Thesaurus Musicarum Latinarum (TML). Giuliano Di Bacco, Project Director; The Center for the History of Music Theory and Literature, Indiana University Jacobs School of Music. URL: http://www.chmtl.indiana.edu/ml/

The Thesaurus Musicarum Latinarum (TML), subtitled an “Online Archive of Music Theory in Latin,” is among the handful of online resources that early music scholars consult with frequency—the other two being the Digital Image Archive of Medieval Music (DIAMM, an image archive and catalog of manuscripts transmitting medieval polyphony) and the Cantus database (a searchable catalog of plainchant).² All three were first developed in the earliest days of web-based scholarly resources, and all three have shed their HTML 2.0 look-and-feel courtesy of recent updates to their interface design. This review considers the newest version of the TML, released in 2017, focusing both on the improvements in usability and functionality of the 2017 version, and on the aims and scope of the TML project in general.

The TML’s purpose, as stated on its home page, is “to give free access to and make searchable every known Latin text on music from the late antiquity to the seventeenth century, in multiple editions and in transcriptions from original sources” (my emphasis). While the TML’s primary audience is identified as musicologists, the home page indicates that the resource will be of use to anyone “interested in documenting the broader intersections of music with the humanities and the sciences within the Western tradition.” The TML corpus comprises writings on music in Latin from the late Greco-Roman through the early modern periods, traversing the philosophical, the speculative, and the practical. One can browse through definitions of music and musicians and their place in society; cosmo logical and metaphysical discussions—for example, of the music of the spheres; the story of Pythagoras’s discovery of the ratios of the consonances; a variety of methods for reproducing pitch arrays on the monochord; technical definitions of pitch, mode, melody, phrasing, rhythm, notation, and form; discussions of various genres and styles of music compositions; descriptions of musical instruments; and passages on musical tastes and aesthetics. The information transmitted in these writings “plays a

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fundamental role in our ability to reconstruct, understand, and ultimately perform the music of the past."

Originally developed to perform a task that a collection of machine-readable texts makes possible, the TML also enables rapid and comprehensive searches for terminology across its corpus. The “access” aspect is important: ideally anyone with an Internet connection (and knowledge of Latin) could read the full texts of these treatises on the TML, treatises previously accessible only to those with reading privileges at a good research library. And since the texts are machine-readable, their presentation can be adjusted to suit the individual reader; for example, the TML’s texts can be read by a screen-reader.

Begun in 1990 by Thomas J. Mathiesen, with support from Indiana University and the Jacobs School of Music and funding from the National Endowment for the Humanities from 1992 to 1995, the TML project is now under the direction of Giuliano Di Bacco. This resource would not exist but for many hours of transcription and proofreading by the seventy-five contributors acknowledged on the “Browse by Contributor” page. Oliver Ellsworth, Andreas Giger, Stephen Hayes, Peter Lefferts, Angela Mariani, Peter Slemon, and Bradley Jon Tucker deserve special mention, each having made a huge number of contributions to the project.

In the early days, the text files of the TML corpus were distributed via FTP and on CD-ROM. Mathiesen and his team released the web version in 1998, though for several years the data files were concurrently available for bulk download by individual users. The core of the corpus is its transcriptions of Latin theory already available in modern print editions, including those edited by Edmond de Coussemaker in the nineteenth century, those edited in the Corpus scriptorum de musica series published by the American Institute of Musicology, the publications of the Greek and Latin Music Theory series at the University of Nebraska, and various other editions published as stand-alone volumes or as appendices to peer-reviewed articles in a variety of musicological journals. In the early 2000s, a number of treatises were

3. According to the HTML 4.01 specification, to enable the correct pronunciation the language should be flagged in the code with the appropriate value for the @lang attribute, although the TML currently fails to follow this specification.
4. The technical and editorial staff are listed as follows: “Michael McClimon, Dana Barron, Sebastian Bisciglia, Daniel Bishop, with warm thanks to Magda Dragu, Bill Guerin, Adam Hochstetter, Elizabeth Elmi, Chelsey Hamm, and Molly Ryan”. “TML People,” TML, http://www.chml.indiana.edu/tml/about/people.
added to the TML that were transcribed by project team members directly from the medieval manuscripts. The “Browse by Source” page lists all the print editions and manuscript sources for the current corpus. The numbers that indicate the scope of the current corpus are summarized as follows: “As of June 2017, the archive contains over 8 million words and 18,000 graphics for around 950 unique titles in multiple versions, from 328 printed and 42 manuscript sources,” and a list of “Titles for future inclusion in the TML” on the same web page lists a further ninety-five items.

**Basic Principles and Structure**

The structure of the TML is relatively simple: it is a collection of HTML pages with associated metadata. In general, each HTML page is a transcription of a single medieval theory treatise. In the original TML these HTML pages were organized into nine directories according to date (third–fifth, sixth–eighth, ninth–eleventh, twelfth, thirteenth, fourteenth, fifteenth, sixteenth, and seventeenth centuries), and this organization still informs the “Browse: by century” section of the main navigation menu in the 2017 edition. At the outer realms of this corpus lie texts such as Censorinus’s *De die natali liber*, written in the third century, and Christiaan Huygens’s *Novus cyclus harmonicus*, published in 1724.

Two crucial decisions were made at the beginning of the project that facilitated the rapid transcription of texts, and simplified their presentation online. First, only the edited text of each treatise has been transcribed (or, in the case of manuscripts, transcribed as found in the individual manuscript source), without any further editorial intervention. Any additional text included in the print edition—the introduction, any commentary or notes, and the critical apparatus—was not transcribed. Second, music examples are presented in one of two ways: simple single-line examples, especially those that do not specify pitch, were recorded using a custom-based system of codes, while more complex music examples or diagrams are provided.

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9. Lengthy treatises—that is, those originally published in multivolume print editions—are split up into several HTML files.
on the TML as .gif images scanned from the original print editions or manuscripts. In other words, the more complex music examples and diagrams have not been encoded in a machine-readable format.14

The 2017 edition of the TML consists of a design update and some new features relating to its browse and search functionality. The new design is aesthetically pleasing, and its serif fonts on a light background make lengthy texts easy to read. A simple and user-friendly interface is well laid out with intuitive menu and navigation features, new buttons with filtering options, pop-up information windows, and collapsible and expandable texts. No user account or log-in is required, and the content of the 2017 edition is made available for further use under a Creative Commons license.15

Browsing the TML

While the number of unique titles contained in the archive is given as 950 (see above), this number represents a smaller number of actual treatises, since each separate edition of a treatise (including manuscript transcriptions) is counted as a unique title. Consider, for example, the treatises of the fourteenth-century French astronomer and music theorist Jean des Murs, known in Latin as Johannes de Muris. The “Browse” menu offers a number of different options: by author, contributor, incipit, source, title, and century. Selecting the author Johannes de Muris from the “Browse by Author” page renders a result set of thirty-three unique items ostensibly “by” Johannes de Muris (see Figure 1).16 Several items in this result set have identical titles: two items have the title Compendium musicae practicae, nine have the title Musica speculativa, and six have the title Libellus cantus mensurabilis. Clicking the [+], symbol to the left of each title makes the full reference for the transcription’s source viewable (either the bibliographic reference for the print edition, or the manuscript shelf number): thus we see that the six items titled Libellus cantus mensurabilis comprise the Coussemaker edition and five manuscript transcriptions (see Figure 2).17 Three additional items related to the Libellus are found within this result set. The item Libellus cantus mensurabilis [fragmentum] is a fragmentary manuscript transmission of the same text, and two items at the top of

14. In the old TML, a new window opened for each music example or diagram; in the 2017 edition, the images are now navigable as an image gallery that opens in the same window as the transcribed treatise.
15. “Creative Commons: Attribution 4.0 International (CC BY 4.0),” Creative Commons website, https://creativecommons.org/licenses/by/4.0/.
17. The unique TML identifier, a combination of uppercase letters relating to the author and source, is found in parentheses to the right of each title: the Coussemaker edition, for example, has the identifier MURLIB.
the list with titles beginning *Ars practica mensurabilis cantus* are also transcriptions of the *Libellus* treatise (in two distinct versions), in this case from the most recent and most authoritative edition by Christian Berktold.\(^\text{18}\)

Clicking on the first of the *Ars practica* texts, and then clicking the

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Figure 2  Screenshot from TML, showing the source references for Johannes de Muris’s *Libellus cantus mensurabilis*, accessed from http://www.chmtl.indiana.edu/tml/browse/authors. This figure appears in color in the online version of the *Journal*.
Johannes de Muris

*Ars practica mensurabilis cantus secundum Iohannem de Muris (Recensio A)*


• TML Notes
  
  Cf. MURARSPB, MURLIB, MURLIBF, MURLIBM, MURLIBM1, and MURLIBV-85. [TJM]

• Concordances

  We have found the following concordances with the *Lexicon musicum Latinum* [2] and the *Repertoire International des Sources Musicales*:

  (--) MURLIB/LIR/LS
  Johannes de Muris *Ars practica mensurabilis cantus (= Libellus cantus mensurabilis)*

Figure 3  Screenshot from TML, showing the page for Johannes de Muris’s *Ars practica mensurabilis cantus*... (Recensio A) with “TML Notes” and “Concordances,” http://www.chmtl.indiana.edu/tml/14th/MURARSPA. This figure appears in color in the online version of the *Journal*.

