Classifying Musical Medium of Performance

Object or Property?

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1.0 Introduction

How best to classify musical medium of performance in music knowledge organization systems? Interpretation of medium of performance is not easily articulated and thus not easily classified. We write this paean to *Notes* with the hope of engaging the scholarly community of musicians, musicologists, music librarians, and audiologists in this enterprise. (In other words, we are happy to lay out for discussion our own systematic comprehension in the hope of learning from the community what we might have missed.)

Specifically, we have been interested in what is often presented as a dichotomy: when referring to the sources of musical sound, should we be describing the objects (e.g., aerophone) or the properties (e.g., piccolo), or some combination of the two? In other words, we have undertaken to solve a specific problem in knowledge organization (the science of the order of knowledge) and how it is therefore manifested in knowledge organization systems for music, such as the Library of Congress Classification M or the Alpha-Numeric System for Classification of Recordings. Thus, the classification of musical medium of performance poses a specific problem for the structure of systems for organizing music.

Since 2017, the Institute for Knowledge Organization and Structure, Inc. (IKOS)[1] has worked to resolve some of these problems by developing its domain analysis clinic methodology for focused work by researchers.[2] The methodology involves meta-analysis of existing knowledge organization systems and the research that supports them, synthesis by a group of scholars working together, and then generation of both empirical analyses and knowledge organization systems (specifically

[1] See https://knoworg.org.

[2] "A domain is a group that shares an ontology, undertakes common research or work, and also engages in discourse or communication, formally or informally." Richard Smiraglia, *The Elements of Knowledge Organization* (Cham: Springer, 2014), 85. Domain analysis "denotes the domain analytical work within KO . . . including domain analysis techniques, e.g. Citation Analysis, Co-word Analysis, Author Co-citation Analysis, Network Analysis, Cognitive Work Analysis." Richard P. Smiraglia, Joshua A. Henry, Elizabeth Milonas, and Sergey Zherebchevsky, comp., *A Formal Taxonomy of Knowledge Organization (FTKO),* version 1.2 (Lake Oswego, OR: Institute for Knowledge Organization and Structure, 2022), s.v. "Analysis," https://knoworg.org/a-formal-taxonomy-of-knowledge-organization-version-1-2.

ontologies, taxonomies, classifications, thesauri, etc.). In November 2019 a domain analysis clinic was convened to discuss "the phenomena of music for classification."[3]

The clinic was convened in conjunction with the Digging into the Knowledge Graph project (Di4kg), an international multipronged research program funded by the Fourth Digging into Data challenge.[4] Di4kg was designed to provide best practices for the creation and maintenance of linked open data (LOD) for the social sciences and humanities. An essential part of the project was to create and apply LOD classifications to research resources so as to create a large body of "self-indexing" points in the LOD Cloud.[5] The two specific projects of the Di4kg worked with the United Nations Standard Products and Services Code (for the social sciences) and computerized mensural music editing (for the humanities).[6] Two classifications were employed: the Universal Decimal Classification (UDC),[7] an international, faceted, discipline-based bibliographic classification, which we used as a sort of control, or stable reference classification, and the newer interdisciplinary phenomenon-based Basic Concepts Classification (BCC), discussed in more detail below.[8] Both the UDC and the BCC were converted to linked data for the project.

As a result of the work of Di4kg, it became apparent that the BCC required further development of its music schedules (both musical phenomena and relationships among them). Obviously, it was possible to import existing thesauri of musical phenomena. An interesting research question evolved, however, concerning the phenomenon-based approach to classifying music. In other words, what does it mean to classify the phenomena of music rather than musical documents or documents containing texts about music? Furthermore, we were interested in the thought experiment of considering how to represent music apart from its documentary representations (scores, recordings, etc.). This was the focus for the domain analysis clinic.

Specifically, the research questions posed were:

1. What constitutes the classification of music? What does meta-analysis tell us about meta- and substrate-level phenomena of music?
2. What do nontraditional sources of musical data identify as specifically classifiable phenomena of music?
3. What can be used as facets of music in the Basic Concepts Classification?
4. What are the outlines of discourse that govern the phenomena of music for classification?

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[3] "Phenomena" is used in this article to indicate any aspect of a work of (or about) music that we might seek to classify, such as the particular instruments employed, subject of a piece, or form/genre. We might also classify relationships among phenomena or the properties (the adjectival qualities) of phenomena.
[4] See http://di4kg.org and https://diggingintodata.org/awards/2016/project/digging-knowledge-graph.
[5] The LOD Cloud is the full set of publicly available datasets coded for use in the Semantic Web. For our purposes it signals the full set of terminology employed in the Semantic Web. See https://lod-cloud.net.
[6] "The Computerized Mensural Music Editing Project," https://www.cmme.org.
[7] See https://udcc.org..
[8] See https://sites.google.com/a/ualberta.ca/rick-szostak/Basic-Concepts-Classification. The BCC is further described at https://www.isko.org/cyclo/bcc.

