Asia, is the heartland of a simpler but related solo style. Region 10, Europe, though closely allied to regions 8 and 9, still shows its ancient affiliation with Siberia in the north and with the polyphonic gardener zone of the south. (Lomax, 1989, p. 231, emphasis added)

**Functional (structuralist-functionalist).** Lomax also suggested that the correlations between music and culture (see Figure 2) represented not only historical connections but also functional ones in which certain types of singing acted as functional reinforcers of social structure:

A framework of explanatory hypotheses for these and other song-style variations has emerged from the study of the powerful correlations among cantometric scales and standard measures for social structure, derived from ethnographic compendiums. The many relationships can only be summarized here.

**Style.** Song style tends to grow more articulated, ornamented, and exclusive as societies grow bigger, more productive, more urbanized, and more stratified. Specifically, (1) the level of text repetition decreases directly as productivity increases, (2) the level of precision of enunciation increases as states grow in size, (3) the prominence of
small intervals and embellishments indicates the level of stratification, (4) orchestral complexity symbolizes state power, and (5) melodic size and complexity reflect the size and subsistence base of a community.

Organization. The organization of the performing group varies with community organization: (1) the cohesiveness of singing groups reflects and reinforces the level of social solidarity in other aspects of social organizations, (2) solo or individualized choruses are characteristic of network-oriented and individualized social webs, and (3) polyphonic choral performance, in which two or more independent melodic parts coincide, is characteristic of sexually complementary cultures in which women have a productive role equal to or greater than that of men.

Figure 3. (a) Lomax’s evolutionary interpretation of the relationships between his 10 “song-style regions”. “African Gatherer” and “Siberian” song styles are interpreted as representing the two earliest roots of human song style, evolving over time with some admixture to eventually reach the most evolutionarily recent styles “Old High Culture” and “Western Europe” (adapted from Lomax, 1980). (b) My proposed revision of Lomax’s model, replacing his assumption of evolutionary stasis with the modern cultural evolutionary concept of branching “descent with modification”, using dashed arrows to incorporate the idea of horizontal transmission (e.g., cross-cultural borrowing). See Savage (Forthcoming) for further explanation and theoretical background.
Vocal quality. Vocal noise and tension vary with gender roles: (1) harsh-voiced singing is typical of cultures in which boys are trained for aggression, and (2) vocal tension, as measured by nasality and vocal narrowness, tends to be high where sexual sanctions are severe, whereas relaxed, open voices are common where relatively permissive sexual standards prevail.

Rhythm. It appears likely, though a smaller sample was tested, that rhythmic and phrasal preferences may be shaped in childhood: (1) regular rhythms and phrases of moderate length are characteristic of cultures in which discipline imposes regular habits early in life; (2) on the other hand, irregular meters and long phrases are more frequent in cultures in which weaning is long deferred and children are reared indulgently.

Dynamic level. Finally, the dynamic levels of song, dance, and orchestra are highly intercorrelated. Emphasis on loudness, is characteristic of the music of large polities that put a high value on military glory. (Lomax, 1989, pp. 231–233, original emphasis)

Constructive criticism

Dozens of critics have weighed in on cantometrics, but much of this criticism points out problems without offering constructive solutions. Although rarely stated, the implication with such criticism is that better methods exist to achieve the same goals.

I will provide a meta-criticism in which I evaluate the primary criticisms of the Cantometrics Project and suggest constructive alternatives to overcome them, drawing largely on my own experiences over the past decade actively trying to build on Lomax’s work. I will focus primarily on in-depth criticisms, ignoring the many largely appreciative summaries that did not offer in-depth critical evaluation (e.g., Herndon, 1978; McAllester, 1981; Merriam, 1969; Narroll, 1969; P. Seeger, 1979; Titon, 1982). In particular, I will focus on the in-depth reviews by Dubinskas (1983), Downey (1970), Driver (1970), Krader (1970), Maranda (1970), McLean (1973), Wild (1974), Henry (1976), Erickson (1976), Feld (1984), Dowling and Harwood (1986), and Leroi and Swire (2006).

Victor Grauer (2005) and Anna Lomax Wood (2018, Forthcoming) have also provided their own responses to a number of these criticisms. Their responses provide a valuable contrasting perspective and additional historical context, since they were both deeply involved in the Cantometrics Project. In particular, Grauer, the co-inventor and primary coder of cantometrics, disagrees with Lomax’s functionalist interpretation and progressive evolutionary model, proposing an alternative historical model based more closely on contemporary genetic anthropology (Grauer, 2011).

Song sample

Many reviewers expressed some degree of concern with the size and representativeness of the sample. At a basic level, these included the small sample size (~10 songs) per culture and the uneven geographic representation whereby some areas that Lomax was more familiar with were over-represented (e.g., Southern USA, Caribbean, Spain, Italy) and others under-represented (e.g., China, Eastern Europe; Dubinskas, 1983; Krader, 1970; Nettl, 1970; Pantaleoni, 1972). Some also noted that it is impossible to evaluate Lomax’s sample because he never published his data on which songs were included (Grauer, 2002, cited in Averill, 2003; Krader, 1970). At a deeper level, these included the criteria by which popular, classical, contemporary or hybrid genres were excluded, and by which the final sample of ~10 songs was selected from the remaining pool of traditional folk songs (Driver, 1970; Dubinskas, 1983; Maranda, 1970; McLean, 1973), as well as the reliance on field recordings that are inevitably incomplete and biased by logistic and cultural factors involved in the recording process (Dubinskas, 1983; Pantaleoni, 1972).