“TML Notes” and the “Concordances” buttons, informs the user “*Ars practica mensurabilis cantus* (= *Libellus cantus mensurabilis*)” and that “TJM” (Thomas J. Mathiesen) advises the user to “Cf. MURARSPB, MURLIB, MURLIBF, MURLIBM, MURLIBM1, and MURLIBV-85” (see Figure 3). These are cross-references to six transcriptions of the *Libellus* in the TML.19

Less expert users, however, encountering the list of the thirty-three items “by” Johannes de Muris via the “Browse by Author” page, have no intuitive way of deciphering the actual number of unique treatises by Johannes de Muris, or which might be the best version to read. They also might not be aware that several of these thirty-three items are no longer thought to be written by Johannes de Muris: the Grove article on Muris attributes just

19. The links for two of the *Libellus* items (MURLCM_MBAVB307 and MURLIBR_MBAVR114) are not included for some reason.
three music treatises securely to him. If the box “Include LmL authors” is checked in the “Actions” menu on the right sidebar of the “Browse by Author” page, a filtered list is returned with the TML transcriptions grouped by the treatise titles attributed to Johannes de Muris in the Lexicon musicum Latinum medii aevi (LmL) database (see Figure 4), although again this function would not be immediately obvious to an nonexpert. While some of this attribution information is available by clicking through to each text transcription and clicking the “TML Notes” button, perhaps a new release of the TML could include some visual differentiation in the “Browse by Author” results page, possibly by highlighting the most authoritative edition of a particular treatise, and/or placing check marks next to texts securely attributed to a particular author.

The contextual information included in the TML is deliberately sparse. A TML user who wants to know more about Johannes de Muris will need to look elsewhere: the purpose of the TML is for discovering and then reading theory treatises. Without the appropriate contextual background, however, navigating the numerous anonymous works in the TML corpus is difficult, even for the more experienced user. The “Browse by Author” page lists the generic author “Anonymous,” and selecting this checkbox returns the hundreds of titles attributed in the TML corpus to “Anonymous.” The “Browse by Author” page also lists individually the authors named as Anonymous 1–7 (with Arabic numerals) and Anonymous I–XII (with Roman numerals), and one other author known as “Anonymous OP” (see Figure 5). Anonymous IV is not the famous “Anonymous Four” who features in music history surveys as the only witness to the compositional activities of Léonin and Pérotin; this Anonymous IV is the fourth anonymous text of the third volume of Coussemaker’s edition, which is a treatise on fourteenth-century ars nova notation titled Compendium artis mensurabilis tam veteris quam novae and concordant with the text given the siglum “ANON. Paris. II” in the LmL. The historiographer of Notre-Dame polyphony and teacher of modal notation may be found by checking the box “Anonymous 4” in the list of anonymous

22. The TML uses Arabic numerals for the anonymous authors in Volume 1 of Coussemaker’s Scriptum de musica medii aevi; the Roman numerals are used for the anonymous authors in Volume 3.
23. “Anonymous IV: Compendium artis mensurabilis tam veteris quam novae,” TML, http://www.chmtl.indiana.edu/ml/15th/ANO4COM. Frustratingly, this treatise is still located in the “15th century” directory, even though it is copied in a Parisian manuscript whose copying date is given in RISM as ca. 1350 (Paris, Bibliothèque nationale, latin 15128).
authors: he is identical with the author labeled in the LmL as “ANON. Couss. IV” (see Figure 6).24

These examples highlight a set of overlapping problems confronting any reader of Latin music theory: in addition to the issues of dating and attribution, treatises that are frequently transmitted anonymously in the medieval sources in several different versions, often without specific titles, are cited in the scholarly literature in a variety of (mostly ad hoc) formats. Two new reference lists included in the 2017 TML mitigate some of these problems of citation and discovery. First, a complete concordance between the TML transcriptions and Matthew Balensuela’s list of anonymous theoretical works compiled for Grove Music Online is provided in the main navigation menu under “Extras.” Second, the page “Concordances with the Lexicon musicum Latinum” gives the unique siglum used for each music theory treatise cataloged in the LmL. Expanding each siglum by clicking the [+ ] symbol gives the LmL author, title, and incipit together with a link (or links) to the associated transcription(s) in the TML.


27. The “Actions” list in the right sidebar on this page allows the treatises to be sorted and formatted according to these four options.
Anonymous 4

[Musica]


Reproduced by permission of the Franz Steiner Verlag.

Electronic version prepared by Angela Mariani, Bradley Jon Tucker, and Thomas J. Mathiesen for the *Thesaurus Musicarum Latinarum*, 1994.

Figure 6  Screenshot from TML, showing the page for Anonymous 4’s *Musica* with “Concordances,” http://www.chml.indiana.edu/tml/13th/ANO4MUS. This figure appears in color in the online version of the *Journal*.
Searching the TML

Other than browsing through the content and locating a specific treatise to read, the other primary use of the TML is to search for terms across the entire corpus of transcribed texts. There are two options: a “Quick search” bar present on every page that allows searches across the entire corpus; and the “Search” option within the main navigation menu, where searches can be filtered (using “Search options” in the right sidebar) by date (century) and/or source type (print edition or manuscript).

The “Search the TML” page includes a bullet list of hints for searching; an example will best demonstrate the flexibility (and some of the quirks) of this process. My search was for references to mensuration signs, specifically the circle symbol used in mensural notation to indicate perfect (triple) time. The most directed kind of search is performed by enclosing the search phrase (“circulus rotundus”) in double quotation marks: this returns 16 results. Entering the same phrase without double quotation marks returns 23 results and is a more flexible way of searching, since it will return instances of either “circulus rotundus” or “rotundus circulus.” If I want to make sure my search includes all forms of this phrase, regardless of declension (that is, if I also want to see matches for “circulum rotundum”), I can add an asterisk to each term (“circul* rotund*,” again without quotation marks); this method, however, returns 137 results—a bit unwieldy, since my result set now contains references to “b rotundum,” a common way of referring to the pitch B in Latin music theory. Using the right sidebar to filter the results to the thirteenth–fifteenth centuries is somewhat helpful—reducing the result set to 84—and browsing through using the “Show matches” function for each individual treatise allows for a fairly quick review of the results.

What I would really like is some sort of “Shopping cart” function, in order to fine-tune and save my final result set. Each of the searches described above returns passages not present in one of the other searches. And even within the most specific set of search results there are several duplicate passages, since, as mentioned above, most treatises have two or more versions in the TML corpus. The sixteen results for “circulus rotundus” actually represent passages containing the term in just nine treatises. I would propose the addition of a checkbox next to each search result item, so that, as I carry out each search, items could be added to a personal “Shopping cart.” These passages could then be downloaded from my “Shopping cart” together with their bibliographic citations as a .txt or .csv file. If the authoritative edition of each treatise was flagged in the metadata (as described above), and thus also in the TML display of the search result set, the user’s fine-tuning of the search results could be even more efficient. Other kinds of manipulation of the search results would also be useful: in particular, sorting the result set by date or author, in ascending or descending order.
Future Plans

The most dreaded moment of any software development meeting is the point at which nonprogrammers excitedly start suggesting feature after feature, so I will refrain from any further “really neat” suggestions here. One of the pleasures of using the TML is actually its pared-down functionality and the simplicity of its user interface. At its core it is a directory of folders and files, and thus any computer user intuitively knows how to browse and search it.

Nonetheless, the editors of the 2017 edition position this release as “the first product of a plan that calls for the creation of an even more advanced resource, capable of sophisticated queries on text and eventually music.” In addition to the ninety-five new titles proposed for inclusion, other plans listed on the website include the provision of new higher-resolution graphics files for the music examples and diagrams, new search functionalities, and annotations for each transcription. Most ambitiously, this “future edition of the TML” will feature “text and music encoded in TEI (Text Encoding Initiative) and MEI (Music Encoding Initiative), the full delivery of which will depend on availability of funds.”

In closing, I include some final thoughts on the challenges and opportunities that might attend the TML’s future.