Participants in the clinic were Richard Griscom, then associate university librarian for departmental libraries at the University of Pennsylvania; Joshua Henry, then assistant professor and librarian, Westminster Choir College, Princeton, NJ; Deborah Lee, visiting lecturer, City, University of London, London, UK; Richard P. Smiraglia, senior fellow and executive director, IKOS, Lake Oswego, OR; Rick Szostak, professor, University of Alberta in Edmonton, Alberta, Canada; and J. Bradford Young, bibliographic consultant, IKOS, Lake Oswego, OR. Over a period of several months, the group compiled an exhaustive bibliography of research (referred to below as "the bibliographic corpus"), which was used as a basis for meta-analysis. The group met at the Institute for Knowledge Organization and Structure in Lake Oswego, Oregon, for two days, 8–9 November 2019.[9]

1.1 Problem Statement: How Best to Incorporate Medium of Performance in a Phenomenon-Based Classification

Meta-analysis of the bibliographic corpus[10] revealed the presence of a standard core of musical terminology used as the basis of most music classifications, which are categorized generally as bibliographic classifications because their intended use is for arrangement of library materials. But the analysis also pointed to the greater emphasis on user music-information needs arising from the influence of the music information retrieval (MIR) movement. Both the aspects of musical documents and foci of music-information needs are considered critical phenomena of music for a phenomenon-based classification.

We examined the standard core of musical terminology in depth. The Library of Congress Genre/Form Terms for Library and Archival Materials (LCGFT)[11] was plumbed for musical terms, which were compiled into a single set of LCGFT terms specifically for musical form/genre, now maintained online by institute.[12] Exhaustive analysis of the ways in which terms are combined in Library of Congress Subject Headings for music revealed a table of relationships in which we designated the grammar for combining terms for form and genre with terms for medium of performance.

Thus many solutions were considered as a result of the domain analysis clinic, ranging from incorporation of Library of Congress thesauri for form and genre and for medium of performance, to the development of an entirely new facet of terminology related to audio representation of music based on research into music information retrieval. Elements of this facet include not only metadata, such as duration and capture data for performance, but also concepts that are desirable by searchers, such as emotion or function (music for funerals, music to vacuum by, etc.).[13]

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[9] A detailed report of the DAC is available in *The Phenomena of Music for Classification*, IKOS Technical Reports Series, no. 2 (Lake Oswego, OR: Institute for Knowledge Organization and Structure, 2022).
[10] For the contents of the corpus, see https://knoworg.org/phenomena-of-music-for-classification-corpus-bibliography-2
[11] See http://id.loc.gov/authorities/genreForms.html.
[12] See https://knoworg.org/lcgft-music-terms.
[13] While function is included as part of the form/genre facet in some conceptualizations of music information (e.g., LCGFT), in some work it is considered to be a separate type of information from form/genre. See the

One specific problem continues to be the question of how best to incorporate medium of performance in a phenomenon-based classification. Specifically, we discussed two well-known approaches to designating medium of performance. The Library of Congress Medium of Performance Thesaurus (LCMPT)[14] provides an ever-growing extensive list of musical instruments, voices, and ensembles. Hornbostel–Sachs (H-S),[15] a system of musical instrument classification by type, provides an exhaustive cross-cultural picture of the means of making musical sound.[16]

The purpose of the present article is to expand on the discussions surrounding these two approaches to the classification of medium of performance, specifically with regard to instrumental music.

2.0 Background: The Basic Concepts Classification and Music Classification

2.1 Introduction

The Basic Concepts Classification is a "universal" scheme: it attempts to encompass all areas of human understanding. Diverse users—both general users from different cultural backgrounds and scholars from across disciplines—can potentially utilize the BCC to find documents, objects, or ideas produced in any culture or discipline. Whereas most universal schemes are organized around scholarly disciplines, the BCC is instead organized around phenomena (things), relators (the relationships that exist among phenomena), and the properties that phenomena and relators may possess. This structure allows the BCC to apply facet analysis—an approach to classification long emphasized within the field of knowledge organization—without requiring the use of facet indicators to tell the user which facet is being addressed by a particular notation.[17]

2.2 Motivation

The main motivation for the Basic Concepts Classification was a recognition that existing classifications that are organized around disciplines serve interdisciplinary scholarship poorly. The

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conclusion that function acts as a quasi-facet in Deborah Lee, "Modelling Music: A Theoretical Approach to the Classification of Notated Western Art Music" (PhD thesis, City, University of London, 2017), http://openaccess.city.ac.uk/17445.

[14] See https://www.loc.gov/aba/publications/FreeLCMPT/freelcmpt.html.

[15] "Systematik der Musikinstrumente: Ein Versuch," *Zeitschrift für Ethnologie* 46 (1914): 553–90.

[16] Deborah Lee, "Hornbostel-Sachs Classification of Musical Instruments," *Knowledge Organization* 47, no. 1 (2020): 72–91. Postprint available at https://openaccess.city.ac.uk/id/eprint/22554. Also available in Birger Hjørland and Claudio Gnoli, eds., *ISKO Encyclopedia of Knowledge Organization*, http://www.isko.org/cyclo/hornbostel. While LCMPT and H-S are very different as knowledge organization systems, it is noted that some features of H-S (such as some elements of structure) are utilized in LCMPT.