As Dubinskas puts it:

The question is: how could we improve on Lomax’s sample and still achieve his goal of a broad comparative study, which even his most ruthless critics (e.g., Maranda, 1970; Williams, 1974) agree is worthwhile? Logistically, the time and resources required for in-depth fieldwork in a given culture make it all but impossible for any individual to perform a broad comparative study based exclusively on their own fieldwork, and similar constraints limit the ability for any single individual to analyse vast samples of recordings by ear. Automatic analysis by computers might resolve these latter constraints (Leroi et al., 2015; Panteli et al., 2017), but this technology is not well developed for non-Western music even today, and it certainly was not ready in the 1960s.

Previously, Steven Brown and I (Savage & Brown, 2013) have suggested a modified version of Lomax’s methodology, aiming to use 30 traditional songs per culture, selected strictly randomly from the pool of available songs to avoid confirmation bias in the selection. In our studies of musical/genetic diversity among indigenous Taiwanese (Brown et al., 2014; Rzeszut et al., 2012; Savage & Brown, 2014) and Northeast Asian/circumpolar populations (Savage, Matsumae, et al., 2015), we attempted to apply these methods to densely sampled sets of populations within geographically restricted regions in collaboration as much as possible with regional experts (including both ethnomusicologists and genetic anthropologists). In practice, this has proved extremely time-consuming (spending...
hundreds of hours coding songs by ear) and has not substantially reduced the sampling problems. It has also not yet resulted in much interest in collaboration from ethnomusicologists, although it has been relatively successful in interesting geneticists. So far, the broad patterns of our results seem to be relatively robust to sampling problems (Savage & Brown, 2014). However, replication studies and/or simulation studies along the lines of those used by genetic anthropologists (cf. Evanno, Regnaut, & Goudet, 2005) may be needed to formally evaluate the degree to which the results of Lomax or others are influenced by sampling and methodological issues, and what types of samples might be needed to reduce this influence to an acceptable level.

**Classification scheme**

Another major locus of criticism has been the reliability and validity of the cantometric classification scheme itself. While some (e.g., Nettl, 1970) have praised cantometrics’ emphasis on performance features over the traditional musicological emphasis on structure and notation, others have criticized the subjective nature of coding such features (Downey, 1970; Maranda, 1970; McLean, 1973). Likewise, some have criticized cantometrics for being too coarse-grained (Dowling & Harwood, 1986), while others have criticized it for being too fine-grained, such that different raters cannot agree on which point on the scale to code a given feature (Nettl, 1970). Even if the classifications can be agreed on reliably, they may still not be correct if the coders do not understand the language or the broader musical system of a given recording (Maranda, 1970; McLean, 1973). Furthermore, the classifications may be influenced by effects of the order in which songs were coded, or by confirmation biases (whether conscious or unconscious) that result in codings that confirm Lomax’s initial hypotheses (Downey, 1970; Maranda, 1970; McLean, 1973).

How could we improve on this system? My colleagues and I (Savage et al., 2012) offered a modified version of cantometrics dubbed “CantoCore” that emphasized “core” structural features over performance ones, based on the assumption that structural features would prove more reliable and less affected by social structure. We tested CantoCore directly against cantometrics using Lomax’s (1976) Consensus Tape containing 30 diverse songs from around the world. While CantoCore was indeed found to be somewhat more reliable than cantometrics (by ~80%), much of this difference could be attributed to the poor reliability of cantometrics’ instrumental features, while its performance and structural features were both found to be moderately reliable on average. As a result, we proposed a hybrid system combining CantoCore with vocal performance features from cantometrics and instrumental features from Hornbostel and Sachs’ (1961 [1914]) system (Savage & Brown, 2013; Savage, Brown, et al., 2015).

It has proven hard to evaluate the degree of confirmation bias in Lomax’s dataset, although this may be possible now that the Global Jukebox data have been published. My colleagues and I have striven to reduce the chance of confirmation bias by performing coding blind to extra-acoustic information as much as is practically possible,8 having randomly selected quality-control sub-samples coded by raters who are both blind to extra-acoustic information and unaware of the research hypotheses, and by publishing full data spreadsheets as online supplemental material to allow others to scrutinize our sample and codings (e.g., Brown et al., 2014; Savage, Brown, et al., 2015; Savage, Matsumae, et al., 2015). For maximum objectivity, all analyses would be performed by raters blind to the research hypotheses, as is sometimes done in biological or medical studies, but the level of time commitment involved has so far made this logistically impossible.

