2.0 Origins and history

2.1 Instrument classification up to the late nineteenth century

It is important to consider how Hornbostel-Sachs fits into the history of musical instrument classification. In the pre-Medieval eras, key instrument classification ideas came from the Old Testament of the Bible (especially Psalm 150), Ancient Greek ideas (in particular, works by Aristotle and Boetheius), and the Roman-era treatise of Cassidorus (Kartomi 1990). In the Medieval and Renaissance periods, discussion centred on particular treatises, including those by Grocheo, Virdung, Zarlino, Praetorius and Mersenne (Kartomi 1990). Some theories dominated multiple time periods; for instance, Kartomi (1990) claims that all writers on musical instruments in the sixteenth and seventeenth centuries still referenced the Greek or Roman models of instrument classification. Ramey (1974) suggests that rather than a continuously evolving discourse about instruments, the development of instrument classifications and theorisation of instruments remained static from the seventeenth century for two hundred years. DeVale (1990) goes further still: she suggests that aside from adding the brass category, the basics of instrument classification in the western world were fundamentally the same from Cassidorus' scheme in the sixth century through the next 1,300 years.

2.2 Mahillon and the road to Hornbostel-Sachs

It is at this juncture that a seismic change took place. Mahillon's scheme (and corresponding catalogue) for the Conservatoire royal de Musique de Bruxelles was published in 1880 (Mahillon 1880; Jairazbhoy 1990a), and radically altered the fabric of instrument classification in the western world. Mahillon's scheme took the revelatory approach of dividing the population of musical instruments into four, not three, categories, as had been the case for hundreds of years. Furthermore, the top-level categorisation in Mahillon's scheme divided instruments by how the sound was activated, rather than how the instrument was played. For a description of the categorisation of instruments including the categories used in Hornbostel-Sachs, see Section 3.1. Hornbostel- Sachs uses and expands Mahillon's classification from thirty years earlier (Kartomi 1990), therefore, perpetuating the radical changes of Mahillon's scheme. So, Mahillon's scheme is the direct parent of Hornbostel-Sachs, and both these schemes are reactions to the prevalent trends in instrument categorisation that had developed up until the late nineteenth century.[1]

2.3 The germination of Hornbostel-Sachs

Hornbostel-Sachs was developed in the early twentieth century by Austrian and German music theorists and scholars, Erich von Hornbostel and Curt Sachs (Katz 2001; Brown 2001). The scheme was first published in German in 1914 with the title of the scheme given as "Systematik der Musikinstrumente" (Hornbostel and Sachs 1914). Note that this article uses the title of the scheme "Hornbostel-Sachs Classification of Musical Instruments," which places the authors' names in hyphenation in the title of the classification scheme, rather than just the translation "Classification of Musical Instruments." As a further justification for using this format of the name, "Hornbostel-Sachs Classification of Musical Instruments" follows (with one exception) the formulation of the scheme's title as found in an article about the scheme by Sachs in 1914, which calls it "Hornbostel-Sachs'sche Klassifikation der Musikinstrumente" (Sachs 1914, 1056). As well as the schedules, the 1914 scheme includes a detailed introduction, which explains the design of the scheme and outlines what it was trying to achieve, and this introduction is an important source in organology in its own right.

2.4 The purposes of Hornbostel-Sachs

The authors of Hornbostel-Sachs had clear ideas about the users and purposes of their scheme. Hornbostel and Sachs (1961) were designing their scheme for musicologists, ethnologists and curators of ethnological collections and cultural history. So, Hornbostel-Sachs was designed to be a scheme for theoretical and for practical purposes. We can also say that it is a knowledge organization system primarily designed for organising artefacts as opposed to mentefacts, using terminology used by the Classification Research Group (Gnoli 2018b). Note, organology is not mentioned in the introduction to Hornbostel-Sachs, as this term was not in common use in the early twenthieth century (see DeVale (1990) and Kartomi (1990) for the history and boundaries of organology as a domain). Another purpose given for the classification scheme (Hornbostel and Sachs 1961) is that it encourages researchers to find new links between instruments; so, Hornbostel-Sachs is fulfilling one criterion of being a scientific classification by enabling new knowledge to be created through classification (using the term "scientific classification" as way of describing a knowledge organization system created from within a domain (Mai 2011; Hjørland 2008; Lee, Robinson and Bawden 2018).

It is important to ask what problems Hornbostel-Sachs was attempting to solve. A key issue involves the culture of the knowledge being classified, and Hornbostel and Sachs (1961, 5) suggest that a classification that suits "one

era or nation may be unsuitable as a foundation for the instrumental armoury of all nations and all times." Furthermore, one of the issues that the authors (Hornbostel and Sachs 1961) had with Mahillon's scheme was their belief that it was led by European instruments. In contrast, Hornbostel and Sachs were attempting to create a classification that removed instruments from their corresponding cultures (Koch and Kopal 2014). Hornbostel and Sachs' attempts to create what DeVale (1990, 8) delineated as a "cross-cultural system" (in opposition to a "culture-specific system"), and this was part of a general move in organology from the late nineteenth century onwards.