Challenges and Opportunities

In December 2015, the TML disappeared. The victim of a malicious cyber-attack, the site was off-line for several weeks. TML users were thus made acutely aware of their reliance on it. And for those scholars already suspicious of the ephemeral nature of digital content, their worst fears were confirmed. In her discussion of the reluctant scholarly embrace of digital content, Kathleen Fitzpatrick writes, “This is the kind of scenario that sets off warning bells for many traditional scholars; the idea of a book’s protocols suddenly becoming obsolete—the ink fading from the page, the pages refusing to turn—[is] unthinkable.” In truth, though, as Fitzpatrick observes, digital content stored on hard drives is actually very durable. And the TML content, of course, was not actually lost: the site resurfaced the following year with a better user interface, as a beta version of the new edition eventually released in 2017. But the question lingers: how can the preservation of and consistent access to the TML corpus be ensured for the next generation of

scholars? Fitzpatrick describes the preservation of digital content as fundamentally a social rather than a technical problem, requiring funding and community buy-in: “scholars who collaborate with one another, or with larger institutions, will be more likely to produce digital work that will be preserved.” Digitized archives require “a commitment to an ongoing series of costs,” the maintenance of which is probably better suited institutionally to a university library than to a department or school. What steps could the TML project team take to implement a social solution that ensures continued access to its content into the future?

Thanks to the collaborative efforts of the committed group of scholars who have worked with the TML project team since the early 1990s, most of the digitization, at least with respect to the corpus of Latin theory published in print editions, is complete, albeit in HTML, which encodes only the text characters and formatting. If such a digitization project were begun today, the content would likely be encoded following community-based standards for encoding text and music, such as the TEI and the MEI. But while the stated plans for a future edition of the TML include new encodings of the transcribed text and music examples in TEI and MEI, as the TML project team acknowledges, this would require a significant new influx of funds. Such an effort would be relatively time-intensive, and would not result in an immediate difference for the end-user without the development of new tools that could leverage these standards-based encodings. In order to guarantee continued access to the digital content of completed projects, including those begun decades earlier whose format and design may not align with currently accepted standards, and where funds may not be available for continuous maintenance or updating, Fitzpatrick argues for what she terms a “planned obsolescence” through initiatives such as the Mellon-supported CLOCKSS project ("Lots of Copies Keep Stuff Safe"). CLOCKSS provides a secure but lightweight long-term infrastructure for the preservation of electronic scholarship (electronic articles and e-books). Should the TML consider depositing its current corpus in a sustainable long-term archive, and move beyond its digitization efforts toward a new phase of development that would attract a new and expanded user base?

The crossroads at which the TML now stands is one familiar to other humanities computing projects that emerged in the late 1980s and early 1990s. Consider, for example, the Perseus Digital Library (Tufts University; Gregory R. Crane, Editor-in-Chief), begun in 1985, a project that assembles

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32. Ibid., 126.
33. Ibid., 153.
34. According to the website, the archive currently has “26,000 serials titles and 183,000 book titles preserved, in progress or committed for preservation by CLOCKSS”: “What’s in CLOCKSS?,” CLOCKSS, accessed June 14, 2019, https://clockss.org/whats-in-clockss/.
machine-readable versions of Greco-Roman texts. Of their mission, the Perseus editors write,

> We do not know what form such fundamental instruments as editions, lexica, 
> encyclopedias, atlases, diagrams, museum catalogues, and archaeological site 
> reports will assume [in the future], but we know that the infrastructure that we 
> design now will materially enable or constrict how the next generation will be 
> able to read languages from the past, scrutinize ancient artifacts, and explore 
> the historical spaces.35

This acknowledgment indicates that, given the ever-changing processes deployed over the last few thousand years for recording, disseminating, and collecting texts, project goals focusing on comprehensiveness and preservation are only ever partially attainable. The newest iteration of Perseus is the Perseids Project, which moves away from digitization and “aims to support access to scholarship in Classics for students and members of the public at all levels of competence. [It provides] a suite of tools that foster language acquisition, facilitate working with documents, and encourage research.”36

What sorts of tools and interfaces could the TML provide that would allow for more interactive participation by its user base, which must of necessity be broader than a small coterie of medieval and Renaissance specialists with an interest in Latin music theory? One suggestion might be to develop a standardized model for the addition of new TML content that would allow scholars working on new editions and translations to easily contribute their work to the TML project, while still retaining ownership of their own scholarly content (and allow them to publish this content on their personal websites, for example, or to store their “TML publications” within their own institutional repositories). Another possibility could be the development of case studies and tools for using the TML in the classroom. How could, for example, music history students engage more directly with the words of Anonymous 4 on the history of music at Notre-Dame cathedral? How might the discussions of interval species in the treatises of Boethius, Hucbald, and Guido be incorporated into introductory music theory classes? Can we teach our students to sing thirteenth-century motets from the original notation using Franco of Cologne’s treatise to explain the basic rules? What would be especially useful in a teaching context is a tool to link and display passages from the TML alongside English translations of the passages in question. Such uses of the TML would be possible if the TML incorporated protocols to allow its content (individual texts, specific passages, music examples, and queries)

to be directly referenced and interoperable within online teaching tools and other web-based applications.  

Technologies of digitization are developing at a rapid pace, and may soon not require human transcribers. Several projects currently under development use a combination of computer vision and computer-based deep learning to recognize the paleographic features of a whole range of handwritten documents from ancient languages copied on papyrus to modern-day scripts: two key projects are Transkribus at the University of Innsbruck and eScripta at Université Paris Sciences et Lettres (PSL). When entire handwritten manuscripts and collections can be read with a high level of accuracy by computers, research questions will emerge from that data that we have not yet thought of asking. Yet the TML project team’s careful and methodical thinking-through of the issues—browsing, searching, cataloging, encoding, cross-referencing—related to creating a digital archive of Latin music theory has laid the crucial groundwork for the way these music writings will be read and understood by future generations. I am in awe of what the team has achieved to date. The TML has had a huge impact on my own scholarship and on the field of musicology in general. These concluding thoughts are not intended in any way as a criticism of the TML or of its developmental priorities to date. No doubt the forward-thinking TML project team has already considered several of these ideas; many of its current users, myself included, look forward to playing a more active role in its growth over the coming years.

KAREN DESMOND

The Global Jukebox. Anna L. Wood, Creative Director and Anthropologist; Gideon D’Arcangelo, Consulting Executive Producer; Victor Grauer, Codeveloper and Cantometrics Project Advisor; Forrestine Paulay, Codeveloper and Choreometrics Director; et al. URL: https://theglobaljukebox.org/

The Global Jukebox has a venerable history and significant aims. Its central principle is what founder Alan Lomax named “cultural equity,” “the right of

37. For citing specific passages in digital texts, see, for example, the Canonical Text Services (CTS) specification, developed as part of the architecture for the Homer Multitext project (“As many Homers as you please”), http://www.homermultitext.org/. For encoded music, Raffaele Viglianti’s Enhancing Music Notation Addressability (EMA) project creates a system for citing specific passages within a music document in a digital environment, so that passages of notation can be found and retrieved by other applications: “Enhancing Music Notation Addressability,” Maryland Institute for Technology in the Humanities website, https://mith.umd.edu/research/enhancing-music-notation-addressability/.

all people to practice, maintain and pass down their languages, customs and traditions with equal respect and with harm to no one." The safeguarding of the world’s plethora of perspectives and experiences is growing ever more urgent as many confront displacement as a result of political upheavals and climate change, and the promise of the Internet to be a tool for equality threatens to dissolve under the hegemony of mass-produced culture. In the face of these issues, the Global Jukebox is more than just an online museum of sound: the remit is expansive and ambitious. It is intended as a resource for teachers, students, and scholars, enabling them to discover a rich, global tapestry of ethnomusicological content and to explore patterns of connection between the sounds and movements of various cultures. But as well as being a tool for pedagogy and data science, the site also aims to connect people with their cultural heritage. It is for migrants and refugees, separated from their birthplace, “who miss the sounds and body language of home”; it is also for indigenous peoples, “desiring to hear the thrilling voices of their grandparents and great grandparents, and to see the dances which had been for them the most beautiful.”

An assessment of the site must therefore take into account its philosophy as well as the practicalities of its interface. While I will describe here a number of pitfalls in the user experience and suggestions for improvement, this is undertaken out of a deep appreciation of the project team’s ideology and ongoing hard work. I hope that this resource will continue to be nurtured and developed, and I encourage readers to interact with it and offer useful feedback.

The project was originally conceived in 1960 by musicologist Lomax and anthropologist Conrad Arensberg at Columbia University and Hunter College/CUNY. Their scholarly aim was to encode data about expressive styles, and this resulted in, among other things, cantometrics (co-invented with Victor Grauer) and choreometrics. These systems allowed for the codification of performance and aesthetic styles. In the case of cantometrics, thirty-seven variables were identified, including core musical attributes such as the organization of an ensemble and melodic form, attributes associated with emotion and gender, dynamic qualities, and other attributes such as vocal register. This process of encoding forms the basis of the analytic tools offered by the site. The website version of the Global Jukebox, launched in 2017, is directed by anthropologist and folklorist Anna Lomax Wood, who is also the President of the Association for Cultural Equity. Wood heads an impressive team of developers, musicologists, dance researchers, anthropologists, and data analysts.