**Statistical analysis**

Numerous concerns have been raised with the statistical analyses of cantometric data. Many of these are relatively minor technical issues regarding the appropriate methods of converting raw cantometric codings into quantitative data, such as measures of average musical similarity or the frequency of different musical features (Busby, 2006; Driver, 1970; Leroi & Swire, 2006; Rzeszutek et al., 2012). More substantively, many criticized Lomax’s reduction of substantial intra-cultural diversity into a single modal profile (Feld, 1984; Henry, 1976; Nettl, 2006; Rzeszutek et al., 2012; Savage & Brown, 2014). Most crucially, Lomax’s failure to appropriately correct his correlational analyses to account for multiple comparisons (Dowling & Harwood, 1986) or historical relationships among cultures (“Galton’s problem”; Erickson, 1976) was argued to have invalidated most (but not all) of Lomax’s claims of functional music–culture correlations.9 Erickson’s criticism is especially devastating, coming as it does from one of the Cantometrics Project’s two primary statisticians and being based not on theoretical speculation but an actual quantitative reanalysis of Lomax’s data.

Recently, fields such as linguistics and anthropology have addressed similar criticisms by adapting quantitative methods from evolutionary biology to understand cultural evolution (Cavalli-Sforza & Feldman, 1981; Levinson & Gray, 2012; Mace & Holden, 2005; Mesoudi, 2011; Richerson & Boyd, 2005; Whiten, Hinde, Stringer, & Laland, 2012). Although the degree to which such methods may be appropriately applied to music remains debated (see Savage, Forthcoming, for extensive review and discussion), several studies have attempted to use such methods to improve on cantometrics. My colleagues and I showed that it was possible to adapt the Analysis of Molecular Variance (AMOVA) – which quantifies genetic variation within and between populations – to quantify
musical variation within and between populations (Rzeszutek et al., 2012). This analysis of traditional group songs from Taiwan and the Philippines found that 98% of variation was due to within-population variability, while only 2% of variation could be attributed to systematic between-population differences – a breakdown that paralleled the distribution of genetic diversity within and between cultures. This contradicted Lomax’s claim that “the variation of musical style between cultures and culture areas is clearly greater than between the styles of the individuals or groups that compose cultures” (Lomax, 1980, p. 29). At the same time, between-population differences were found to be highly statistically significant ($P < .001$), and the between-population component of diversity was found to be significantly correlated with patterns of linguistic and genetic diversity (Brown et al., 2014). Furthermore, comparison between patterns produced by the AMOVA analysis and those produced by Lomax’s modal profile method of analysis showed that, while the modal profile loses substantial information, the overall patterns remain highly correlated with those produced by the AMOVA analysis ($r_s = 0.73$). Thus, while reanalysis of the cantometric data should improve the details of Lomax’s regional analyses, it is unlikely to invalidate his major regional groupings.

As for Lomax’s music–culture correlations, Erickson’s (1976) reanalysis is more convincing than Lomax’s original analyses, but it is still relatively crude in that it uses only geographical information as a proxy for historical relationships. Some recent studies of cultural evolution continue to use updated versions of Murdock’s Atlas, but they tend to use phylogenetic methods based on linguistic and/or genetic information instead of or in addition to geographic information in order to control for Galton’s problem (e.g., Currie, Greenhill, Gray, Hasegawa, & Mace, 2010; Mace & Holden, 2005; Mace & Pagel, 1994). Adapting these techniques to music has revealed support for some of Lomax’s intra-musical correlations (e.g., high register correlated with loud dynamics; Savage, Brown, et al., 2015). The same techniques could be applied to re-examining Lomax’s proposed music–culture correlations (taking care to appropriately correct for multiple comparisons, cf. Dowling & Harwood, 1986).

**Interpretation**

Both Lomax’s historical and functional interpretations have been strongly contested. Criticisms of the functional interpretations have primarily focused on the methodological limitations described above (Erickson, 1976; Naroll, 1969) and on the vague Freudian mechanisms proposed to explain functional relationships between features, such as that between vocal tension and sexual tension (Zemlianova, 1974). Some have criticized the diffusionist angle of Lomax’s historical interpretation, such as ignoring the possibility of independent invention (i.e., polygenesis) and making dubious historical claims, such as ancient connections between Australia and the Americas or between Africa and Oceania (Dubinskas, 1983; McLean, 1973). The cultural evolutionist angle has been particularly criticized as offensive, unsupported by the data, and perpetuating the errors of Lomax’s teacher Curt Sachs and other early comparative musicologists (Dubinskas, 1983; McLean, 1973; McLeod, 1974; Youngerman, 1974; see also the commentaries accompanying Lomax & Arensberg, 1977). More generally, many have criticized Lomax’s unscholarly tone and tendencies to selectively interpret patterns post hoc to match one or the other of his hypotheses, ignoring deviant cases (Dubinskas, 1983; Maranda, 1970; McLean, 1973).

If we accept that Lomax’s approach has value, how might we improve it? Erickson’s (1976) reanalysis has already pointed out how Lomax’s interpretations could be improved by emphasizing the role of history and identity and de-emphasizing direct functionality. Interestingly, one critic of Lomax’s historical interpretation later presented a conceptually similar approach based on classification, clustering, and mapping to support a historical interpretation of song style and instrument distributions in Oceania (McLean, 1979). Grauer (2006, 2011), Leroi and Swire (2006), Brown et al. (2014) and Savage, Matsumae, et al. (2015) have recently proposed refined versions of Lomax’s historical interpretations. Grauer’s modification maintains Lomax’s assumption of stasis that was inherent in most early Spencerian theories of cultural evolution (i.e., both view contemporary Pygmy and Bushman music as representing the nearly unchanged sounds of early humans tens or hundreds of thousands of years ago). In contrast, I propose a modification grounded in modern cultural evolutionary theory that explicitly recognizes the likelihood that all contemporary styles have changed (albeit possibly to varying degrees) through branching processes of “descent with modification” (Savage, Forthcoming; see Figure 3).