However, this brings to the fore questions about universality and musical instrument classification. The results of Hornbostel and Sachs' efforts to be cross-cultural in coverage can be seen, for example, in decisions not to privilege instruments such as the violin or piano, which are especially associated with western art music. However, it is acknowledged that though this was their aim, Hornbostel and Sachs had their own specific temporal and cultural background that cannot be ignored. The disjuncture between Hornbostel-Sachs' context-neutral design and the cultural-historical context of its creation ("wissenschaftshistorischen Entstehungszusammenhängen") is articulated by Koch and Kopal (2014, 301). In DeVale's (1990) continuums for analysing organological classifications, Hornbostel-Sachs could be considered as mostly exogenous, arguably like any cross-cultural classification system; the authors exist outside of the cultures of the majority of instruments covered by the scheme, as an inevitable result of the scheme covering a variety of different musical cultures. Therefore, for many classes in their scheme, Hornbostel and Sachs are imposing classification on the instruments and the cultures that those instruments represent. Furthermore, recent knowledge organization discourse acknowledges the conceptual issues with universality as a desired attribute of a knowledge organization system, and the blurred definitions of the concept (see, for example Szostak 2014), as well as increasing awareness that neutrality is not an attainable (or even always a desired) goal. So, there is a tension between Hornbostel and Sachs' ambition of writing a cross-cultural scheme, and the reality of cross-cultural instrument classification delivered through a single scheme.

Another issue that Hornbostel-Sachs tries to resolve concerns the historical three-category system of classifying instruments. The authors describe the three traditional categories of instruments as "illogical" and "inadequate," and are complementary about the four categories used in Mahillon's scheme (Hornbostel and Sachs 1961, 6) (A full discussion of the four categories is found in Section 3.1. of this article). So, the obvious question is why Hornbostel and Sachs did not just extend or develop Mahillon's scheme? One reason is that while Hornbostel and Sachs utilised Mahillon's four categories, they found issues with the logic used within each of Mahillon's categories. Therefore, another purpose of Hornbostel-Sachs was to provide what the authors considered to be a logical division and structure of musical instruments, within a four-category system.

3.0 The mechanics of the scheme

This section explores the mechanisms of Hornbostel-Sachs as a classification scheme. The 1914 version will be used as the baseline scheme, in its 1961 English translation, unless otherwise stated.

3.1 Four categories

A revolutionary aspect of Hornbostel-Sachs occurs at its highest level: the division of the universe of musical instruments into four categories. Until the late nineteenth century, western classifications of instruments were organised into three broad categories: wind, strings and percussion. Mahillon's 1880 scheme instead had four, not three, categories based around how the sound was made, and these categories were named "instruments autophones," "instruments à membranes," "instruments à vent" and "instruments à cordes" (Mahillon 1880).

This quadrivium became the basis of Hornbostel-Sachs, albeit with some changes in nomenclature. First, Hornbostel and Sachs takes the neologism found in Mahillon's scheme of naming a category of instrument using "method of sound production" plus "phones," and applies it to the other three categories; for example, "instruments à cordes" in Mahillon's scheme becomes "Chordophone" in Hornbostel-Sachs. Note that the German terms for the category names are given, so "Chordophone" is a plural in the 1914 original German, which becomes "chordophones" once translated to English. Second, Hornbostel and Sachs prefer the term "idiophone" rather than Mahillon's "autophones"; the authors were concerned that a category entitled "autophones" might be confused with automatic instruments (Sachs 1914). This decision was based on research by Sachs published in 1913 (Sachs 1914; Hornbostel and Sachs 1961). Figure 1 shows the progression of the main categories over time.

Note that there is some debate about the novelty of these four categories, which in turn could affect the perception of Hornbostel-Sachs as a disruption of classificatory norms: scholars have commentated that Mahillon's and Hornbostel-Sachs' four-category system appears to match the classification espoused in a fifth-century Indian treatise, "Nātyasāstra," attributed to Bharata (Jairazbhoy 1990a; Heyde 1977). Furthermore, Jairazbhoy (1990a) posits that Mahillon would have been aware of "Nātyasāstra"