There are a number of ways of exploring the website. The home page offers a set of boxes to click on that are quick entry points and that also explain a little about the functionality of each tool. “Steer the Wheel” consists of three color-coded rings around a central image of the globe (see Figure 1). The innermost ring divides the globe into major geographic regions, the next subdivides those regions into smaller subregions, and the outermost ring further subdivides into groupings of peoples, cultures, and more localized regions. Mousing over any of the colored ring sections will generate a title for the selected regional or cultural unit in the upper right-hand corner of the screen (not shown here). You can only click on the outermost ring, and doing so will produce a list of cultures, dances, and songs and begin a playlist of recordings; it will also center the globe on that geographic point. (It is worth noting that as you mouse over the wheel, while the region title in the upper right-hand corner will change, the culture, dance, and song metadata for any grouping you have already clicked on will remain visible below. This caused me a little confusion at first.)

The interface for the Wheel is not perfect. It took me a little while to work out that clicking on the icon of two people in the upper right-hand corner turns on markers that indicate information about dance. Clicking on the up arrow next to the selected culture in the lower left-hand corner brings up a “Highlight Related” bar, but clicking on the choices here does not appear to highlight anything. Despite these issues, the Wheel is undeniably compelling and enjoyable. As an educational resource, its value is immense, allowing students to navigate the myriad forms of musical expression with ease. Using the “Random—surprise me!” button in the lower left-hand corner will select one song from the collection for you (and then play the remainder of that regional playlist), while the “Wander the earth!” button (represented for some reason by a replay symbol) will take you on an endless journey through the collection, spinning the Wheel after each recording to take you to a new destination.

Listening to the recordings (some of which play directly in the site and some of which open a Spotify pop-up) is a captivating experience. Many date back to the 1960s, with all the expected tinny quality, but this only serves to enhance the sensation of journeying to other cultures. We leave behind the world of overproduced perfection and meet real human voices. Lomax’s tapes captured the ambient soundscape together with the music—coughing, cicadas, frogs, laughter, bodies moving. The metadata for each recording is extensive and includes Lomax’s cantometric coding in addition to information about language, culture, and region.3

To take a slightly different journey through the collection, use “Explore the Map” (see Figure 2). This represents peoples on a world map by means

3. From the home page, the sections entitled “Find Out about a Song, a Dance . . .” and “Profile of Performance Traits” guide the user in exploring the metadata and coding.
of colored dots. Size is relative to the number of cultures, and color connects subregions. (The color scheme is the same as that used for the Wheel.) The layout is largely helpful for seeing diasporas at a glance, although this can be somewhat obscured by the number of different colors required. (For instance, Southern Africa and South America have very similar color schemes but are not linked by diaspora.) Clicking on a colored dot will frequently open a further network of dots identifying the exact geographic region of individual cultures. The user can move between these by clicking on the list of cultures displayed on the right-hand side of the screen.

I would be interested to see some more information on the division of regions and cultures. Click, for example, on the East Anglia region of England and you find that “London Folk” and “Durham” are included in the list,

Figure 1  Screenshot from the Global Jukebox, showing the “Steer the Wheel” tool, https://theglobaljukebox.org/. This figure appears in color in the online version of the Journal.
Figure 2. Screenshot from the Global Jukebox, showing the "Explore the Map" tool, https://theglobaljukebox.org/. This figure appears in color in the online version of the Journal.
neither of which is part of modern East Anglia or the medieval kingdom of the East Angles. It is likely that these groupings were based on the cantometric analysis, so it would be useful to have some explanation of the decision-making process.

The organization of the Wheel and Map is interesting not only for anthropologists and ethnomusicologists, but also for those who research the way we codify a world shaped by colonialism, slavery, and diaspora. When we examine the Wheel and the color coding of the Map, it is not only connections of sound and movement that emerge, but of history, too. Lomax was predominantly recording cultures in situ, but the data he collected could not ignore the African and European influences upon North, Central, and South America. This raises interesting questions about the future development of this resource. As the human population becomes ever more mobile, whether through affluence or displacement, as history identifies more cultural diaspora in our pasts, and as anthropology discovers more cultural nuance, how will the site codify this information?

Once you have left the home page and are exploring the Wheel or the Map, you will have access to a search box at the top of the interface. This allows you to search by an individual culture, all cultures (which “finds cultures whose region, subregion or grouping matches the search term”),4 or a genre. This is a helpful way of exploring the site, although it would be useful to be able to browse a list of cultures and genres and to see how these are articulated within the cantometric theory of expressive style. The metadata for each song will usually contain a short blurb on the people or culture from which it originates, but I could not find a link to an overall list. Nevertheless, delving into different genres and cultures via the search box, Wheel, or Map and exploring the individual metadata is a thrilling experience for any musician/musicologist, and even if a browsing list of cultures and genres is added in the future, I would strongly encourage any user to make the Wheel and Map functions their first port of call.

I find the use of language on this site particularly appealing. Often eschewing what might be considered more objective academic language, the site embraces warmth, openness, and invitation. Take, for example, Research Associate Kathleen Rivera’s inducement to join “Global Journey 1”:

Come travelers, come listeners, lay down your burdens and roam far from home. All are welcome, all encouraged to open their hearts and minds to the unique and mysterious voices we’ll encounter along the way. Follow the call of humanity’s song. In time, the path will change, our tracks will alter course, but keep a weather eye on that destination straight ahead. Marvel at the horizon shared by all on earth.5

4. “Culture Search,” accessed via the “Search the Culture” panel on the home page.
5. Kathleen Rivera, “Global Journey 1,” accessed from the home page or under “Journeys” in the three-line menu in the upper left-hand corner of the screen.
The “Journeys” offered by the Global Jukebox (accessed from the home page or from the three-line menu in the upper left-hand corner of the screen) are a very good way for the newcomer to experience the power and potential of the site. Some, like “Global Journey 1,” explore connections, taking the listener on a trail across the Map accompanied by a playlist of recordings; others, such as Lamont Jack Pearley’s “Global Juke Joint,” are personal stories that delve into rich heritage.

For those who wish to use the site for analysis, the “Patterns” and “Similarities” tools can help (again, accessed from the home page or from the three-line menu, under “Analytics” and then “Visitor Queries & Analysis”). “Patterns” allows the user to click on specific features in the cantometric coding sheet and see which cultures embody those kinds of patterns. You can use the Map or the Wheel for this. The Wheel is slightly more successful because you can see the individual markers pop out around the outside of the circle. One problem, however, is that, using my laptop, I was not able to see the bottom of the Wheel and could not scroll down (I tried in different browsers), though I was able to use CTRL +/– to change the overall screen size. While this solved the problem, it did make the Wheel and text smaller and harder to interact with, which will provide accessibility problems for some. Using the Map did not present the same problems, since it can be zoomed and dragged, but it was sometimes harder to see which cultures were being highlighted. For example, clicking “maximal glissando” on the cantometric table identifies two cultures in the Western Highlands Province of Papua New Guinea, but this was a little tricky to spot given the cluster of highlights. It also made me wonder how well this feature would work with screen readers for the visually impaired.

“Similarities” allows the user to select a culture or region and discover which others are most like it on the basis of Lomax and Grauer’s cantometric coding (see Figure 3). Again, using the Wheel makes seeing which cultures have been highlighted a little easier. For the most part, similarities between cultures grouped as I expected, but exploring the tool also revealed some surprises for me. For example, northeast Siberia and Patagonia in South America showed more than 78 percent similarity, causing me to wonder why and listen to the recordings. This could be a very productive way of making schoolchildren interested in exploring similarities and differences in world music. It would be useful, though, to be able to click on the top matches in the generated lists in order to move more easily between the cultures identified as similar. The site creators have indicated that being able to create playlists is a future intention, and I can only imagine what an enjoyable and enlightening classroom exercise this could be when combined with the “Similarities” or “Patterns” tools.

I found the overall menu structure confusing at times, as material is duplicated between some of the menus. When using the “Global Journey 1” interface, I found a panel opened on the left-hand side that is similar in design.
Figure 3  Screenshot from the Global Jukebox, showing the “Similarities” tool, https://theglobaljukebox.org/. This figure appears in color in the online version of the Journal.
to the “About” panel and appears in the same position as both the “About” panel and the three-line menu. (The “About” panel is accessed from the navigation menu along the bottom of the screen.) After closing the “Global Journey” panel, it took a little bit of exploration to realize that I could re-open it at the bottom of the screen, though not via the same menu as the “About” panel. The three-line menu could be described as the technical version of the “About” menu. It presents in subpanels snippets of information about the science and analytics used by the site. Delving into the subsections of the three-line menu can in fact lead to some more extensive information panes or take you into one of the Journeys. (You cannot always navigate back from these and may have to click on the three-line icon again.) From a user experience perspective, it would be helpful to have a clearer distinction between the various menus and the information to which they provide access; a reimagining of the menu structure could also make the user experience smoother. It might work better if the menus directed the user to some information pages (and it would no doubt make accessibility easier). The bottom navigation menu contains a “Tour” option that opens up dialogue boxes that guide the user on using the Wheel, Map, and Journeys options. This is very helpful, although I found that some of the boxes auto-closed very quickly before I had time to fully read them.