While Lomax may have been overly dogmatic in implying that most stylistic similarities were the result of historical diffusion, in general his results suggest a promising degree of correspondence with known historical developments. In particular, six out of his 10 regional styles seem likely to match known patterns of human migration and cultural contact. In order of increasing time-depth, these are:

(a) **“Western Europe”:** Ballads from Western Europe were brought to the Americas with European colonization (Sharp, 1932) beginning ~500 years ago (ya).

(b) **“Old High Culture”:** Musical instruments with origins in the Middle East had travelled via the Silk Road as far as Japan by well over 1,000 ya (Tokita & Hughes, 2008). Around the same time, the Arab conquest of the southern Mediterranean brought people and their songs to southern Mediterranean areas such as Sicily.
Nevertheless, Lomax’s map provides a useful starting point for rigorous confirmation of findings. Furthermore, it remains unclear whether Lomax’s musical codings were affected by confirmation bias that may have led them to be influenced by prior knowledge about historical relationships. Nevertheless, Lomax’s map provides a useful starting point from which to attempt to replicate the findings and understand how to explain exceptional cases.

**Ethnocentrism/reductionism**

Many critics are less concerned about Lomax’s specific claims than with the broader sociopolitical implications of his comparative, scientific approach. Some have pointed out that Lomax’s analyses and interpretations have ignored the semiotic domain of musical meaning that many find to be more important than acoustic style (Blacking, 1977; Dubinskas, 1983; Feld, 1984). As Dubinskas (1983, p. 34) puts it, “For all its statistical elegance, cantometrics cannot tell us what music means to performers”. Some object even more generally to the reductionism and ethnocentrism they see as inherent in scientific approaches to cross-cultural musical comparison (Feld, 1984; Pantaleoni, 1972). Again, if we accept that comparative research is worthwhile, what alternatives might be better?

Feld (1984) is one of Lomax’s few critics to have proposed a constructive alternative. After attempting unsuccessfully to use cantometrics to gain insight into the music of the Kaluli, Feld notes:

> I still feel that Lomax is asking many of the right questions about music and social institutions, but the mechanics of cantometrics crunches them in ways that cannot satisfy the researcher accustomed to intensive field work, in-depth analysis, and grounded ethnographic theory…My suggestion is true heresy to many committed comparativists, but I think we need to pioneer a qualitative and intensive comparative sociomusicology. (Feld, 1984, p. 385)

Feld’s proposal for this “comparative sociomusicology” was a list of 32 questions, organized into six categories: (1) competence, (2) form, (3) performance, (4) theory, (5) environment, and (6) value and equality. For example, one question asks “Who can make sounds/music, and who can interpret/use them?” (competence), while another asks “How do balances and imbalances manifest themselves in expressive ideology and performance?” (value and equality). Feld uses these questions to interpret and compare the relationship between song structure and social structure among the Kaluli and their neighbours in Papua New Guinea. In the same issue of *Ethnomusicology*, Roseman (1984) applied Feld’s 32 questions to the music of the Temiar in Malaysia, comparing them both with their Southeast Asian neighbours and with the Kaluli. This issue also includes comments by nine other scholars (Keil et al., 1984).

While many applauded the attempt to improve on cantometrics, several noted that Feld’s proposal simply replaced a quantitative, ethnocentric method of comparison with a qualitative, ethnocentric one. As Judith and A. L. Becker note:

(c) “Tropical Gardeners”: Bantu-speaking agriculturalists began expanding eastward from West Africa around 3,000 ya to eventually occupy much of sub-Saharan Africa (Currie, Meade, Guilhon, & Mace, 2013; Phillipson, 2005). Later (beginning around 500 ya), Africans were forcibly transported through the Atlantic slave trade westward throughout the Americas.

(d) “Malayo-Polynesia”: Austronesian-speaking agriculturalists began expanding from Taiwan approximately 4,000 ya, reaching Micronesia by ~3,000 ya and spreading to New Zealand by ~1,000 ya (Bellwood, 2011; Gray, Drummond, & Greenhill, 2009; Lipson et al., 2014).

(e) “Siberia”: The First Americans crossed from northeastern Siberia to the Bering Strait sometime before the end of LGM (Last Glacial Maximum) ~15,000 years ago (O’Rourke & Raff, 2010). If the musical style of the Ona (Selk’nam) of South America truly reflected Siberian roots as Lomax claims, this may be the most extreme example of deep musical stylistic roots being preserved across vast expanses of time and space. Later (~1,500 ya), the expansion of the Okhotsk fishing culture from southeastern Siberia resulted in Siberian influences (although not complete replacement) on both the music and the gene pool of the indigenous Ainu of north Japan (Savage, Matsumae, et al., 2015).