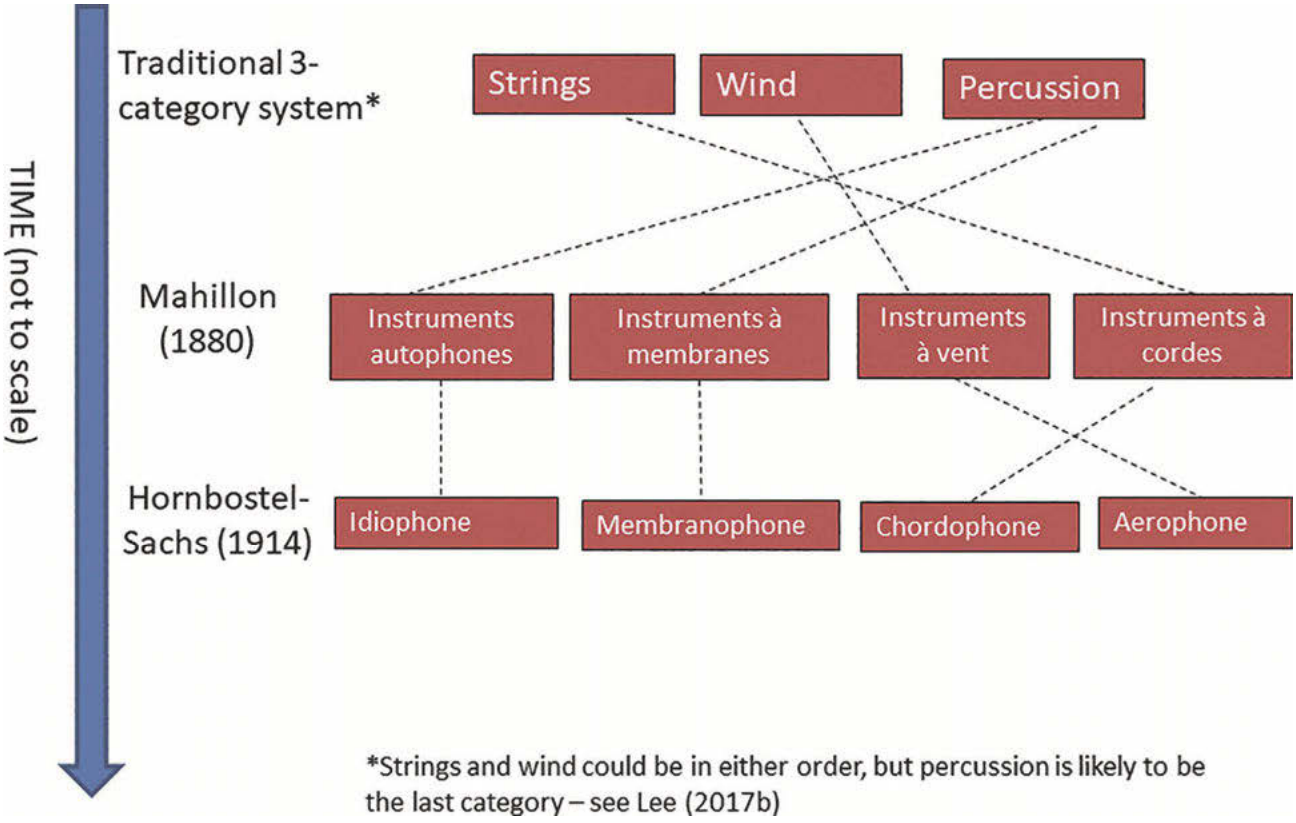

Figure 1. The top-level categories in Hornbostel-Sachs and its antecedents.

and describes anomalies that strongly infer that Mahillon consciously borrowed the Indian four-category system. So, although the radical four-category system of Hornbostel-Sachs is credited to Mahillon, the origins of a four-category system is not (only) a nineteenth century, European invention.

The four-category system did, however, break the continuum of European instrument classification in a number of ways. First, what could be called the "characteristic of division" is different in the four-category systems of Mahillon and Hornbostel-Sachs from traditional three-category schemes. For example, both a gong and a drum are struck, so in a traditional three-part system are considered "percussion;" however, in the four-category system, the fact that the gong's sound is produced by the solid material of the gong itself vibrating and the drum's sound is produced by the stretched membrane of the drum vibrating means they would be placed in different classes (classed in membranophones and idiophones respectively in Hornbostel-Sachs). Second, the four-category system gives much more space to what in older categorizations would be called "percussion" instruments, and notably in Hornbostel-Sachs, sees the percussion-equivalents appear earlier in the order of categories. The prominence of idiophones and membranophones in Hornbostel-Sachs is no accident. In systems designed primarily for western art music, the percussion instruments have far less importance than in the whole universe of music cultures; categorisng based on sound-production means that the privileging of instruments from one culture at the expense of other cultures is reduced, thus enabling Hornbostel and Sachs' universal intentions. However, although Hornbostel-Sachs is noted for its four categories, a fifth category for electrophones becomes the standard structure in later years—see Section 4.3.

3.2 Notation

Hornbostel-Sachs is remarkable as it uses a decimal notation (Gnoli 2018b, Section 3.1), and this feature alone makes it significantly different from its Mahillon parentage. While attributed by the authors of Hornbostel-Sachs as being a *Dewey Decimal Classification* (*DDC*) notation (Hornbostel and Sachs 1961), a close look at Hornbostel-Sachs makes it clear that it is not exactly *DDC* that has been used. Gnoli (2006) states that Hornbostel-Sachs uses the European version of *DDC*, which is an authorised version of *DDC* and the precursor to the "Universal Decimal Classification" (UDC) (Gnoli 2006). There are a number of ways in which Hornbostel-Sachs adopts UDC notation rather than pure *DDC*. For example, the four base catego-

ries are given as "1," "2," and so on; yet, if this used *DDC*'s decimal notation, extra zeros would be added so that these categories would have the notation "100," "200," and so on. In addition, the presence of a period every three digits also marks out Hornbostel-Sachs as adopting European/UDC notation; for instance, Hornbostel-Sachs has "211.212.2" for "sets of cylindrical drums" (Hornbostel and Sachs 1961), which would have been written as "211.2122" (or similar with apostrophes) in *DDC*'s notation.

Hornbostel-Sachs' notation works by each new level of classification adding an extra digit to the right-hand side of the notation (see Gnoli 2018b, Section 3.1, for more information on how decimal notations function). For example, "4" represents aerophones, "41" free aerophones, and "411" displacement free aerophones (which includes the whip or sword-blade). There is also something interesting about the digits selected by Hornbostel and Sachs. For example, the aerophones are divided into three main types: free aerophones (41), wind instruments proper (42), and trumpets (43). Note that the digits "1," "2" and "3" have been selected; this is in contrast to what we might expect to find in other decimal systems where three digits selected across the range from "1" to "9" might be used instead.[2] For an example of Hornbostel-Sachs notation, see Figure 2, which presents a selection of classes from aerophones with their corresponding notations. The same design can be seen at every level of Hornbostel-Sachs; frequently, only the digits "1" and "2" are used, and there are very few occurrences of digits over "4." The impact of this choice is that it diminishes Hornbostel-Sachs' hospitality: there is no room to insert a new category between existing categories in future versions, at least in a way that keeps the new category at the same level of notation as its siblings. So, when Montagu (2009) wishes to add a new high-level group for the half-spike lute, which conceptually fits between the spike-lutes (321.31) and necked lutes (321.32), he is faced with a notational problem. Montagu's (2009) solution was to add a new class of 321.31.5, to sit between 321.31 and 321.32. This destroys the symmetry of having only 3 numbers between periods; also, the choice of "5" appears to be representing thirty-one-and-a-half, rather than a class equal in hierarchy to 321.31 and 321.32. Therefore, adding new classes is unideal in Hornbostel-Sachs due to its particular application of decimal notation.