At several points in the “About” pane, the creators hint at what is to come, including the ability to create playlists and make enhancements to usability. This is encouraging. The Global Jukebox is the result of years of work by an enormous team of people, and it is important that this work continues. In a resource of this size, there are, of course, gaps. From my own Anglo-Celtic perspective, it was noticeable that the Welsh songs are all in English (the metadata identifies them as Welsh language) and there are no Cornish songs at all. The site does, however, welcome contributions, and this is an opportunity to add corrections, expand the metadata, and tell more stories about these pieces of music. For example, “The Nutting Girl,” discoverable in the East Anglia playlist, is part of the Bampton tradition of English morris dancing and is still widely used today; there are many morris performers who could share tales of its use, and I would encourage groups such as the Morris Ring to explore the site and contribute their knowledge—for instance, concerning the similarities between morris and some of the Catalan and Basque dances.

Over time, more examples would be beneficial. As the site explains, “Lomax and Grauer found that coding more than ten songs from a culture usually resulted in little new information, so samples of songs for each culture or community are often quite small.” Accordingly, many cultures are indeed represented by only a few example recordings. The site creators

promise, however, that many more examples will be added, which is reassuring, since while a few samples may serve for the cantometric analysis, the humanistic aims of the project (that is, to connect people with their cultural and historical heritage and to amplify marginalized voices) require a greater number of examples.

Overall, the user experience of this site is a mixed bag at present, and yet my enthusiasm is not diminished. Digital humanities projects of this scale and ambition often experience a few glitches in their early years. But the rule is to publish early and garner user feedback, so the site cannot be heavily criticized for minor teething problems. I, for one, am glad that this resource has been made widely available, because bugs aside, the music, together with its gloriously ample metadata, is too exciting and important to languish in a basement in the Library of Congress. My advice is to use the site and send your comments and feedback; good digital project managers will not only expect but welcome your input.

As the site develops further, it would benefit from the provision of hyperlinks to sites that specialize in regional music and dance history. The Morris Ring is just one example I can offer from my own Anglo-Celtic perspective. Another would be the Global Gaelic Jukebox, directed by Dr. Sim Innes and Dr. Barbara Hillers, a project with similar aims to those of the Global Jukebox. But beyond the boundaries of the British Isles, there are innumerable websites and projects dedicated to sharing and making visible cultures of music and dance, and the Global Jukebox would benefit from exploring the connective potential. In addition, a greater social media presence would allow it to draw attention to the excellent work of all on the project and share updates and new material. I would also suggest that a mobile version of the site should be explored; as it currently stands, it is not at all practical to use it from a mobile device.

The Global Jukebox has lofty aims and it is clear that there is an intention to do more and develop further, but the onus is also upon the community to use it and respond to it. Today’s plethora of digital projects places new demands upon us as scholars, librarians, archivists, and other users. Books and CDs about the world’s music sit on our library shelves, unchanging monuments to the eras in which they were conceived, but digital projects can and indeed must have a different kind of life. If we are to enjoy the fruits of labor presented on sites such as the Global Jukebox, we must also be prepared to answer the challenge of how digital projects can be sustained and allowed to evolve into new things. This project has evolved from one man’s vision realized on reels of tape, to a CD-ROM, to a website that invites contribution as well as use. The question becomes not just how to use such a resource, but how to contribute to and promote it? Grant money has generously brought

the project this far and the site invites users to donate, but it will be easier to attract the necessary funding if we commit as a community to using, participating, and contributing.

It is also important to be involved with projects of this nature, because while Lomax’s approach was founded in cultural sensitivity and the belief that all forms of creative expression are equally important, this is, nonetheless, a resource conceived and managed from a largely white, North American perspective. The distinctions of culture are based on a particular anthropological approach, and the analytics of pattern and similarity are drawn from the specific codification of cantometrics, a system that has not been universally accepted and that has its detractors. Such approaches and codifications must be continually questioned. We must also ask how equity and access to cultural resources can be fostered when access to digital resources is itself a privilege. This is by no means to say that we should dismiss the Global Jukebox on these grounds; rather that we should participate and ask the difficult questions that the burden of academia demands of us.

Projects such as this, with such a wide-ranging remit, are rare and special, and they deserve our attention. They force us to face difficult questions about the potential erasure of the diversity of human experience, about the loss of unique perspectives, and about our abilities to categorize, preserve, record, and convey human existence and experience. Is this site always successful? As a website, or as a complete archive, or even as a tool for global equity? Not always. But that is hardly the point. Such grand aims are not about success, but about a journey toward a horizon of cultural equality that we may never reach, but for which we must always strive.

TAMSYN MAHONEY-STEEL

Measuring Polyphony: Digital Encodings of Late Medieval Music. Karen Desmond, Project Director. URL: https://measuringpolyphony.org/

Transcription is hard. Complicated or unfamiliar music makes it harder. In his book on music editing, James Grier reminds us that the edited or transcribed musical text is “not so much a tool, leading to higher ends, as an active, critical participant in those ends, fostering further critical study and the ultimate goal, one hopes, of all types of musical endeavour, the animation of the music in performance.”1 These are high stakes, especially when the pieces at hand are motets from the end of the medieval era, written in mensural notation.

The website Measuring Polyphony uses the most recent technology in digital transcription to “animate” upward of sixty of these motets as found in the pages of several well-known thirteenth- and fourteenth-century manuscripts. This project is more than simply a digital update to the more traditional format of the printed edition; each piece is linked to a high-resolution image of its appearance in the original manuscript, and an audio playback (in MIDI) is available for listening while watching the notes in the various voice parts turn red as they sound. These visual and auditory features lift these motets out of their traditional identity as academic notation exercises and imbue them with life, appealing to the “musician” within the “musicologist.” As a medievalist, my view is that we badly need this kind of revitalization, especially in the current academic climate, in which our field flirts increasingly with extinction. We must use all the technology now available to us to fill the experiential gaps left by traditional print editions in order to cultivate a genuine appreciation of the richness of the *ars nova* repertoire in the next generation of scholars. As Margaret Bent warns, “without that symbiotic relationship of shared expectations, notated music is like seaweed out of water; as time passes, it becomes divorced from what originally gave it vitality and beauty.” Measuring Polyphony is a helpful, hopeful little pool that will benefit the musicological community by growing and deepening in the future.

Digital humanities methodologies notwithstanding, it is still easy for students of thirteenth- and fourteenth-century mensural notation to get sidetracked by the initial tasks of learning to recognize the various Franconian note types, memorizing the rules for their interpretation, and then testing their understanding by transcribing each voice part in modern notation, hoping against hope that they all end at the same time. With these priorities, is there time to really think about what these pieces might have sounded like at their first performances, or what color the ink on the manuscript page was, or whether the audiences were pleased with the new sounds? Craig Wright describes his experience as a student in a “Notation of Polyphonic Music” course in the 1960s in this way:

Our assignment was to convert these medieval documents into equivalents in modern musical notation. At no time did we ask, “Why should we want to do this?” “What might we accomplish?” “What damage might we do through this exercise?” We were students. This was Harvard. It was not our place to challenge the rules of the game; we were simply trying to ascertain what the rules were—how the game was played or the piece transcribed. More specific questions might have been: “How does this manuscript relate to performance?” “Is this a prescriptive document intending to allow performers to recreate a work of art from

these signs?” . . . Thus we failed to ask—nor were we encouraged to ask—the most basic question: “What is this document that we see on the page?”

The transcriptions and links on Measuring Polyphony address this question and welcome other researchers into that process.

From a theoretical standpoint, late medieval motets are a perfect fit for the methods and assumptions of twenty-first-century digital transcription. The logic informing their compositional style is well documented. Anonymous IV’s account of the Notre-Dame school and Franco of Cologne’s *Ars cantus mensurabilis* are still key sources for most undergraduate survey courses, and upper-year students in notation seminars regularly come across fourteenth-century treatises such as Johannes de Muris’s *Notitia artis musicae* and Jacques de Liège’s *Speculum musicae*. Several other thirteenth- and fourteenth-century books could augment this list further. Such rigorous documentation in the fourteenth century of a new way of conceiving of music that uses *time* as a guiding principle is a witness to the deliberate proliferation of this new music across western Europe and its academic associations with mathematics and geometry in the scholastic quadrivium. Expressing and measuring time in and through music was a radically new way of composing and conceiving of the demands and implications of harmony, let alone examining what a piece of music actually is in the first place. Measuring Polyphony celebrates, with this same kind of attention and exactitude, the complexity and ingenuity of late medieval harmony; it is the latest in a centuries-long chain of musical projects that take these fascinating motets as opportunities to look

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deeply into what they represent in terms of musical possibilities, assumptions, and expectations.