[17] Relators are indicated by a set of nonalphanumeric symbols. Properties are all prefaced by the capital letter Q. Different types of phenomena, such as object, subject, and intermediate subject are indicated by placement within a BCC subject string, which always follows a standard grammatical order.

fact that different terminology and organizing principles are pursued for different disciplines hampers the research and communications of interdisciplinary scholars and students. Over time, a variety of other advantages of a classification grounded in phenomena, relationships, and properties (basically adjectives and adverbs clarifying the nature of phenomena or relators) have been appreciated by knowledge organization scholars.[18] Such a classification can achieve greater precision even within disciplines than existing classifications are able to achieve and can be used across galleries, libraries, archives, and museums (the so-called GLAM sector) and indeed across any organized repository of information. This is especially important as users increasingly seek information across a variety of databases and, at present, struggle to master different classifications and search interfaces for each. Such a classification is useful not just for documents but also for objects (thus its utility for museums and galleries) and ideas (and thus its utility for a variety of databases). It may prove advantageous for the Semantic Web, since its separate schedules of things, properties, and relators are well suited to the "(subject)(predicate or property)(object)" structure employed on the Semantic Web.[19]

2.3 Potential Advantages for Classifying Works of Music

We can easily imagine users who might wish to search for works in a particular genre, for works designed for a certain combination of voices or instruments, for works designed for a particular (religious or other) purpose, or for works addressing a particular subject or theme. Users might also wish to search for particular melodies, perhaps to accompany a video. The universal and synthetic approach of the Basic Concepts Classification potentially allows us to cope with subject, theme, and purpose by incorporating terminology from nonmusical schedules within the classification (e.g., song about love, music for a quinceañera).

The logic of the BCC guides us to seek a comprehensive classification of musical genres.[20] It also guides us to seek a comprehensive classification of medium of performance.

2.4 Potential Challenges in Classifying Works of Music in the BCC

The Basic Concepts Classification was first developed for use in the social sciences and has been gradually extended over time into other fields. The classification of works of music presents particular challenges.

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[18] See Rick Szostak, Claudio Gnoli, and María López-Huertas. *Interdisciplinary Knowledge Organization* (Cham: Springer, 2016).

[19] See Rick Szostak, "The Basic Concepts Classification as a Bottom-Up Strategy for the Semantic Web" *International Journal of Knowledge Content Development and Technology*, June 2014. www.ijkcdt.net Standards for the Semantic Web can be found at https://www.w3.org/standards/semanticweb/

[20] See Joshua Henry, "LCGFT Music Terms," https://knoworg.org/lcgft-music-terms (terms extracted in December 2019), and Deborah Lee and Rick Szostak, "Classifying Musical Genres: Building Musical Form and Genre into BCC; Repurposing LCGFT Terms for Music into the Basic Concepts Classification," *Knowledge Organization* (forthcoming).

How can we know the subject of a work of music? As in classifying any other document, a classifier will be guided by the documentation associated with a work. The general expectation is that a classifier will identify or construct a key sentence from a document abstract or some other description and then translate that sentence into the BCC controlled vocabulary. We will only be able to classify the subject or theme of a particular work of music if this is summarized in the documentation associated with the work. At times, the title itself will convey useful information.

For the purpose of the present article, the approach of the BCC presents a particular challenge. At present, musical instruments are classified in different ways for different purposes. Hornbostel-Sachs focuses on the physical nature of instruments and how they make sound. The Library of Congress Medium of Performance Thesaurus instead effectively identifies specific instruments by name.[21] Is it possible to have one classification of musical instruments that serves both (and perhaps other) purposes?

We should note that this is not an entirely novel challenge. Birger Hjørland and Karsten Nissen Pederson worried that pharmacologists wish to classify chemicals in an entirely different way from chemists.[22] Yet this is no challenge for the BCC, which classifies chemicals the way chemists do (employing the Periodic Table in the classification), since chemists stress the internal nature of chemicals. It then meets the needs of pharmacologists synthetically: "chemicals that lower blood pressure."

A greater challenge is the practical one. H-S does not provide the level of granularity that we need in order to tell users what specific instruments are required for a particular work. The LCMPT has a much larger set of terms, but these are organized inadequately, using only a few layers of hierarchy as compared to H-S.

3.0 Analysis

3.1 Hornbostel–Sachs

Hornbostel-Sachs was first published in 1914 in German. Its authors considered its contents to be pertinent to "musicologists, ethnologists, and curators of ethnological collections and those of cultural history."[23] Hence, while the purpose of H-S was in part for the physical arrangement of musical instruments, it also had a more theoretical purpose. This is significant when considering it as a possible system of organizing knowledge, especially for an interdisciplinary classification

[21] It should be noted, however, that LCMPT does also include terms for groups of instruments higher up in the hierarchy, too, and sometimes uses H-S terminology for these node terms.
[22] "A chemical database emphasizes structural descriptions while a pharmacological database emphasizes medical effects." Birger Hjørland and Karsten Nissen Pedersen, "A Substantive Theory of Classification for Information Retrieval," *Journal of Documentation* 61, no. 5 (2005): 586.
[23] Erich M. von Hornbostel and Curt Sachs, "Classification of Musical Instruments: Translated from the Original German by Anthony Baines and Klaus P. Waschmann," *Galpin Society Journal* 14 (March 1961): 4, http://www.jstor.org/stable/842168.

scheme such as the Basic Concepts Classification: its original use was not merely to organize artifacts, and its original purpose was for an audience of users from different disciplines and purposes, rather than being only, say, a curator's tool.

H-S has a number of distinct features that are important when considering its appropriateness as a structural system and vocabulary for the BCC and other phenomenon-based classification schemes, and this section considers six such features.