4 Aerophones
41 Free aerophones
411 Displacement free aerophones
412 Interruptive free aerophones
413 Plosive aerophones
42 Wind instruments proper
421 Edge instruments or flutes
422 Reedpipes
423 Trumpets

Figure 2. Selection of classes from aerophones demonstrating decimal classification (Hornbostel and Sachs 1961). Note, only the first three levels are shown.

Another and related feature of Hornbostel-Sachs' notation is its expressivity. For instance, the class with notation "1" (idiophones) has only one digit and is a very broad category, whereas "111.141" (castanets) has six digits and represents a specific type of instrument (though as will be discussed below, not an actual instrument). However, as the classification scheme does not have the same number of hierarchical levels between category and type of instrument for each type of instrument, as discussed in more detail in Section 3.4, this means that the notation cannot be fully expressive; for example "421.121.12" is a category with eight digits representing a specific type of end-blown flute, while the three-digit "413" for "plosive aerophones" also represents a specific type of instrument. So, while it is generally true that the number of digits represents some broad idea of where you are within the hierarchy, there is some variation for different areas of the scheme.

3.3 Arrangement within categories

Hornbostel-Sachs (1961) has a different order of knowledge within each of its four main categories. The authors selected the most appropriate divisions for each category rather than consistently apply the same criteria or order of these criteria across each of the four main categories (Hornbostel and Sachs 1961). Furthermore, Hornbostel and Sachs are concerned with placing too much emphasis on method of playing as a main dividing principle, which is the basis of Mahillon's scheme: for example, if playing method is the primary way of dividing chordophones, then the plucked violin and bowed violin would go in very different places, yet they are the same instrument (Hornbostel and Sachs 1961). Gnoli (2006) summarises the different orders within the four main categories as follows: while chordophones and aerophones are mostly concerned with morphology, the playing technique largely governs the ordering of the idiophones and membranophones categories. The structure of the first two levels within each of the four main categories is shown in Figure 3, Figure 4, Figure 5 and Figure 6, and these figures highlight the inconsistencies in structure between the classes. Kartomi (1990) suggests that Hornbostel and Sachs' reason for forgoing logical division was a pragmatic choice, where the complexities of reality

1 Idiophones
11 Struck idiophones
111 Idiophones struck directly
112 Indirectly struck idiophones
12 Plucked idiophones
121 In the form of a frame
122 In board-or comb-form
13 Friction idiophones
131 Friction sticks
132 Friction plaques
133 Friction vessels
14 Blown idiophones
141 Blown sticks
142 Blown plaques

Figure 3. The first two levels within the idiophones class, extracted from Hornbostel and Sachs (1961).

2 Membranophones
21 Struck drums
211 Drums struck directly
212 Rattle drums
22 Plucked drums
23 Friction drums
231 Friction drums with stick
232 Friction drum with cord
233 Hand friction drums
24 Singing membranes
241 Free kazoos
242 Tube-or vessel-kazoos

Figure 4. The first two levels within the membranophones class, extracted from Hornbostel and Sachs (1961).

3 Chordophones
31 Simple chordophones or zithers
311 Bar zithers
312 Tube zithers
313 Raft zithers
314 Board zithers
315 Trough zithers
316 Frame zithers
32 Composite chordophones
321 Lutes
322 Harps
323 Harp lutes

Figure 5. The first two levels within the chordophones class, extracted from Hornbostel and Sachs (1961).

4 Aerophones
41 Free aerophones
411 Displacement free aerophones
412 Interruptive free aerophones
413 Plosive aerophones
42 Wind instruments proper
421 Edge instruments or flutes
422 Reedpipes
423 Trumpets

Figure 6. The first two levels within the aerophones class, extracted from Hornbostel and Sachs (1961).

win out over classificatory niceness. However, the inconsistency in ordering within categories is given as one of the main criticisms of Hornbostel-Sachs (for example, see Wachsmann et al. 2001).

These points give some insight into the philosophical foundations of Hornbostel-Sachs. This suggests that Hornbostel-Sachs adopts an ontological approach, where the phenomena (the instruments) are considered to be the centre of the classification scheme, and decisions about the hierarchical levels used in the scheme are driven by what is found in the real world of instruments.

The authors of Hornbostel-Sachs are particularly eloquent about their choices for the terminology of knowledge-levels within each category. Hornbostel and Sachs (1961) decided not to formally label the levels within each category, despite their comment that labels of strata are used in biological classification and in Mahillon's scheme; however, Hornbostel and Sachs (1961) do suggest informal names for these levels, suggesting that the idiophones and so on would be called classes, followed by sub-classes, orders and sub-orders. The authors' comments mentioning biological classification are interesting as they could be read as a link between organology and other scientific classifications. Furthermore, the deliberate omission of official terms for the levels within the hierarchies could be viewed as an expression of the confusion within music classification about how to appellate the chains between broad instrument categories and individual instruments. For example, issues about which levels in the chain are covered by the amorphous term of "instrument family" are explored conceptually by Lee (2017c) in her discussions about string ensembles, and in practical terms in a *DDC* working paper (*Dewey Decimal Classification* 2016).