In practical terms, Measuring Polyphony offers the user MEI (Music Encoding Initiative) transcriptions of more than sixty pieces found in three fourteenth-century manuscripts. The transcriptions can be viewed, downloaded, or printed, in either modern notation or using a digitized form of the original notation through Verovio, an open-source, online library for engraving MEI. The pieces can also be heard through the browser by activating an audio playback feature of Verovio. These pieces include twenty-four ars antiqua and ars nova motets from the Montpellier Codex, eighteen motets from the Roman de Fauvel, and twenty-two from the Ivrea Codex. The texts for the motets in the Roman de Fauvel and the Montpellier source were transcribed from images of the originals, and those for the motets in the Ivrea Codex were taken from an edition.

The website itself is divided into two main pages: “About,” in which the entire project is explained, and the names of researchers, developers, and contributors are listed; and “Browse,” in which the motets are listed by composer and by the opening text of each voice part. Someone less familiar with the repertoire might appreciate the addition of a column indicating the manuscript source for each motet, though this information is included with the individual transcriptions. The motet list under “Browse” (see Figure 1) links to the individual transcriptions, an example of which is shown in Figure 2. Here, the transcription is displayed digitally using the Verovio engraver to represent the original notation on screen. If the user would rather see it in modern notation, the red “Switch score to modern notation” command in the upper right-hand corner will toggle the view. To the left of this switch is the option to play the transcription on MIDI as the notation scrolls by. Beneath the transcription, the user can click to download the MEI code for the transcription (which requires an environment in which to run XML code) or a printable version of the transcription itself in either modern or mensural notation. Appropriate metadata for the piece is also given, including its source, concordances, and notes on its transcription.

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8. Respectively, Montpellier, Bibliothèque interuniversitaire, Section Médecine, H 196; Paris, Bibliothèque nationale de France, Département des Manuscrits, français 146; and Ivrea, Biblioteca capitolare, 115.

Figure 1  Screenshot from Measuring Polyphony, showing part of the “Browse” page, accessed July 14, 2019, https://measuringpolyphony.org/transcriptions.html. This figure appears in color in the online version of the Journal.
Figure 2  Screenshot from Measuring Polyphony, showing the page for one of the individual transcriptions, accessed July 14, 2019, https://measuringpolyphony.org/display.html?/assets/mensural/adepto_MENSURAL.mei. This figure appears in color in the online version of the Journal.
Karen Desmond of Brandeis University is both Project Director and visionary for Measuring Polyphony and was forthcoming in answering my questions about the development of and future plans for the project. She was quick to credit the technical expertise at McGill University, where Martha E. Thomae developed the scripts necessary to transform transcription in modern notation into the MEI-encoded mensural notation. Several graduate students and postdocs from both Brandeis and McGill are listed on the site as having provided editorial or user-interface (UI)/design assistance. Laurent Pugin (RISM, Switzerland) provided the Verovio customization.

The project is built on Desmond’s transcriptions of these motets into Sibelius in 2015. Each piece took between forty-five minutes and two hours to type into the program (or scan from an edition and then manually correct). At that time, Desmond’s research interests centred on the notation itself, so the transcriptions were ultimately checked against images of the original and double-checked whenever ficta appeared. Since Sibelius does not support queries or analysis of the transcription, Desmond turned to music analytical software, under development at the time, to help to identify aspects of her Sibelius transcriptions that would have seemed “new” (ars nova, after all) to a fourteenth-century audience. By working closely with the MEI community, she developed a schema for MEI that would address the challenges of mensural notation, using the fourteenth-century rules. Fortunately, most of these rules are clearly set out in the sources like 700-year-old “ReadMe” files.

Turning a manuscript score into a Sibelius file and then into MEI holds our assumptions about musical syntax and grammar up to the light. In the thirteenth and fourteenth centuries, mensural notation for the first time expressed rhythm at a level as fundamental as pitch, adding a new layer of complexity to the relationships between voice parts. There were as yet no standards concerning what might be allowed and what was not, and the variations in complexity are sometimes downright intimidating. For example, there are currently seven motets that are impossible to display using Verovio on account of their use of mixed mensurations mid-piece. It will be the MEI community itself, made up of researchers who use MEI and driven by a management board and technical team, that addresses this problem, using it as a test case for improving its overall adaptability to other notation challenges. The summer of 2019 will see development of an input tool for ars antiqua and ars nova notation, allowing users to contribute their own transcriptions online and listen to them as they go. Desmond envisions musicologists locating an image on DIAMM and transcribing the note shapes they see (longs, breves, semibreves, etc.) in a separate input tool window on their screen. She successfully piloted the site in a recent university “Early Notations” course and saw both the need and the capacity to develop the tool in order to increase the site’s usefulness. Such an input tool would certainly increase the number of pieces in the collection—on Desmond’s wish list.
are the one hundred motets in the Bamberg Codex—helping musicologists to gain a broader and more substantial overview of the “new style.” It is important, however, that the input tool should not presuppose extensive knowledge of Sibelius or XML; users should be able to simply transcribe what they see. Perhaps the audio playback could also be made to play only select voices at a time, in the event that someone would like to test their skill by playing or singing against it. Similarly, if two competing versions of a piece exist, the playback systems could allow the researcher to make instantaneous aural comparisons, as opposed to laborious visual ones.

With the technical challenges for encoding and displaying mensural notation now well in hand, the next step will be: Analysis. One of the most powerful ways in which computers can aid musicology is in comparative study on a scale impossible for individual researchers, allowing us to skip over the initial step of repetitive manual work and moving the starting line for research right up to the edge of notational *terra incognita*. With even a roughly sketched treasure map of this new land in hand, we will get a better start.

The Measuring Polyphony project takes a progressive stand on “open source” as a methodology and philosophy. In addition to the free downloads of all the editions in both notation types, the code and the Sibelius transcriptions are also available on the open-source version of GitHub, a development platform used all over the world to host code and facilitate projects in a way that is open to all. This kind of generous scholarship goes hand in hand with Desmond’s resolve to make the results of this project available before they are perfect, preferring to solicit help and advice from the scholarly community rather than present a “finished product”—the idea of which, especially in the world of editions, is suspect at the best of times.

The astonishing (and daily increasing) number of high-quality manuscript images now available on the Internet ought to constitute nothing but good news for musicological scholarship, but their value seems to be determined by the collective imagination of the researchers who use them. Are these images to be understood as simply electronic facsimiles, now more widely and cheaply available than their hard-copy predecessors? Or are there ways of working with these images that will further scholarship itself? The answer depends on the kind of attention we pay to the music and how intensely we scrutinize the way it is represented on the page. The particular layouts and the tiny horizontal and vertical distributions of notes and text tell us about the way this music was understood, just as any glossing or additional comments written in at a later date give us an indication of its life over time. Measuring Polyphony has grown with the

various phases of online image policies over the past five years, building in the ability to refer to online images from IIIF (the International Image Interoperability Framework, a standardized method of providing images and metadata on the Internet),\textsuperscript{11} as well as from individual library and archive websites.

As it stands, Measuring Polyphony is a great pedagogical resource that can be used to introduce the next generation to the intricacies of mensural notation and the complex and astounding music that it encodes. The ability to see each motet in both a representation of the original notation and modern notation puts to rest questions about note values and time signatures in a quick and clear way—something that previous editions have seemed at great pains to do, with mostly underwhelming results. Of course, “digital natives” expect to use the digital images and metadata to power through the spadework of transcribing, to accelerate the business of comparing repertoires for musical and exegetical similarities, and to explore how the manipulation of tempos and tuning systems can be used to render this music more vibrant and alive than formerly.

As image-document analysis software becomes more able to deal with all the usual challenges (such as warping of the page, faded ink colors, and marginalia) it will perhaps automatically decipher, identify, and classify mensural notation with only minimal help from a human musicologist to train it on the Franconian rules. Ideally, there would be a way of coupling the input tool, currently under development, with the classroom as well as our colleagues, so that the number of pieces available on the site can continue to grow and inspire our understanding of our musical history.

KATE HELSEN

\textit{International Music Score Library Project (IMSLP).} Edward W. Guo, Project Founder; Project Petrucci LLC, Owner. URL: https://imslp.org

\textit{Six pièces faciles,} op. 13 (published in 1925), is a set of solo guitar pieces by Antonio Alba (see Figure 1).\textsuperscript{1} I discovered this score thanks to the “random page” navigation feature on the International Music Score Library Project (IMSLP) home page. Alba was new to me. Through a quick Internet search, I learned that he was a Catalan guitarist, composer, and music teacher who lived in Chile from 1873 to 1940. He composed more than 400 pieces, 250

\textsuperscript{11}. For an explanation of this image format, see Sarah Ann Long, review of International Image Interoperability Framework (IIIF), Gallica, and e-codices: Virtual Manuscript Library of Switzerland, this \textit{Journal} 71, no. 2 (Summer 2018): 561–72.