3.1.1 Feature 1: Decimal notation

H-S's use of decimal notation, based on an early version of Universal Decimal Classification, is notable.[24] In the case of this particular exploration, however, this notable feature is not relevant, as the Basic Concepts Classification has its own notation system.

3.1.2 Feature 2: Broad structure

The structure of Horbostel-Sachs is highly important and novel: it is based on Victor-Charles Mahillon's revolutionary categorization of instruments,[25] which categorizes instruments by "the nature of the vibrating, sound-producing body" rather than other aspects, such as how the instrument is played or the position of the performer in society.[26] Deborah Lee summarizes the discussion about the originality of the four-part structure (idiophone, membranophone, chordophone, and aerophone),[27] including the arguments about whether it was actually Mahillon's invention at all,[28] and the move from the traditional tripartite categorization of instruments (strings, wind, percussion). The importance of the four-part structure centers on the contrast between popular knowledge and scientific knowledge. While Mahillon's and H-S's four categories are driven by a singular characteristic, the resulting classes create divisions and placings of instruments that do not in some cases match the conception of instruments by the general public or musicians, especially those involved with Western art music. Examples include how H-S has an absence of a keyboard subcategory within the structure and how percussion instruments are divided into two categories (idiophones and membranophones). This could present additional complexities within an interdisciplinary environment where instruments could be used outside the music discipline as appropriate, such as for instruments as iconography or instruments as themes in literature. This might be problematic if using H-S's structure pertaining to a particular subdiscipline of music (namely, organology). Ultimately, this could lead to those using the Basic

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[24] Lee, "Hornbostel-Sachs," section 3.2, "Notation."
[25] Victor-Charles Mahillon, *Catalogue descriptif & analytique du Musée instrumental du Conservatoire royal de Bruxelles: Précédé d'un essai de classification de tous les instruments anciens et modernes* (Ghent: C. Annoot-Braeckman, 1880).
[26] Margaret Kartomi, *On Concepts and Classifications of Musical Instruments* (Chicago: University of Chicago Press, 1990), 163-64.
[27] Lee, "Hornbostel-Sachs," section 3.1, "Four categories."
[28] See also Nazir Ali Jairazbhoy, "The Beginnings of Organology and Ethnomusicology in the West: V. Mahillon, A. Ellis, and S. M. Tagore," in *Issues in Organology*, ed. Sue Carole DeVale (Los Angeles: University of California, Los Angeles, 1990), 67-80.

Concepts Classification—and the systems of knowledge that the BCC underpins—not finding the concepts and phenomena they are looking for.

3.1.3 Feature 3: Terminology for category names

Another key feature of Hornbostel-Sachs is its use of a particular terminology for these categories of instruments, such as *chordophones* and *idiophones*, which follows on from Mahillon's naming approach. Adopting these technical category names in the Basic Concepts Classification offers potential advantages and disadvantages. Again, there is a question of expertise and how this translates to an interdisciplinary environment. The technical vocabulary of terms such as *chordophones* is not necessarily known outside organology, the particular discipline concerned with musical instruments, so its use could prove counterproductive to an interdisciplinary classification scheme that is attempting to bring together knowledge and break down disciplinary boundaries. It also asks a question, however: Could the idea of, say, a *chordophone*—very crudely, a combination of strings (*chord*) plus sound (*phone*)—be itself built from the BCC rather than stated in the schedules?[29]

3.1.4 Feature 4: Contents of classes

Another important feature of Hornbostel-Sachs is that it consists of classes for categories of instruments rather than being a schedule of distinct species of instruments. For example, class 321.322 represents "Necked box lutes or necked guitars." While H-S gives three examples of instrument species within this entry—violin, viol, and guitar—these instruments do not constitute the class. So it would be problematic relying on H-S to take you directly to "violin". Here the violin happens to be included as an example, but if you were looking for "cello" or "viola" you would not be as fortunate. Also, the examples of instruments are not given in any seemingly systemic way in terms of how many are included in an entry, which cultures are represented, and so on. We note that in the 321.322 example, the three examples are all important to Western music, and two are particularly important to Western art music.

This means that if H-S were interpolated into the Basic Concepts Classification as is, the BCC would be adopting broad classes of instruments rather than the names of specific instruments. This could have an impact on classifiers and those seeking knowledge that has been classified using the BCC: they might know they want a violin or cello but not necessarily that these are "necked boxed lutes."

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[29] At present, *chordophones* is included in BCC as AR4i2 with an explanatory note (sound made by vibrating strings). See https://sites.google.com/a/ualberta.ca/rick-szostak/Basic-Concepts-Classification/the-classification-of-things-phenomena/a-art/ar4i-musical-instruments. The notation for *sounds in general* is N8. For *strings in general*, the notation is E0931151507, where EO9 signals *goods and services in general*, and 31151507 is imported from the United Nations Standard Product and Services Code. *From* is /. *Vibrating* would be →mh (hitting without moving). *Musical instruments* are AR4i. So we could produce *chordophones* synthetically with "AR4i (N8/→mh E0931151507)". Though this is somewhat cumbersome, it does indicate the synthetic potential of BCC.