3.4 Individual classes

The size of the chain in Hornbostel-Sachs between broad category (for example, "idiophones," "membranophones") and lowest level class (for example, "slide trumpets," "double-skin stationary drums with friction-cord") varies across the scheme. For example, "friction drum with whirling stick" is at 232.2, showing only four levels of hierarchy, and "free kazoos" is at 241, showing only three levels of hierarchy; conversely, the "without tuning noose" mono-heterochord music bow with resonator is at 311.121.221, showing nine levels of hierarchy. An example of the hierarchy leading from chordophones to the class 311.121.221 can be seen in Figure 7. Figure 7 also demonstrates how the decimal notation adopted by Hornbostel-Sachs makes it simple to see the hierarchical pedigree of any class; for example, one glance at the number 311.121.221 shows that it contains 311.121 (mono-hetereochord musical bow), meaning that 311.121.221 must be a mono-heterochord musical bow, because it has the (great grand-) parent class of 311.121 included within it.

These lowest levels of classes are not titled by names of specific instruments. Instead, the lowest-level classes have titles that are the shared characteristics of instruments, which would reside in those classes. Specific instruments are given as selective examples, such as the hade, African lyre, violin, European flute, Ocarina, and so on. For example, class 321.322 is entitled "necked box lutes or necked guitars," with a note stating "violin, viol, guitar." This list only contains selected examples, and any instrument considered a necked box lute of necked guitar would be classed here, such as violas, cellos or the double bass (to give some examples important to western art music).

3 Chordophones
31 Simple chordophones or zithers
311 Bar zithers
311.1 Musical bows
311.12 Heterochord musical bows
311.121 Mono-heterochord musical bows
311.121.2 With resonator
311.121.22 With resonator attached
311.121.221 Without tuning noose *S. Africa (hade, thomo)*

Figure 7. Example of hierarchy in 311.121.221 (Hornbostel and Sachs 1961). Note, classes have been omitted which are not direct descendants of 311.121.221.

These examples and notes will be examined in more detail in Section 3.7, which discusses typographical layout.

3.5 Coverage and warrant

The "necked box lutes or necked guitars" example illustrates a number of important points about the coverage of Hornbostel-Sachs. First, the authors' intention of being culturally universal is illuminated by this example, as even the typically western instruments in this class are still only given as examples rather than the title of the class. Second, this example shows how Hornbostel-Sachs does not distinguish between current and obsolete instruments; viols are usually associated with music of the seventeenth century and earlier and were largely superseded by the violin, viola and cello, while violins and guitars are popular (in specific cultures) in the twenty-first century. This fits with Hornbostel-Sachs' philosophy to be for all times, as laid out in the scheme's introduction (Hornbostel and Sachs 1961) and also seen in the tensions presented by each class representing both the current instrument and its evolutionary progression to get to that form (Gnoli 2006). Furthermore, this treatment of temporal existence of instruments also fits into Hornbostel-Sachs' purpose of organising collections of instruments, as instrument collections usually contain many historical, "superseded" instruments.

Literary warrant is another important aspect of understanding Hornbostel-Sachs, and literary warrant is taken as a broad term to include all types of documents including objects such as musical instruments (Barité 2018). Hornbostel and Sachs discuss whether instruments need to exist to be included: "we have refrained from providing a subdivision containing no existing representative" (Hornbostel and Sachs 1961, 10). In other words, there is a literary warrant for any class to be included in Hornbostel-Sachs. This contrasts with Mahillon's scheme (on which Hornbostel-Sachs is based), which includes categories for instruments which had not yet been invented (Jairazbhoy 1990b, 82-83).

However, the question of literary warrant is not quite this straightforward. The Hornbostel-Sachs schedules suggest that the scheme itself is less clear-cut than is implied in its introduction. First, there are a very small number of classes where the example or note has the word "unknown," suggesting that either specific instruments are unknown or the geographic location where such instruments are found is unknown. Examples include "132.1 (Individual) friction sticks" (under Friction sticks) and "131.1 (Individual) friction sticks" (under friction plaques).

Second, there is one class, "421.121.311 with fixed stopped lower end" (under stopped side-blown flutes) which has the note "Apparently non-existent." It is not explained whether there are just no extant exemplars of that instrument, or there is no evidence that the instrument ever existed. At least some of these examples, especially the friction sticks, might be explained by the authors' (Hornbostel and Sachs 1961) caveat in the introduction to the scheme: sometimes they assigned classes to simpler versions of a known instrument, because they assume this earlier and simpler version existed, even if they do not have evidence. So, the literary warrant of Hornbostel-Sachs is not just instruments that were known to have definitely existed, from the temporal perspective of 1914; instead, the literary warrant of Hornbostel-Sachs also includes instruments that were thought to have existed, from the temporal perspective of 1914.

3.6 Extensions and alternatives

Hornbostel-Sachs includes a number of extensions. These extensions could be considered number-building, or even loosely as an analytico-synthetic feature of the scheme. Furthermore, some alternatives are also offered.

There are two broad types of extension in Hornbostel-Sachs. The first type involves optional additions to existing classes, which are different depending on the broad category of instruments. These additions are found at the end of each category, and are suffixes to the main classes. For example, you can add "with membrane glued to drum" to any class within membranophones (Hornbostel and Sachs 1961). However, you can only add it to a class in the membranophones category; clearly, this addition would make little sense to a class in chordophones or aerophones. To add this suffix, a dash is added to the regular class, and it is possible in some cases to add multiple additions. The purpose of these extensions is to provide more detail to existing classes. To some degree these extensions could be considered a light sort of synthesis, at least within the universe of any individual broad category of instruments such as membranophones.