(f) “African Gatherer”: Lomax initially believed that the musical similarities between Pygmies and Bushmen reflected the influence of social structure because these groups were not thought to be historically related. Grauer (2011) later interpreted these similarities as a relic of an ancient style preserved from the time of the first anatomically modern humans (~200,000 ya). However, recent genetic evidence suggests that these two groups do share common “Proto-Khoesan-Pygmy” roots, although these roots go back to ~35,000 ya or beyond (Tishkoff et al., 2009). If the musical similarities between the two groups truly reflect similarities preserved from 35,000+ ya, this would suggest that music may potentially have a greater time-depth than language, which is often considered to be limited to ~10,000 ya (Hammarström, 2016).
In order to facilitate comparison, a unified frame has been followed by both [Feld and Roseman] which includes a set of categories which have strong historical associations with western scholarship, that is, competence, form, performance, environment, theory and value and equality. The categories belong to our world, not to theirs. (Keil et al., 1984, p. 455)

Inevitably, similar criticisms will apply to any proposed method of cross-cultural comparison (Nettl, 2015; Nettl & Bohlman, 1991). This doesn’t mean we should abandon comparison – but it does mean we should strive to interpret our results with an awareness of the types of biases and assumptions that may limit whatever methods we adopt. Since no method will be perfect, my opinion is that we should encourage a diversity of approaches, including cantometrics and related methods. I have previously expressed whole-hearted support for alternative (including non-acoustic and/or non-scientific) approaches to comparative musicology, whether based on sociomusicology, semiotics, or otherwise (Savage & Brown, 2013). But I see no need that these approaches be mutually exclusive with the scientific study of song style, dance, instruments, song texts, and other domains championed by Lomax. There is no need to set up a false dichotomy pitting Lomax against Feld: both their and others’ approaches may be useful for different goals, and they may even be able to complement one another.

Conclusion

The Cantometrics Project was an important and controversial landmark in the history of the science of music whose details remain poorly understood more than half a century after its first publication. Although I have offered a few suggestions I feel have the potential to overcome some criticisms, the primary goal of this article was not to defend the claims of Lomax, his supporters, or his critics, but simply to clarify and synthesize the claims and the debates that the Cantometrics Project has produced. I do not intend to imply that any of these debates have been permanently resolved. In particular, debates regarding the nature of musical evolution, correspondence between musical and genetic histories, and the relationship between music and culture remain contested areas ripe for future testing. A nuanced understanding of the Cantometrics Project provides an important starting point for any future attempts to do so.

It is important to remember that Lomax’s Cantometrics Project was fundamentally integrated with his ideological vision unifying research, education, and activism, summarized in his “Appeal for cultural equity” (Lomax, 1977; see also Baron, 2012). Here, Lomax derided the cultural “grey-out” (Lomax, 1977, p. 125) through which globalization of Euro-American styles threatened all other stylistic regions identified by cantometrics. To correct this imbalance, Lomax advocated for equal “money, time on the air, and time in the classroom” (Lomax, 1977, p. 131) across all musical regions identified by the Cantometrics Project. Toward this end, he published training tapes for cantometrics and choreometrics, aiming to introduce students to the world’s musical diversity, established the Association for Cultural Equity, and continued to pursue projects such as the Global Jukebox until his death. Today, these are precisely the kinds of areas that organizations such as schools and UNESCO are targeting to safeguard as the “Intangible Cultural Heritage of Humanity” and teach about cultural diversity through global arts curricula (Grant, 2014; UNESCO, 2003).

Recent renewed interest by scientists and some ethnomusicologists in Lomax’s work has so far been limited primarily to the comparative, historical aspects of cantometrics, with little extension yet into areas such as social structure, non-musical arts, pedagogy, or activism. This may be for the best for now, as Lomax’s over-eagerness to accomplish all of his goals at once may have contributed to some of the methodological shortcomings and cool reception of his work (Wood, Forthcoming). However, it will be important to keep in mind Lomax’s vision of a unified humanistic science of the arts if we are to do justice to the legacy of his Cantometric Project (Clarke, 2014).

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Peer review

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Robert Attenborough, University of Cambridge, Department of Archaeology and Anthropology.
Notes

1. Both “Pygmy” and “Bushmen” can be considered pejorative, but so can other potential alternatives such as “San” (Barnard, 1992, p. 8). Therefore, in the absence of clear alternatives I will use Lomax’s terminology here.

2. These data appear to be published more fully as Appendix E of Naroll (1970), where they are presented as percentages of the presence of 31 features across each of the 233 cultures.

3. The full training requires listening through 10 hours of training tapes containing examples from around the world (Lomax, 1976). I have edited the key sections from each tape into my own condensed version that takes three hours. Note that Victor Grauer believes that the training tapes – although valuable as an educational tool – are not sufficient to properly train a coder for cantometric research, which he argues requires days of personal training from himself or other experienced coders (personal communication, May 2016).

4. The revisions are condensed versions of the original scheme (Lomax & Grauer, 1968) that was used to code the cantometric database. Thus, for the most part, the original and revised schemes can be interconverted while maintaining comparability.

5. For example, Lomax described African Pygmies as “living representatives of early man” (Lomax, 1976, p. 127). However, it should be noted that despite adopting this theoretical framework, Lomax strongly rejected the racism associated with many of its proponents: “Man’s total heritage of lifestyles can contribute to the future, without giving precedence any longer to the European social and esthetic practices... For almost a century, the intellectual atmosphere of the world has been poisoned by a false Darwinism that judged human social development as the survival of the fittest – that is, of the most successfully aggressive individuals and societies. This view can now be corrected” (Lomax & Arensberg, 1977, pp. 238–239).