3.1.5 Feature 5: Cross-cultural design

One of Hornbostel-Sachs's heralded features is its purposefully cross-cultural design. For example, while Western art music has historically treated the category of percussion instruments as relatively unimportant,[30] they are very important in the musics of many other cultures. So H-S gives much space, prominence, and careful classification to such instruments—found in H-S's two broad categories of *idiophones* and *membranophones*. Conversely, the keyboard instrument category, found as a primary division in many traditional library classification schemes, favors Western art music;[31] consequently, this idea of grouping around keyboards is not found in H-S. The lauded four-category structure of H-S is enshrined in a cross-cultural view of musical instruments. Furthermore, even H-S's notation is deemed useful for a cross-cultural and non-European-focused environment due to its use of numbers for classes rather than words.[32] This is useful for a scheme such as the Basic Concepts Classification, which hopes to be universal in multiple planes, including moving away from a Western-centric viewpoint.

3.1.6 Feature 6: Changing knowledge and information

When considering Hornbostel-Sachs as a possible vocabulary and structure in a modern classification scheme, it is vital to consider how the classification represents changing knowledge and information. This is an intriguing question for H-S, a scheme first published in 1914, with its structural antecedents from Mahillon's late nineteenth-century system. The answer is complicated and, in part, is based on what constitutes "the" H-S. As a brief summary, H-S was quickly and widely adapted by those using it, yet it can be argued that it was not until nearly one hundred years later that a new official version was published.[33] The English translation of H-S in 1961 was hugely influential,[34] and it was republished in a more widely available format in 1992.[35] It must be noted, however, that these versions merely published the content and structure of the 1914 version rather than including new knowledge about musical instruments and new musical instruments as they became available during the twentieth century. A fifth main category for instruments that produce sound electronically, *electrophones,* was developed by Francis Galpin and taken up by Sachs.[36] The boundaries of this category have been used imprecisely,[37] and much work was done to develop

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[30] Lee, "Modelling Music," 246-48.
[31] Lee, "Modelling Music," 250.
[32] Margaret J. Kartomi, "The Classification of Musical Instruments: Changing Trends in Research from the Late Nineteenth Century, with Special Reference to the 1990s," *Ethnomusicology: Journal of the Society for Ethnomusicology* 45, no. 2 (2001): 285.
[33] Lee, "Hornbostel-Sachs," section 4, "Edits, Updates and Revisions."
[34] Erich M. Hornbostel and Curt Sachs, "Classification of Musical Instruments: Translated from the Original German by Anthony Baines and Klaus P. Waschmann," *Galpin Society Journal* 14, (March 1961): 3-29, http://www.jstor.org/stable/842168.
[35] Erich M. von Hornbostel and Curt Sachs, "Classification of Musical Instruments," in *Ethnomusicology: An Introduction*, ed. Helen Myers (London: Macmillan, 1992), 444-61.
[36]Francis W. Galpin, *A Textbook of European Musical Instruments* (London: Williams & Norgate, 1937) and Curt Sachs, *The History of Musical Instruments* (New York: W.W. Norton, 1940). See a summary of this development in Lee, "Hornbostel-Sachs," Section 4.3, "New Categories: Including Electrophones."
[37] Kartomi, *On Concepts,* 173.

these as a class.[38] Electrophones were not adopted into "the" H-S during the twentieth century, because "the" H-S only officially existed as the original 1914 version or the 1961 English translation of that 1914 version.

There is one new potential version of H-S, however, that does incorporate twentieth- and twenty-first-century knowledge: the version of H-S developed for Music Instrument Museums Online (MIMO), first published in 2011[39] and heavily based on the work of the eminent organologist Jeremy Montagu.[40] Updates and developments include a developed *electrophones* class, some new categories in *aerophones*, and some renaming in the kettledrums section. So what does this all mean for the potential inclusion of H-S within the Basic Concepts Classification? It is important that any adoption of a musical-instrument structure and vocabulary represents a take on this knowledge that is as up to date as possible. The 2011 version of H-S would be suitable; yet, if this version did not exist, it would be problematic to adopt the 1914 H-S in the BCC—whether in translation or not—as the knowledge would be historical only.

Governance plays a part of any classification scheme's ability to stay up-to-date. While H-S has been the subject of much research about extending the scheme and has been the center of many new developments in thinking about instrument classification, H-S had no official or central governance in itself, being the work of two long-deceased scholars. At the time of writing, however, MIMO is an active concern and their version of H-S is actively used for live data sets, increasing the chances that H-S will continue to develop and evolve in the future. Therefore, while H-S in its classic 1914 version would be problematic for use in an interdisciplinary and contemporary classification such as the BCC, the MIMO version of H-S would not present these difficulties and could be considered as a live and reasonably contemporary vocabulary.[41]

3.2 Library of Congress Medium of Performance Thesaurus for Music

The Library of Congress Medium of Performance Thesaurus developed as a separate vocabulary when the creators of the music section of the Library of Congress Genre/Form Terms for Library and Archival Material agreed that medium of performance terms were important for music discovery but should not be embedded into a genre/form vocabulary. The thesaurus was approved for use in 2014, and its terminology "is designed to be used in both authority records (as an alternative to the RDA medium of performance vocabulary) and in bibliographic records (as a

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[38] See for example this important chapter: Michael B. Bakan, Wanda Bryant, Guangming Li, David Martinelli, and Kathryn Vaughn, "Demystifying and Classifying Electronic Music Instruments," in *Issues in Organology,* ed. Sue Carole DeVale (Los Angeles: University of California, Los Angeles, 1990), 37-64.