The second type of extension involves building a new class from two or more existing classes. The introduction to Hornbostel-Sachs (1961) gives an example of the modern, western orchestral trombone, which has slides and valves; in Hornbostel-Sachs, the slide trombone is found at 423.22 and the valve trombone is found at 423.23. Hornbostel-Sachs (1961) says that this instrument could be represented using both classes, with a plus between the two notations (423.22 + 423.23). A notational short-cut is also offered: 4232.2 + 3. This shorthand notation works by using the period to indicate the division between the digits that are being repeated (in this case, 4232) and those digits which are not; so, this class reads 423.22 + 423.23, with the user alerted to the repeat of "4232" by the position of the period. Changing the position of the period is an interesting variation on decimal notation, and is not

seen in schemes such as *DDC*. This type of extension sees composite instruments intellectually represented as a combination of two types of instruments. This could be considered as faceting, where the composite notation representing the composite instrument could be considered as a complex class created from the simple classes of the initial instruments. This is taken further by the examples of bagpipes given in Hornbostel and Sachs (1961), and discussed in Ghirardini and Gnoli (2005): using the decimal point, brackets and colons (for example, 422-62:22 for a reed instrument with flexible air reservoir with exclusively clarinet pipes, or 422-62 : .2]1 for set of reedpipes with flexible air reservoir with bagpipe of oboe), this quasi faceting can be used to specify the way sound is produced in different parts of the instrument using the existing schedules and extensions to build a more specific notation than is listed in the schedules.

There is a third, and vaguer type of extension. For example, the introduction (Hornbostel and Sachs, 1961) says that adding new subdivisions, principles or classes is also acceptable. In other words, the classifier is free to change and extend the scheme at will. Consequently, Hornbostel-Sachs is theoretically infinite in its coverage, although the limitations of decimal notation in base ten mean that the scheme cannot be infinitely hospitable in terms of how this infinite universe is notated.

Hornbostel-Sachs also permits alternatives. For instance, the bagpipes example (Hornbostel and Sachs 1961) also shows how suffixes in the aerophones class are made part of the main class, thus altering the order of elements. This flexibility would be useful for curators and others selecting the most appropriate arrangement for their specific collection. However, this does have an impact on universality, as it suggests Hornbostel and Sachs (1961) did not intend for their scheme to be used in the same structure at different institutions and that the authors were not positing a singular order of instruments.

3.7 Typographical layout

It is important to consider how the information within a scheme is structured and labelled, as it illustrates the authors' structural intentions and is often used to communicate these intentions to the schemes' classifiers. The Hornbostel-Sachs typography is particularly interesting as different layouts of information are adopted in the German original, English translation of 1961, English reprint of 1992 and 2011 updated version. (For more information about these versions, see Section 4.) This asks important questions about typographical meaning and its transmission across versions of schemes.

Hornbostel-Sachs contains four types of information in the main schedules: the notation, title of class, description and notes. The notes are varied, often containing geographic information about where the instrument is found (for example, "China und Vorderindien" (Hornbostel and Sachs 1914, 563)) or examples of specific instruments (for example, "Violine, Gambe, Guitarre" (Hornbostel and Sachs 1914, 580)). In the original German version of the scheme (Hornbostel and Sachs 1914), the scheme is laid out as a table, with the three columns labelled as follows: Klassifikation (which contains the notation and title of class), Charakteristik and Beispiele. The table is presented in landscape form.

The tabular layout is not followed through to subsequent versions (such as 1961, 1992 and 2011), nor are there any labels for the different types of information; instead, the differentiation between notation/class and other types of information is presented using typefaces and punctuation. The 1961 and 2011 versions use bold typeface for the notation and class titles, with roman typeface for the "Charakteristik," and italic typeface for the equivalent of the "Beispiele" (The 1961 and 2011 versions are typographically very similar, apart from the significant spacing between "Charakteristik" and "Beispiele" in the 1961 version, and completely different family of typefaces used in the 1961 and 2011 versions). The formatting in the 1961 and 2011 versions makes it relatively easy to distinguish the different types of information, even without Hornbostel and Sachs' (1914) labels or tabular layout.

The 1992 reproduction adopts a different typographical layout from the original 1961 English translation. In the 1992 version, the scheme is presented in two unmarked columns of text, with the notation in the left column and the other types of information in the right column. Class titles are in bold, upper-case letters or italics, depending on their hierarchy. The equivalent of the "Charakteristik" is in roman typeface, usually preceded by a colon. However, the equivalent of the "Beispiele" is also given in roman typeface. Sometimes the Beispiele-equivalent is preceded by an m-dash, with an introductory phrase "found in" for geographical examples, and with other examples the Beispiele-equivalent is displayed in parenthesis. Furthermore, some of the examples are located in a different place within the description of a class, as compared to the German original. The overall effect of the 1992 typographic layout arguably makes it more difficult to delineate the different types of information than other versions. This could be interpreted as a sign that the strong divisions found in the 1914 version between the different types of information that constitute the scheme, are not considered a core tenet of Hornbostel-Sachs (or at least, were not considered core by those responsible for the 1992 version). The different types of information that make up the presentation of a classification scheme could be considered key parts of the "verbal plane" of a knowledge organization system (where the ver-

bal plane is an intrinsic part of a classification scheme and separate but related to the structural elements found in the notational plane (Gnoli et al. 2011)). These verbal planes are an important part of the knowledge organisation of databases (Gnoli et al. 2011), which is especially interesting when considering the intended use of the 2011 version of Hornbostel-Sachs (see Section 4.4).