6. I find Dubinskas’s review to be the most detailed, accurate, and balanced.

7. Average Cohen’s Kappa inter-rater reliability values were 0.47 vs. 0.26, respectively, corresponding to percentage agreement values of 62% and 45%, respectively (Savage et al., 2012). However, percentage agreement is not an ideal measurement of inter-rater reliability because it ignores partial agreement and other factors (Cohen, 1968). Lomax sometimes reported his reliability data as percentages, but his values were actually in the form of Ebel’s inter-rater reliability coefficient (Lomax, 1976, p. 270); a measure that is similar to Cohen’s Kappa but is not technically appropriate for use on nominal data.

8. Specifically, using iTunes’ smart playlist and shuffle functions to select songs from the sample pool in a random order without displaying metadata about population of origin, genre, etc. (although this metadata is of course included in later analysis and interpretation).

9. Erickson (1976) did find that the following correlations appeared to be robust to Galton’s problem: (1) vocal tension–sex mores; (2) vocal texture–division of labour; (3) interlocking texture–small-scale hunter-gatherer production.

10. Kaeppler (1978, p. 43) described Lomax as “an incarnation of Sachs at the computer”.

References

Averill, G. (2003). Cantometrics and cultural equity: The academic years. In R. D. Cohen (Ed.), Alan Lomax: Selected writings, 1934–1997 (pp. 233–248). New York, NY: Routledge.

Ayres, B. (1968). Effects of infantile stimulation on musical behavior. In A. Lomax (Ed.), Folk song style and culture (pp. 211–221). Washington, DC: American Association for the Advancement of Science.

Barnard, A. (1992). Hunters and herders of southern Africa: A comparative ethnography of the Khoisan peoples. Cambridge, England: Cambridge University Press.

Baron, R. (2012). “All power to the periphery”: The public folklore thought of Alan Lomax. Journal of Folklore Research, 49(3), 275–317.

Bellwood, P. (2011). Holocene population history in the Pacific region as a model for worldwide food producer dispersals. Current Anthropology, 52(S4), S363–S378.

Bishop, J., & Association for Cultural Equity. (Eds.). (2008). Rhythms of Earth: The choreometrics films of Alan Lomax and Forrestine Paulay. Portland, OR: Media Generation.

Blacking, J. (1977). Some problems of theory and method in the study of musical change. Yearbook of the International Folk Music Council, 9, 1–26.

Brown, S., Savage, P. E., Ko, A. M.-S., Stoneking, M., Ko, Y.-C., Loo, J.-H., & Trejaut, J. A. (2014). Correlations in the population structure of music, genes and language. Proceedings of the Royal Society B: Biological Sciences, 281(1774), 20132072.

Busby, G. (2006). Finding the blues: An investigation into the origins and evolution of African-American music (Master’s thesis, University of London, England). Retrieved from http://users.ox.ac.uk/~some2456/docs/Busby_GBJ_finding_the_blues_2006.pdf

Callaway, E. (2007). Music is in our genes. Nature News. doi:10.1038/news.2007.359

Cavalli-Sforza, L. L., & Feldman, M. W. (1981). Cultural transmission and evolution: A quantitative approach. Princeton, NJ: Princeton University Press.

Cavalli-Sforza, L. L., & Feldman, M. W. (2003). The application of molecular genetic approaches to the study of human evolution. Nature Genetics, 33 Suppl(March), 266–275.

Cavalli-Sforza, L. L., Menozzi, P., & Piazza, A. (1994). The history and geography of human genes. Princeton, NJ: Princeton University Press.

Clarke, D. (2014). On not losing heart: A response to Savage and Brown’s “Toward a new comparative musicology”. Analytical Approaches to World Music, 3(2), 1–14.

Cohen, J. (1968). Weighted kappa: Nominal scale agreement with provision for scaled disagreement or partial credit. Psychological Bulletin, 70(4), 213–220.
Currie, T. E., Greenhill, S. J., Gray, R. D., Hasegawa, T., & Mace, R. (2010). Rise and fall of political complexity in island Southeast Asia and the Pacific. *Nature*, 467(7317), 801–804.

Currie, T. E., Meade, A., Guillou, M., & Mace, R. (2013). Cultural phylogeography of the Bantu Languages of sub-Saharan Africa. *Proceedings of the Royal Society B: Biological Sciences*, 280(1762), 20130695. doi:10.1098/rspb.2013.0695

Douceff, M. (2015, July 9). From Pygmy hunting songs to Taylor Swift, what makes music universal. *National Public Radio*. Retrieved from http://www.npr.org/sections/goatsandsoda/2015/07/09/418587373/from-pygmy-hunting-songs-to-taylor-swift-what-makes-music-universal

Dowling, W. J., & Harwood, D. L. (1986). Cultural contexts of musical experience. In W. J. Dowling & D. L. Harwood (Eds.), *Music cognition* (pp. 225–239). Orlando, FL: Academic Press.

Downey, J. C. (1970). Review of A. Lomax, *Folk song style and culture*. *Ethnomusicology*, 14(1), 63–67.