[39] Music Instrument Museums Online, "Revision of the Hornbostel-Sachs Classification of Musical Instruments by the MIMO Consortium," 2011, http://www.mimo-international.com/documents/hornbostel%20sachs.pdf.

[40] Jeremy Montagu, "It's Time to Look at Hornbostel-Sachs Again," *Muzyka: Kwartalnik Poswiecony Historii i Teorii Muzyki* 54, no. 1 (2009): 7-28.

[41] There are other ways in which H-S can also deal with developments in thinking about musical instruments. Its use of classes of instruments rather than types of instruments means fewer problems if a new instrument is created or discovered by organologists or if an instrument becomes newly important. Also, H-S does have the capacity to build classes, though this is quite a complicated procedure.

complement to terms from LCGFT, and as an eventual replacement for Library of Congress Subject Headings that include medium and genre/form terms)."[42] Terms are continually added to LCMPT based on literary warrant and sorted into hierarchies under the three broad categories of *performers*, *ensembles*, and *visuals*. Its simple structure makes it a knowledge organization system worth investigating for incorporation into BCC.

Although LCMPT is not a classification, its simple structure can provide insight into how the BCC can address medium of performance in its music schedules. The three main hierarchies are also themselves terms that can be used. There are no broader terms than these three, and there are currently no narrower terms in the *visuals* hierarchy. Therefore, the other two hierarchies contain the rest of the terms, which are mostly either vocal or instrumental (some terms that are neither vocal or instrumental include *dancer*, *conductor*, and *audience*). Looking more closely at the structure of the *ensemble* and *performer* hierarchies can give further information on how to construct the BCC music schedules.

The *ensemble* hierarchy contains considerably fewer terms, in part because terms such as *duet*, *trio*, *quartet*, and their types, such as *string quartet*, are excluded. These terms were not included in LCMPT in favor of representing the number of parts/players and number of ensembles by separate subfields in the MARC 382 field.[43] The number of parts/players/ensembles is an important subproperty of medium of performance, and it does occasionally appear in scope notes for certain terms. It is not, however, a crucial aspect of LCMPT's structure, and its lack of significance in LCMPT means that a structure would need to be devised for that property in the BCC music schedules. Most of the terms fall under *vocal ensemble* or *instrumental ensemble*, and these are the only terms that have a lower level in the hierarchy. The next level under *vocal ensemble* contains two terms (*chorus* and *solo vocal ensemble*) and provides another example of how the number of parts/players appears in LCMPT. *Solo vocal ensemble* does not have any narrower terms, but it is included for musical works and expressions that specify a number of parts but not the range for each part, e.g., a song for four unspecified solo parts. The remaining levels under *chorus* are mostly structured around the range and gender of the voice parts. The level under *instrumental ensemble* is more extensive and varied than the level under *vocal ensemble*. It is more varied in the sense of how the terms are distinguished. Some are differentiated by how the instruments of the ensemble produce sound, such as *wind ensemble*. Others are determined by the style of music, such as *jazz combo*, and yet others are established ensembles of a particular culture such as *khrūang sāi*. These factors could be used in the BCC music schedules, but they would likely need to be better defined.

The *performer* hierarchy is more extensive than the *ensemble* hierarchy, but its structure is quite similar: there are few terms that are not vocal or instrumental; the vocal terms are eventually

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[42] Music Library Association, Vocabularies Subcommittee, "Best Practices for Using LCMPT (A Manual for Use with MARC Field 382)," 14 February 2017, https://cmc.wp.musiclibraryassoc.org/wp-content/uploads/sites/5/2020/01/BPsForUsingLCMPT_14022017.pdf

[43] Subfield $n for the number of parts/players (also indicated in $r if the performer is playing alongside an ensemble), subfield $e for the number of ensembles, and subfields $s and $t for the total number of parts/players and ensembles respectively.

separated by range and gender; and the instrumental terms are distinguished by various factors. The second level consists of terms based on how a performer, broadly speaking, contributes to a musical work—by dancing, by using their voice, by playing an instrument, and so forth. Before the vocal terms are separated by range and gender, they are first distinguished by how the voice is used—for example, rapping, singing, speaking, or imitating percussive sounds. Polyhierarchy occurs quite frequently among the instrumental terms, because they are not distinguished based solely on how they produce sound. If LCMPT is used as a basis for medium of performance in the BCC music schedules, one question to consider would be whether prevalence of polyhierarchy is beneficial, detrimental, or inconsequential.

Since LCMPT was created by extracting terms from Library of Congress Subject Headings, Western art music is well represented. The aim of LCMPT, however, is to be more diverse, and it already contains terms outside Western art music, such as *bonkó* and *rapper,* among many others. In order to avoid Western-centrism, the creators of LCMPT borrowed terms from H-S that function as gathering terms in LCMPT. For example, *ductless flute* was borrowed rather than subsuming all instruments of that type under the term *flute*, which represents the only Western flute.[44] LCMPT also avoids centering the common-practice period in Western art music by including broad terms such as *instrument*, *voice*, and *audience*, which makes it possible to describe music that does not have a specific medium of performance. The use of polyhierarchy makes the structure less rigid and better at drawing out relationships between terms, and because it is a true thesaurus, unlike LC Subject Headings, it can be used for machine inferencing if the need arises. Since the BCC strives for shared understanding among different perspectives, this decentering of Westernness can be a model for the structure of the BCC music schedules.