\textsuperscript{1}. See “Antonio Alba,” IMSLP, https://imslp.org/wiki/Category:Alba%2C_Antonio. Unless otherwise noted, the links cited in this review were accessed in July 2019.
Figure 1. Screenshot from IMSLP showing the page for Antonio Alba’s Six pièces faciles, Op. 13, https://imslp.org/wiki/6_Pièces_faciles%2C_Op.13_(Alba%2C_Antonio). This figure appears in color in the online version of the Journal.
of which were printed by commercial publishers in Valparaíso, Barcelona, Madrid, and Paris. Works for guitar make up the bulk of Alba’s output. I clicked on his IMSLP artist profile and saw twenty-two of his compositions available to download. For each work on IMSLP, I could download a scan of the first printed edition, a nonprofessionally engraved modern edition, and tablature.

IMSLP is a digital archive of public domain music scores available for free download. The site was founded in 2006 by Edward Guo, then a composition student at the New England Conservatory. Thirteen years later, IMSLP has grown from an obscure experiment by a nineteen-year-old undergraduate to a major resource accessed by more than 3.4 million unique monthly visitors from around the globe. Comprising more than 480,000 scores, parts, and arrangements by roughly 17,700 composers, IMSLP has become an essential Internet resource for classically trained musicians (see Figure 2). The website is a nonprofit entity managed by Project Petrucci, a limited liability company with twenty-five full-time employees. It supports its operations by selling advertising space and soliciting donations from individuals and foundations. Like Spotify, it has a premium (paid) subscription option with fewer advertisements and faster file downloads. Most of the scores on the site are uploaded by volunteer users, and these volunteers also scour the files in the archive to identify copyright issues. In addition to music scores, IMSLP has a partnership with Naxos Music Library that provides streaming access to thousands of recordings for premium (paid) subscribers.

Given its operating model, it is not surprising that IMSLP has raised serious intellectual property concerns. The site faced high-profile lawsuits in its early days and even shut down for several months in 2007 on account of copyright infringement issues. When I interviewed him in 2018, Guo stated that the site is governed by Canadian copyright law because that is where its servers are located. IMSLP also maintains smaller servers in the United States and Europe to host scores that are still under copyright in Canada but in the public domain in other countries. Notwithstanding IMSLP’s efforts to comply with Canadian copyright law, the site places...

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5. Guo, interview.
the onus on individual uploaders and downloaders to ensure that they are not violating copyright in their own countries.8

As Napster and Spotify have done for audio, the archive has undoubtedly transformed the distribution of musical scores. Visitors to IMSLP can access an array of printed music from their own computers at no cost. In this sense, the site’s labor and business model reflects broader trends in the twenty-first-century cultural landscape toward a data- and advertising-driven framework in which consumers no longer pay directly for goods and services. But these transformational aspects should not obscure deeper continuities. IMSLP’s representation of Western classical music in digital format reinforces many traditional aspects of this repertoire. In this respect, the site’s full disruptive potential remains unrealized, despite its democratizing aspirations.

Like other cost-cutting disruptors, IMSLP depends on cheap labor. The website is kept running by a legion of volunteers. The level of commitment varies widely, from providing a rating for a downloaded file to more active involvement such as uploading scans, posting on discussion boards, or even contributing original arrangements and compositions.

8. Guo, interview. Guo is a lawyer who states that he went to law school after completing his studies in composition to ensure that he had adequate knowledge to keep the site in compliance with international copyright law.
to the archive. A contributor known as “Marieh Marieh,” for example, uploaded all the tablature editions of Antonio Alba’s works on the site. Marieh’s IMSLP profile lists 7 original compositions, 66 arrangements, and 263 scanned scores (see Figure 3). Marieh’s compositions encompass a variety of genres, including “Classical,” “Jazz,” “Modern Jazz,” and “Traditional Folk.” The instrumentation is also diverse: solo and combination guitar, flute, saxophone, and drum set. Marieh does not have a biography or a photograph on IMSLP, just a link to a Musescore profile with even more compositions. With so many volunteer contributors like Marieh, IMSLP has amassed hundreds of thousands of scores at no cost. The site’s twenty-five paid employees perform many of the same tasks as volunteers—patrolling the files for copyright infringement and inaccuracy, uploading new scores, and translating song lyrics and descriptive text into other languages. Advertising revenue and donations pay their salaries, but there is not enough funding to compensate every user’s work on the site.

Still, IMSLP’s business model resembles the traditional concept of music-as-commodity upon which commercial publishing was built. Volunteers upload scores because they choose to and know that others will benefit. They measure the value of their own labor by the popularity of the uploaded files, not by monetary compensation. A visitor to the site has many reasons for downloading a score, but for the uploader the fulfillment of the exchange comes from high ratings and growing download counts. Meanwhile, visitors also help IMSLP fulfill a more traditionally recognizable exchange: advertising revenue for user impressions. Thus, IMSLP depends on the all too common ecology of the culture industries, whereby music, art, and information are collectively produced but selectively compensated.

In addition to the work by volunteers, IMSLP depends on the work of thousands of long-dead collaborators. Though most (if not all) of the original composers, arrangers, and editors of the public domain works available on the site are dead, their work lives on and interacts productively with current users, who upload, download, re engrave, and even compose new orchestrations for or arrangements of the works hosted by the site. This integration of “dead” and “living” labor is an example of what Jason Stanyek and Benjamin Pickut

11. Musescore is a free music notation software with an online community where users can upload sheet music for free download; see “Press,” Musescore, https://musescore.com/press. Though Musescore has similarities to IMSLP, Guo told me that he considers Musescore to be a collaborator, rather than a competitor.
Figure 3  Screenshot from IMSLP, showing the profile for contributor “Marieh Marieh,” https://imslp.org/wiki/Category:Marieh,_Marieh. This figure appears in color in the online version of the Journal.
call “intermundane collaboration,” which they define as effective colaboring between the living and the dead.\textsuperscript{14} IMSLP’s living users work closely with partners who cannot respond, and since these works are no longer under copyright, even their estates and descendants have no involvement.

To be sure, some contemporary composers (or their estates) whose works are not in the public domain, such as Frederic Rzewski and Leo Ornstein, have granted explicit permission to IMSLP to include their works on the site.\textsuperscript{15} But many contemporary composers resist the inclusion of their works on IMSLP for fear of losing the prestige of a commercial publishing contract or royalty income.\textsuperscript{16} While Guo acknowledges that these concerns are valid, he justifies the archive’s approach by noting that most contemporary composers earn little from published scores and rely instead on commissioning fees and performances.\textsuperscript{17}

Moreover, even traditional music publishers are experimenting with new, rent-based models that may one day replace the traditional buying and selling of scores. Apps developed by Bärenreiter, Henle, and other publishers offer access to scores for a fixed amount of time in an attempt to replicate the way Spotify, Apple Music, and other streaming platforms have transformed traditional models of musical exchange while still paying lip service to the moral and economic rights of artists.\textsuperscript{18} By contrast, IMSLP neither sells nor rents access to musical scores, and in this respect its philosophy is similar to that of the MP3-file-sharing sites that flourished in the early 2000s, such as Napster. Napster users argued that recorded music in MP3 format should not be treated as private property because it is nonrival and immaterial.\textsuperscript{19} The advent of IMSLP demonstrates how this manner of thinking has converted published music from a rival to a nonrival good, at least if it has entered the public domain.

IMSLP’s practice of giving music away for free suggests a radical break with the music industry by cutting out traditional middlemen. The website’s guiding philosophy is that “music should be something that is easily accessible for everyone,” and the site proclaims that “[t]he ultimate goal of IMSLP is to gather all public domain music scores, in addition to music scores of all contemporary composers (or their estates) who wish to release them to the public


\textsuperscript{16} Guo, interview.

\textsuperscript{17} Ibid.


free of charge.” The sheer number of scores available for download on the site (a number increasing by the hour) suggests that IMSLP could perhaps one day fulfill its goal of making all known notated music available to everyone. But the scope of repertoire available in the archive is limited to music that is in the public domain, notated, and selected by its volunteer contributors. And despite the breadth of musical offerings, most visitors to IMSLP do not seek lesser-known and obscure repertoire. The site’s most downloaded score is Beethoven’s String Quartet no. 13, op. 130, and the most popular composers, according to download statistics, are Beethoven, Brahms, and Mozart (see Figure 4).

The dominance of certain types of music in the archive and the relative absence of others reflect both internal and external constraints that prevent IMSLP from amassing a truly comprehensive collection of the world’s music. Besides user preference, Western classical music is one of the only musics in the world to rely largely on written scores for dissemination, and the robust history of commercial music printing means that public domain copies of Western classical scores are relatively easy for users operating in the United States and Europe to acquire and scan. Traditional African music, for example, which is not usually notated and often composed collectively, is more challenging to include on IMSLP and therefore almost entirely absent from the archive’s offerings. While IMSLP’s philosophy implies universality, in practice “making music available to everyone” actually means “making Western, notated music available to everyone with a high-speed Internet connection.”