Another important factor is to examine the typographical representation of Hornbostel-Sachs' hierarchy. The original German scheme used indentation to indicate hierarchy; for example, 322.21 is set to the right of its parent class 322.2, but to the left of its child, 322.211. However, the difficulties of presenting indentation within a column of a table may be the reason that only the first few levels of the hierarchy are indented. The 1961 and 2011 versions use a subtle form of indentation to indicate hierarchy, using the differences in length of the decimal notation to indent the class names. The 1992 scheme does not use indentation to represent hierarchy, which asks a question about whether hierarchy was considered an important aspect of Hornobostel-Sachs to the editors of this version. All four versions also make some use of changes in typeface to represent different levels of hierarchy. The German original uses a bold weight for the four main categories, and italic typeface for the fourth level; the 1961 and 2011 versions only differentiate the first level from all the other levels, and do this using upper-case letters and type size; the 1992 English version uses bold weight for the four main categories, upper-case letters for the next level down, and then italic typeface for all other levels. In conclusion, hierarchy is represented typographically in Hornbostel-Sachs in various ways and comparing the different versions illustrates different approaches to the importance of visually representing the hierarchy of Hornbostel-Sachs, such as the 1992 version forgoing the communication of hierarchy through indentation. Furthermore, these variations between different versions indicate that the visual representation of hierarchy is not deeply imbued within Hornbostel-Sachs, as it is not transmitted in a consistent form between versions.

3.8 The introduction to Hornbostel-Sachs

Hornbostel-Sachs includes a substantial introduction written by its authors. The introduction makes up a sizeable component of the scheme; for example, there are eleven-and-a-bit pages of introduction in the 1961 edition, which is the same size as the scheme itself. The introduction includes the following: an outline of why a systematic classification is needed and the purposes of the scheme; ideas about being a classification for all cultures and this as a driving force behind the creation of the scheme; the problems of the incumbent three-category system; details about, and a critique of, Hornbostel-Sachs's direct predecessor, the Mahillon scheme; an account of the structure of Hornbostel-Sachs and explanations for some of its structural features; an explanation of Hornbostel-Sachs' notation; number-building and alternatives. So, as well as being a practical guide to using the scheme, the introduction also serves as Hornbostel-Sachs' manifesto.

The introduction to Hornbostel-Sachs is such an important source in its own right that not only is it quoted by numerous commentators on instrument classification, but the English translation of the introduction is also reprinted in various "Grove" (the prominent encyclopaedia of music) resources. The introduction to Hornbostel-Sachs appears in the 1980 *New Grove Dictionary of Music and Musicians* and remains in the current version of this resource, as an appendix to the entry on the classification of instruments (Wachsmann et al. 1980, 2001), as well as appearing in the *New Grove Dictionary of Instruments* (Wachsmann et al. 1984). This indicates the centrality of Hornbostel-Sachs to the development of organology; this is further discussed in Section 5.3, which places this discussion in the context of the impact of Hornbostel-Sachs.

4.0 Editions, updates and revisions

4.1 Introducing updates

Hornbostel-Sachs was first published in 1914 under the title *Systematik der Musikinstrumente: ein Versuch*, within the German journal *Zeitschrift für Ethnologie: Organ der Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte.* In other words, this seminal classification scheme was first published in a journal for anthropology and ethnology, rather than being in a musical journal. Furthermore, the term "ein Versuch" suggests it was intended as a discussion document rather than the absolute version of a classification scheme (Montagu 2009). The publication language and subject area are seen by some commentators to have had a negative effect on Hornbostel-Sachs. Baines and Wauschsmann ([Translator's introduction], Hornbostel and Sachs 1961), suggest that the German language and the subject matter of the home journal hindered the accessibility of the scheme in its first fifty or so years. Similarly, Montagu (2009) suggests that discussion about the proposed classification scheme was curtailed by the unfortunate timing of the scheme's publication in 1914, when Europeans had other urgent matters to consider aside from the classification of instruments.

After initial publication, Hornbostel-Sachs was subsequently adapted and altered. In fact, adapting Hornbostel-Sachs appears to have been prevalent even from the first years of the scheme: for example, Montandon produced an adaptation of the scheme in 1919, just five years after its original publication (Dournon 1992).

4.2 Translations

Hornbostel-Sachs was translated into English for an issue of the "Galpin Society Journal" in 1961. The translators, Baines and Wachsmann, describe the motivation for their translation: the original German Hornbostel-Sachs is often quoted by those working with or researching instruments, and has not been superseded in terms of usage ([Translator's introduction], Hornbostel and Sachs 1961). Interestingly, Baines and Wachsmann ([Translator's introduction], Hornbostel and Sachs 1961) acknowledge that modifications have been made to Hornbostel-Sachs between 1914 and 1961, but they choose to translate the original 1914 text rather than any modified version. This is all the more remarkable considering the development of a new class of electrophones in the 1930s (see Section 4.3). The translators ([Translator's introduction], Hornbostel and Sachs 1961) were concerned about students having access to original classification schemes as a source; this situates the original 1914 scheme as an important document in its own right, of such value that it should be studied in its frozen form nearly fifty years later. This shows the pre-eminence of Hornbostel-Sachs within the organology community, and also illuminates the versioning (to use the terminology of Tennis 2010) of the scheme by placing (retrospectively) the 1914 original as a distinct and self-contained document rather than part of a continuum of minor adaptations and small updates.