3.2.1 LCMPT and encoding/modeling

Although the Library of Congress Medium of Performance Thesaurus has a structure, it does not convey all aspects of medium of performance as mentioned earlier about number of parts/players. Therefore, the terms from LCMPT have to be encoded or used in a model that can convey other aspects of medium of performance, including solo versus accompaniment, whether a performer is playing multiple instruments, whether a musical part can be played on different instruments, the number of hands needed to perform, and stated medium versus realized medium. The MARC 382 field was expanded during the creation of LCMPT to address almost all of these aspects. Unfortunately, the number of hands for a keyboard and the distribution of choral parts (e.g., SATB) can only be conveyed as a free text note in subfield $v. Stated versus realized medium is not conveyed directly in the MARC 382 field; rather it is conveyed by whether the field is in an authority record or a bibliographic record.[45] The structure of the MARC 382 field can be used in

[44] Beth Iseminger et al., "Faceted Vocabularies for Music: A New Era in Resource Discovery," *Notes* 73, no. 3 (2017): 424.

[45] The MARC 382 field in an authority record does not function as a controlled heading such as a text string found in the MARC 100 field of an authority record. This means that if a musical work is arranged or if the realized medium of performance of a sound recording is different from the stated medium of performance of

tandem with LCMPT to construct the Basic Concepts Classification music schedules, but there are other models available, such as the Performed Music Ontology[46] and the Ontology for Voice, Instruments, and Ensembles,[47] both of which can be enhanced by a model for instrumental ensembles written for one player per part as proposed by Deborah Lee.[48]

3.3 Hornbostel-Sachs vs. LCMPT

Considering how to incorporate music into the Basic Concepts Classification, the group looked closely at the venerable Hornbostel-Sachs classification and the new, faceted Library of Congress Medium of Performance Thesaurus. The difficulty of synthesizing the two became apparent, and we were able to articulate some of what made this so. The most obvious is that H-S was developed to classify tangible objects, while LCMPT was extracted from the preexisting Library of Congress Subject Headings to describe musical works and expressions as embodied manifestations. The distinct purposes have broader ramifications. Users of H-S have tangible objects in front of them. They can describe the visible characteristics of what they see—acoustical mechanism (for example, aerophone versus chordophone), the structure and material of construction, and so forth—even if they do not know the name of the instrument used by the person who made it or where and when it was made. Even if the local name is known to the classifier, it might not be widely known elsewhere. This is the problem H-S seeks to solve. Local nomenclature is not helpful for the cross-cultural investigation in which Sachs was engaged. His focus was the acoustical and tangible qualities of an instrument, not the music for which it might be used. This cross-cultural aim accounts for the lack of focus in H-S on the instruments of the symphony orchestra—the terms for which are well known and well organized—rather than on classifying more exotic, non-Western, traditional, and obsolete instruments. H-S also does not include voices or ensembles, while LCMPT does. H-S has a focus entirely contrary to that of indexing the media of performance in music from the period of common practice.

LCMPT has an entirely different genesis. It is a thesaurus of terms, not primarily a classification, extracted from LC Subject Headings. It has been implemented in the MARC format, with the expectation of future deployment expressed as Resource Description Framework (or semantic) triples in an open linked-data environment.[49] LCMPT is not used for topical material (that is, materials about music, such as books or articles). Since the terms were derived from LC Subject

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the musical work, then the MARC 382 field in the bibliographic record should reflect those changes rather than match the MARC 382 field in the authority record for the musical work.

[46] See https://performedmusicontology.org.

[47] Kimmy Szeto, "Ontology for Voice, Instruments, and Ensembles (OnVIE): Revisiting the Medium of Performance Concept for Enhanced Discoverability," *Code4lib Journal* 54 (2022), https://journal.code4lib.org/articles/16608.

[48] Deborah Lee, "Numbers, Instruments and Hands: The Impact of Faceted Analytical Theory on Classifying Music Ensembles," *Knowledge Organization* 44, no. 6 (2017): 405-15.

[49] All information on the Semantic Web must be indexed by "RDF triples" that take the format subject, predicate/property, and object. For example, Sibelius's Fifth Symphony (subject) has a medium of performance (predicate/property) of orchestra (object).

Headings, they were selected for use at the monographic level rather than for depth indexing.[50] Terms are arranged in a partially hierarchical structure with little depth. The structures are less well suited to guide end users, but rather to serve as an aid for indexers and thesaurus developers by providing a helpful place to collect similar terms. As a hierarchical classification, it is weak because it is conceived as a thesaurus rather than as a multilevel ontology. Terms may be used in both a specific and general sense. *Ductless flute* is used both for an unspecified or unidentified instrument of this type and as a point of collocation for specific types of ductless flutes. It is polyhierarchical in that a term may be linked to more than one broader term. For example, the pipe organ falls under both *keyboard* and *aerophone*.