Driver, H. E. (1970). Review of A. Lomax, *Folk song style and culture*. *Ethnomusicology*, 14(1), 57–62.

Du Toit, D. (2011). *Cultural variation of music* (Dissertation, University of Auckland, New Zealand).

Dubinskas, F. A. (1983). A musical Joseph’s coat: Patchwork patterns and social significance in world musics. *Reviews in Anthropology*, 10(3), 27–42.

Ellis, B. K., Hwang, H., Savage, P. E., Pan, B.-Y., Cohen, A. J., & Brown, S. (2018). Identifying style-types in a sample of musical improvisations using dimensional reduction and cluster analysis. *Psychology of Aesthetics, Creativity, and the Arts*, 12(1), 110–122. doi:10.1037/aca0000072

Erickson, E. E. (1976). Tradition and evolution in song style: A reanalysis of cantometric data. *Cross-Cultural Research*, 11(4), 277–308.

Evanno, G., Regnaut, S., & Goudet, J. (2005). Detecting the number of clusters of individuals using the software STRUCTURE: A simulation study. *Molecular Ecology*, 14, 2611–2620.

Feld, S. (1984). Sound structure as social structure. *Ethnomusicology*, 28(3), 383–409.

Ghose, T. (2013). Take note: Folk music could track human migrations. *NBC News*. Retrieved from http://www.nbcnews.com/science/science-news/take-note-folk-music-could-track-human-migrations-f4211591384

Gold, J. R., Revill, G., & Grimley, D. (2017). Music, maps and the Global Jukebox: Culture areas and Alan Lomax’s Cantometrics Project revisited. In S. D. Brunn & M. Dodge (Eds.), *Mapping across academia* (pp. 287–303). Dordrecht, Netherlands: Springer.

Grant, C. (2014). *Music endangerment: How language maintenance can help*. New York, NY: Oxford University Press.

Grauer, V. A. (2005). “Cantometrics – Song and social culture”: A response. *Musical Traditions*, 159. Retrieved from http://www.mustrad.org.uk/articles/cantome2.htm

Grauer, V. A. (2006). Echoes of our forgotten ancestors. *The World of Music*, 48(2), 5–58.

Grauer, V. A. (2007). New perspectives on the Kalahari debate: A tale of two “genomes”. *Before Farming*, 2(4), 1–14.

Grauer, V. A. (2009). Concept, style, and structure in the music of the African Pygmies and Bushmen: A study in cross-cultural analysis. *Ethnomusicology*, 53(3), 396–424.

Grauer, V. A. (2011). *Sounding the depths: Tradition and the voices of history*. CreateSpace. Retrieved from http://soundingthedepths.blogspot.com/}

Gray, R. D., Drummond, A. J., & Greenhill, S. J. (2009). Language phylogenies reveal expansion pulses and pauses in Pacific settlement. *Science*, 323(5913), 479–483.

Hammarström, H. (2016). Linguistic diversity and language evolution. *Journal of Language Evolution*, 1(1), 19–29.

Henry, B. O. (1976). The variety of music in a North Indian village: Reassessing Cantometrics. *Ethnomusicology*, 20(1), 49–66.

Herndon, M. (1978). Review of cantometrics: An approach to the anthropology of music by Alan Lomax. *American Anthropologist*, 80(1), 206–207.

Hornbostel, E. M. von, & Sachs, C. (1961 [1914]). Classification of musical instruments. *Galpin Society Journal*, 14(Mar), 3–29.

Kaeppler, A. L. Dance in anthropological perspective. *Annual Review of Anthropology*, 7(1978), 31–49.

Kealinonhokoku, J. W. (1974). Review of *Folk song style and culture* by A. Lomax: Caveat on causes and correlations. *CORD News*, 6(2), 20–24.

Keil, C., Robertson, C. E., Seeger, A., Becker, J., Becker, A. L., Gourlay, K. A.,…Dentan, R. K. (1984). Responses to Feld and Roseman. *Ethnomusicology*, 28(3), 446–466.

Krader, B. (1970). Review of *Folk song style and culture* by Alan Lomax. *Anuario Interamericano de Investigacion Musical*, 6, 113–118.

Le Bomin, S., Lecointre, G., & Heyer, E. (2016). The evolution of musical diversity: The key role of vertical transmission. *PlsOne*, 11(3), e0151570.

Leroi, A. M., Mauch, M., Savage, P. E., Benetos, E., Bello, J., Panteli, M.,…Weyde, T. (2015). The deep history of music project. In *Proceedings of the Folk Music Analysis 2013 Workshop*, Paris, France, 10–12 June (pp. 83–84).

Leroi, A. M., & Swire, J. (2006). The recovery of the past. *The World of Music*, 48(3), 43–54.

Levinson, S. C., & Gray, R. D. (2012). Tools from evolutionary biology shed new light on the diversification of languages. *Trends in Cognitive Sciences*, 16(3), 167–173.

Lipson, M., Loh, P.-R., Patterson, N., Moorjani, P., Ko, Y.-C., Stoneking, M.,…Reich, D. (2014). Reconstructing Austronesian population history in Island Southeast Asia. *Nature Communications*, 5, 4689. doi:10.1038/ncomms5689

Lomax, A. (1955–1956). Nuova ipotesi sul canto folkloristico italiano. *Nuovi Argomenti*, 17–18, 109–135.