Yet the predominance of “great” Western classical composers in the archive is complemented, to some degree, by the presence of works by more obscure composers from all over the world, such as Antonio Alba and Marie Marieh. What is more, the large volume of arrangements and original compositions by anonymous (often amateur) individual uploaders like Marieh demonstrates that many of the site’s most active contributors view IMSLP as an outlet for sharing their work with a wider audience, rather than merely a repository for the greatest hits of the classical canon. Even for the well-known works, there are some surprising adaptations. These include Beethoven’s Piano Sonata no. 14, op. 27, the “Moonlight” Sonata, arranged for five recorders; Bach’s Prelude and Fugue in C Minor BWV 847 adapted for clarinet, trombone, bass guitar, drum set, and piano, and retitled “Bach Was a Cool Dude” (see Figure 5); and Mozart’s Eine kleine Nachtmusik, K. 525, arranged for four saxophones (see Figure 6). While the

22. IMSLP does have a collection of nineteenth-century transcriptions of Arab and North African folk music arranged for piano and voice by Edmond-Nathan Yafil, an Algerian musician, and Jules Rouanet, a French ethnomusicologist: https://imslp.org/wiki/R%C3%A9pertoire_de_musique_arabe_et_maure_(Yafil%2C_Edmond-Nathan).
Figure 4  Screenshot from IMSLP, showing the page for Beethoven’s String Quartet no. 13, op. 130, https://imslp.org/wiki/String_Quartet_No.13_%2C_Op.130_(Beethoven%2C_Ludwig_van). This figure appears in color in the online version of the Journal.
majority of public domain scores currently date from the nineteenth century or earlier, copyrights on twentieth-century compositions are quickly expiring and these works will likely appear on IMSLP at some point.\textsuperscript{23} To be sure, anonymous Bach and Beethoven arrangements seem a far cry from twentieth-century avant-gardist compositions. Nonetheless, the tongue-in-cheek nature of these unconventional adaptations recalls the irreverent attitudes that generated \textit{The Rite of Spring} and \textit{“total serialism,”} opening the way to further innovation.\textsuperscript{24}

Despite the presence of these delightfully unconventional arrangements and obscure compositions, most individuals who use the site may never know that they exist. The majority of the site’s web traffic involves downloading a

\textsuperscript{23} Under Canadian copyright law, works published during the composer’s lifetime generally enter the public domain fifty years after the composer’s death; see, for example, “Public Domain in Canada,” University of British Columbia Library website, http://guides.library.ubc.ca/c.php?g=698822&p=49614408s-lib-ctab-15622469-1.

\textsuperscript{24} While these arrangements reflect an impious, avant-gardist spirit that seems distinctively twentieth-century, they are also in keeping with adaptive practices that are an integral part of music history, such as medieval contrafacta settings of new (sometimes ribald) poems to older melodies and Liszt’s virtuosic piano transcriptions. Clearly, creative reinterpretations of old standards have been essential to the development of music for hundreds of years.
Figure 6  Screenshot from IMSLP, showing the page for arrangements of Mozart’s *Eine kleine Nachtmusik*, K. 525, with a view of the first page of an arrangement for four saxophones, https://imslp.org/wiki/Eine_kleine_Nachtmusik%2C_K.525_(Mozart%2C_Wolfgang_Amadeus). This figure appears in color in the online version of the *Journal*.
specific score or browsing works by certain composers.\textsuperscript{25} IMSLP even suppresses noncanonic versions of well-known works: site guidelines instruct volunteers to patrol the files and flag unusual arrangements for deletion.\textsuperscript{26} Though IMSLP offers tools—such as the “random page” feature—that expose visitors to some of the obscure offerings that fall outside the narrow constraints of the traditional canon, the number of scores in the archive is overwhelming. Ultimately, most downloaders use IMSLP to find music they already know, rather than to discover something new or unusual.

A wiki-based website, IMSLP uses open-source code. Its home page and interface project have a scrappy, do-it-yourself air (see Figure 7). So much music seems to be only a few clicks away, but orienting oneself to the intricacies of the site can be challenging for novices. The easiest way to browse scores in the archive is to search by composer, keyword, or work title using a Google-powered search function on the home page. Because the information for the scores is user-generated, however, there are sometimes gaps. Depending on what interests the uploader, there could be a plethora of detail about the composer’s biography yet little to no information about instrumentation, difficulty level, or genre. These discrepancies can render the site’s offerings somewhat opaque to users without prior knowledge. Admittedly, the learning curve to fully benefitting from IMSLP’s corpus is perhaps not that different from that required to navigate a physical collection of music in a college or university library. Despite its aspirations to universal access, the online archive assumes that its users already have the requisite knowledge, involuntarily replicating common barriers to entry found in other, more conventional classical music resources.

And even when the site does promote noncanonic composers, its limitations quickly become apparent. At first glance, the archive appears to contain works by composers from a diverse array of countries and ethnic backgrounds, with ninety distinct nationalities represented (see Figure 8).\textsuperscript{27} But categorizing composers by national identity is hardly a straightforward affair. For example, though there are twenty names listed under the subcategory of “Indian people,” a cross-check with Grove Music Online and Wikipedia confirms that many of the “Indian” composers are actually people of British descent who inhabited colonial India in the eighteenth and nineteenth centuries.\textsuperscript{28} It is not part of IMSLP’s mission to historicize

\textsuperscript{25} Guo, interview.
\textsuperscript{26} Ibid. See also the IMSLP deletion log, which lists recently deleted files and reasons for deletion: “Deletion Log,” IMSLP, https://imslp.org/index.php?title=Special:Log&type=delete.
\textsuperscript{27} The description of “nationality” on IMSLP reads, “The following are lists of people represented on IMSLP sorted by their countries of origin, as given in standard reference sources”: “Category: People by Nationality,” IMSLP, https://imslp.org/wiki/Category:People_by_nationality.
Figure 7  Screenshot from IMSLP, showing the home page, https://imslp.org. This figure appears in color in the online version of the Journal.
the composers or works contained in its archive, and it would be unfair to expect a site run primarily by volunteers to spend the resources required to educate users on its platform to this kind of nuance. This example merely underscores how unstated assumptions can involuntarily guide and shape users’ understanding of music history itself, even on a website that offers a vision of democratic transformation.

The digital format of the scores on IMSLP marks a paradigm shift in the value and role of notated music for performers, composers, and audiences everywhere. Whereas previously consumers purchased authoritative, commercially produced versions of scores or even exhaustive “critical editions”—often edited by musicologists—from music publishers, many of IMSLP’s users choose to bypass these expert publications. Instead, they turn to public domain editions, many of which were published more than a hundred years ago. Much like Dover Publications’ “Thrift Editions” (perhaps a predigital analogue to IMSLP’s digital scores and parts), they make up for their lack of accuracy with low cost, ease of access, and convenience.

But some users turn to IMSLP for more than just free, near-instant access to scores and parts. One user maintains a list of popular and newly added scans of first editions and manuscripts.29 This list is prominently featured on IMSLP’s home page and updated regularly (see Figure 7). From Beethoven’s late string quartets to sixteenth-century madrigals, the scans of these “original” scores are in high demand among certain musicians. The Borromeo Quartet’s members often play from files downloaded from IMSLP and extol the virtues of practicing and performing from full score and manuscript—albeit a digital copy displayed on an iPad.30 Borromeo’s first violinist, Nicholas Kitchen, has said that he loves playing from manuscripts because “I can tell you that Beethoven’s personal interaction with the page results in a completely different system than what we see in printed music.”31 In their attempts to understand the composers’ intentions and uncover, as Borromeo violist Mai Motobuchi says, “exactly the direct picture [the composer] had in their mind,” these musicians turn to full scores and scanned copies of handwritten pages from the nineteenth century.32 Yet while the iPad makes the process easier, these modern musicians’ belief that the autograph offers access to the Werktreue is not new.33 Deirdre Loughridge’s work

29. Guo, interview.
32. Quoted in Watkin, “Bytes and Beethoven.”
33. Werktreue is defined as a score’s faithfulness to the musical work; see Lydia Goehr, The Imaginary Museum of Musical Works: An Essay in the Philosophy of Music (New York: Oxford University Press, 1992), 231.
Figure 8  Screenshot from IMSLP, showing the page “People by Nationality,” https://imslp.org/wiki/Category:People_by_nationality. This figure appears in color in the online version of the Journal.
on the creation and circulation of lithograph facsimiles before photography demonstrates that amateur musicians and collectors have long believed that the original autograph can offer insight into the composer’s inner being.34

In sum, IMSLP provides more widespread access to printed music by making files available for free download to anyone with an Internet connection. Yet if it augurs a quantitative revolution by cutting out publishers and thus increasing the supply of scores, it has done less to qualitatively change the music industry than we would suspect. The ways musicians use the site are of a type with practices that have been deeply ingrained in the Western classical canon for centuries. Still, the site is only in its second decade. Music by composers such as Florence Price and Clara Wieck Schumann, not to mention Antonio Alba and Marieh Marieh, exists in the site’s archive alongside more familiar works by Bach, Beethoven, and Brahms. It is not hard to envision a world in which IMSLP becomes more than just a means for users to download the old favorites over and over again.

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