H-S and LCMPT employ different facets by which to classify. H-S 321.322 is the notation for *necked box lutes—guitar, violin, etc*. In LCMPT, the guitar and violin appear in separate hierarchies for plectral and bowed instruments. These two terms can be placed into narrower categories in H-S by the addition of standard subdivisions: ".5 activated by hand" and ".71 activated with bow." So 321.32205 would include, among others, the guitar, while 321.322071 would include, among others, the violin. The two classification systems are not sufficiently specific to classify notated music performed by multiple players on an instrument (for example, music for oboe, two violins, and cello). It might be sufficient for classifying writings about music or classifying simple general concepts, such as chamber music for strings (as opposed to music for violin, cello, and guitar). To provide specific classifications in H-S would require a massive body of subdivisions created within the BCC.

4.0 Conclusions

Our purpose in sharing this work of reflection with the music library community is twofold. First, we hope to encourage further discussion about the representation of medium of performance in music knowledge-organization systems. Second, and perhaps more importantly, we hope to encourage discourse about the representation of the phenomena of music in nondocumentary contexts and, in particular, in Semantic Web applications. What, really, are the phenomena of music? In our earlier work we came to the conclusion that these are the phenomena of music for classification:[51]

- Medium
- Form or genre
- Type of music

[50] In knowledge organization, indexing depth is described in terms of the object of representation. For example, in library practice it is traditional to represent a specific document with one set of descriptors (subject headings, classification strings, etc.). This is known as monographic or summary-level indexing. Depth indexing involves assignment of descriptors to elements of a document, such as the topics of individual chapters. Exhaustive indexing is the representation of all subject content, as is typical of a "back of the book" index.

[51] *The Phenomena of Music for Classification,* IKOS Technical Reports Series, no. 2 (Lake Oswego, OR: Institute for Knowledge Organization and Structure, 2022), 49.

- Elements of music (audio, structural, language/textual, time [rhythm, tempo], pitch and pitch class)
- Function

There is a venerable standard core of music terminology that effectively represents most of these. Medium, form and genre (although usually mixed and not disambiguated), textual settings, pitch or key or tonal anchor, and type of music are all incorporated in one way or another as the basis of most "bibliographic" music classifications. Semantic Web applications, on the other hand, require new facets and new faceting relators. Elements of music are not represented in the standard core: this includes audio phenomena (e.g., beat boxing), structural (e.g., sonata form, binary form), time (e.g., rhythm, tempo), and emotion (e.g., sad or happy) arising from music information-retrieval needs. New facet-analytical techniques are required for combining complex interrelated descriptors. That is, the standard core is generally more than adequate for classifying scores and recordings of musical works. But Semantic Web applications (and phenomenon-based systems like the Basic Concepts Classification) must be flexible enough not only to describe segments of musical works but also to gather and disambiguate similar musical expressions by phenomena of sound and sound production apart from notation or recording (for example, "joyous music for strings" or "contemplative ethereal music").

We have compared the cross-cultural, categorical Hornbostel-Sachs classification, which was designed for interdisciplinary classification of musical instruments, with the library-catalog–based Library of Congress Medium of Performance Thesaurus, a thesaurus of terms for describing performers and ensembles as represented in scores and recordings held in library collections. H-S avoids local nomenclature, LCMPT embraces it. The two are attractive precisely because they provide well-developed vocabulary that can easily be imported into a phenomenon-based classification such as BCC and because their differences manifest as different strengths for a Semantic Web application.

And yet, we all are aware that music is only barely analyzable in empirical contexts. Music—its performance, its reception—is a necessary existential ingredient for human existence. We make music, we respond to music, we desire music in ways that are tied to our souls. It is beyond the scope of our research program to delve into these existential questions.

Thus, the easiest conclusion might be to select one or the other approach to representation of medium of performance, or even to provide a faceting technique for using the two together when appropriate. In fact, our analysis reaches no specific conclusion. Instead, we hope we have reflected thoroughly on the panoply of phenomena associated with the representation of medium of performance as phenomena of music in nondocumentary contexts. We invite input from the world of music.

Abstract

How best to classify musical medium of performance? We welcome the advice and expertise of the community of *Notes* readers to inform our deliberations. Specifically, when referring to the sources

of musical sound, should we be describing the objects (e.g., aerophone) or the properties (e.g., piccolo), or some combination of the two? The Institute for Knowledge Organization and Structure convened a research group to discuss "the phenomena of music for classification." What does it mean to classify the phenomena of music rather than musical documents or documents containing texts about music? How might we represent music apart from its documentary representations (scores, recordings, etc.)? We considered the Library of Congress Medium of Performance Thesaurus (LCMPT) and Hornbostel-Sachs (H-S) classification. The universal Basic Concepts Classification (BCC) is interdisciplinary and is organized around phenomena (things), relators (the relationships that exist among phenomena), and the properties that phenomena and relators may possess. We sought a comprehensive classification of medium of performance for the BCC. H-S focuses on the physical nature of instruments and how they make sound, the LCMPT effectively identifies specific instruments by name. H-S does not provide the level of granularity that we need but LCMPT's larger set of terms are organized with only a few layers of hierarchy. H-S avoids local nomenclature, LCMPT embraces it. The two are attractive because they provide well-developed vocabulary and because their differences manifest as different strengths for a Semantic Web application. Ultimately our analysis reaches no specific conclusion. Instead, we have reflected thoroughly on the panoply of phenomena associated with the representation of medium of performance as phenomena of music in nondocumentary contexts.