Lomax, A. (1956). Folk song style: Notes on a systematic approach to the study of folk song. *Journal of the International Folk Music Council*, 8, 48–50.

Lomax, A. (1959). Folk song style. *American Anthropologist*, 61(6), 927–954.
Richerson, P. J., & Boyd, R. (2005). *Not by genes alone: How culture transformed human evolution*. Chicago, IL: University of Chicago Press.

Roseman, M. (1984). The social structuring of sound: The Temiar of peninsular Malaysia. *Ethnomusicology*, 28(3), 411–445.

Russonello, G. (2017). The unfinished work of Alan Lomax’s Global Jukebox. *New York Times*. Retrieved from https://www.nytimes.com/2017/07/11/arts/music/alain-lomax-global-jukebox-digital-archive.html

Rzeszutek, T., Savage, P. E., & Brown, S. (2012). The structure of cross-cultural musical diversity. *Proceedings of the Royal Society B: Biological Sciences*, 279(1733), 1606–1612.

Savage, P. E. (Forthcoming). Cultural evolution of music. Preprint available from https://patrickesavage.files.wordpress.com/2016/04/savage_cultural_evolution_of_music_preprint.pdf

Savage, P. E., & Atkinson, Q. D. (2015). Automatic tune family identification by musical sequence alignment. In *Proceedings of the 16th International Society for Music Information Retrieval Conference (ISMIR 2015)*, Málaga, Spain, 26–30 October (pp. 162–168).

Savage, P. E., & Brown, S. (2013). Toward a new comparative musicology. *Analytical Approaches to World Music*, 2(2), 148–197.

Savage, P. E., & Brown, S. (2014). Mapping music: Cluster analysis of song-type frequencies within and between cultures. *Ethnomusicology*, 58(1), 133–155.

Savage, P. E., Brown, S., Sakai, E., & Currie, T. E. (2015). Statistical universals reveal the structures and functions of human music. *Proceedings of the National Academy of Sciences of the United States of America*, 112(29), 8987–8992.

Savage, P. E., Matsumae, H., Oota, H., Stoneking, M., Currie, T. E., Tajima, A., . . . Brown, S. (2015). How “circumpolar” is Ainu music? Musical and genetic perspectives on the history of the Japanese archipelago. *Ethnomusicology Forum*, 24(3), 443–467.

Savage, P. E., Merritt, E., Rzeszutek, T., & Brown, S. (2012). CantoCore: A new cross-cultural song classification scheme. *Analytical Approaches to World Music*, 2(1), 87–137.

Seeger, A. (2006). Lost lineages and neglected peers: Ethnomusicologists outside academia. *Ethnomusicology*, 50(2), 214–235.

Seeger, P. (1979). Appleseeds [review of *Cantometrics: A method in musical anthropology* by A. Lomax]. *Sing Out!*, 27(3), 32.

Sharp, C. J. (1932). *English folk songs from the southern Appalachians*. London, England: Oxford University Press.

Stevens, S. S. (1946). On the theory of scales of measurement. *Science*, 103(2684), 677–680.

Stone, R. (2008). *Theory for ethnomusicology*. Upper Saddle River, NJ: Pearson/Prentice Hall.

Szwed, J. (2010). *Alan Lomax: The man who recorded the world*. New York, NY: Viking.

Tishkoff, S. A., Reed, F. A., Friedlaender, F. R., Ehret, C., Ranziaro, A., Froment, A., . . . Williams, S. M. (2009). The genetic structure and history of Africans and African Americans. *Science*, 324(5930), 1035–1044.

Titon, J. T. (1982). From the Record Review Editor: Cantometrics. *The Journal of American Folklore*, 95(377), 370–374.

Tokita, A. M., & Hughes, D. W. (Eds.). (2008). *The Ashgate research companion to Japanese music*. Farnham, England: Ashgate.

Udy, S. H. Jr. (1959). *Organization of work: A comparative analysis of production among non-industrial peoples*. New Haven, CT: HRAF Press.

UNESCO. (2003). *Convention for the safeguarding of the intangible cultural heritage*. Retrieved from http://www.unesco.org/culture/ich/en/convention

Whiten, A., Hinde, R. A., Stringer, C. B., & Laland, K. N. (2012). *Culture evolves*. Oxford, England: Oxford University Press.

Wild, S. (1974). Review of *World history of the dance* by A. Lomax. *Ethnomusicology*, 18(2), 112(29), 8987–8992.

Wood, A. L. C. (2018). “Like a cry from the heart”: An insider’s view on the genesis of Alan Lomax’s ideas and the legacy of his research: Part I. *Ethnomusicology*, 62(2), 230–264.

Wood, A. L. C. (Forthcoming). “Like a cry from the heart”: An insider’s view on the genesis of Alan Lomax’s ideas and the legacy of his research: Part II. *Ethnomusicology*, 62(3).

Youngerman, S. (1974). Curt Sachs and his heritage: A critical review of *World history of the dance* with a survey of recent studies that perpetuate his ideas. *CORD News*, 6(2), 6–19.

Zemlianova, L. M. (1974). Structuralism and its most recent modifications in current American folklore studies. *Soviet Anthropology and Archeology*, 13(2), 57–77.