In 1992, the scheme appeared in its English translation as part of an anthology of "reference aids" within an ethnomusicology textbook (Hornbostel and Sachs 1992). Again, this inclusion places Hornbostel-Sachs as a cultural work in its own right, presented as a canonical document of ethnomusicology. Whether the scheme appearing in a textbook of ethnomusicology as opposed to being available in a back issue of a key journal in organology would have had much of an impact on availability, will not be explored, but it is assumed that any availability issues for the 1961 edition was resolved once older issues of the *Galpin Society Journal* became available electronically. The 1992 reprint differs from the 1961 version in terms of layout, typography, pagination and the absence of the translators' introduction, but not in the contents of the scheme or authors' introduction.

However, there are other translations of Hornbostel-Sachs: for instance, the translation into Italian of the scheme and its introduction by Guizzi (2002), as well as translations into languages such as Catalan, Finnish and Spanish mentioned by authors commentating on Hornbostel and Sachs (Kartomi 2001; Montagu 2009). The translations are important to note when considering the universal intentions of Hornbostel-Sachs, and that translations are one aspect of considering the impact of a classification scheme (Lee 2015).

4.3 New categories: introducing electrophones

A significant development sees the introduction of a fifth category of instruments. This category is first found in Galpin's (1937) book about European musical instruments, under the title "electrophonic instruments." Galpin's (1937) book includes a discussion about instrument classification which discusses Hornbostel-Sachs and an outline of Galpin's classification scheme. Furthermore, the chapters of the book are assigned to the broad categories of instruments including the new category "electrophonic instruments" (Galpin 1937). Galpin (1937, 30) acknowledges that this class is "entirely new and included here for the first time." Galpin (1937, 30) defines electrophonic instruments as "instruments in which the sound-waves are formed by oscillations set up in electronic waves." However, the scheme that Galpin (1937) presents and discusses is an updated version of Galpin's own 1900 scheme, which appeared between Mahillon's scheme in 1880 and Hornbostel-Sachs in 1914.

The first appearance of the fifth category as part of Hornbostel-Sachs appeared in 1940, in a history of musical instruments by Curt Sachs (1940). Sachs (1940, 455) states that there are "five main classes" of instruments, and there is a section for electrophones alongside the existing four categories in the "Terminology" chapter of the book. The term "electrophones" is the typical title for instruments of this nature, and this is the term adopted by the MIMO version of Hornbostel-Sachs (see Section 4.4). However, the boundaries of electrophones can be ambiguous (Kartomi 1990). For example, Bakan et al. (1990) discuss distinguishing between "electrophones" and "electronophones" when talking about the classification of electronic music instruments. The presence of the fifth category for electrophones in the general Wikipedia article on Hornbostel-Sachs (Hornbostel-Sachs 2019) could be seen as evidence of the accepted norm of Hornbostel-Sachs being considered a five-category scheme.

Other new categories in Hornbostel-Sachs have also been suggested. For example, Olsen (1986) proposes a new fundamental category for sound produced by using the human body as an instrument, called corpophones. Unlike electrophones, "corpophones" do not (yet) seem to have been adopted as a standard category.

4.4 MIMO: a new version of Hornbostel-Sachs?

There is one resource that has strong arguments for being considered a truly distinct version of Hornbostel-Sachs, as opposed to just a new state (using the distinction found in Tennis (2010)). A new version of Hornbostel-Sachs was published electronically in the twenty-first century, for use by the Musical Instrument Museums Online (MIMO) project. The MIMO project's purpose was to create "a single

access point to digital content and information on the collections of musical instruments held in a consortium of European museums" (Musical Instruments Museums Online 2011, 1); to fulfil this aim, a new version of Hornbostel-Sachs was created (Musical Instruments Museums Online 2011). According to the introduction to the scheme (Musical Instruments Museums Online 2011), the main purpose of this revision was to classify instruments that were invented since the 1914 scheme was published, such as electrophones. From a knowledge organization perspective, this comment is insightful: the purpose of the MIMO revision was not to rethink the structure of instrument classification but predominantly to incorporate the new knowledge that had been generated since the scheme was originally created.

The MIMO version of Hornbostel-Sachs was created by the "MIMO Working Group for Classification and Thesauri," chaired by Margeret Birley of the Horniman Museum, London (Musical Instruments Museums Online 2011, 1). However, this version is closely related to another instantiation of the scheme: the revised version of Hornbostel-Sachs by the organologist Jeremy Montagu (Musical Instruments Museums Online 2011). Therefore, to consider the MIMO version of Hornbostel-Sachs, it is imperative to also consider its direct descendant. Montagu's version was published in 2009, in the Polish music journal *Muzyka*.[3] Montagu (2009) uses typographical features such as crossing out text and asterisks to indicate changes from the 1961 translation of the 1914 scheme, to his new version. Furthermore, Montagu's (2009) version builds on his previous research and modifications to Hornbostel-Sachs from earlier years, such as his work with Burton in 1971 (Montagu and Burton 1971). From this we can see that the MIMO version is a substantial revision, but its creation is part of a continuum of scholarship through the twentieth and twenty-first centuries, with Montagu a key creator of these developments. See Figure 8 for a visualisation of the MIMO scheme and some of its antecedents, which shows the types of relationships between the various instantiations.

Arguably the most significant change between the MIMO version and the original 1914 version of Hornbostel-Sachs is the addition and development of the electrophones main category. The inclusion of electrophones was inevitable, and had been missing from the English translation in 1961 and 1992. The significant stages between Galpin's initial use of "electrophonic instruments" and the inclusion of an electrophones as a fifth category in the

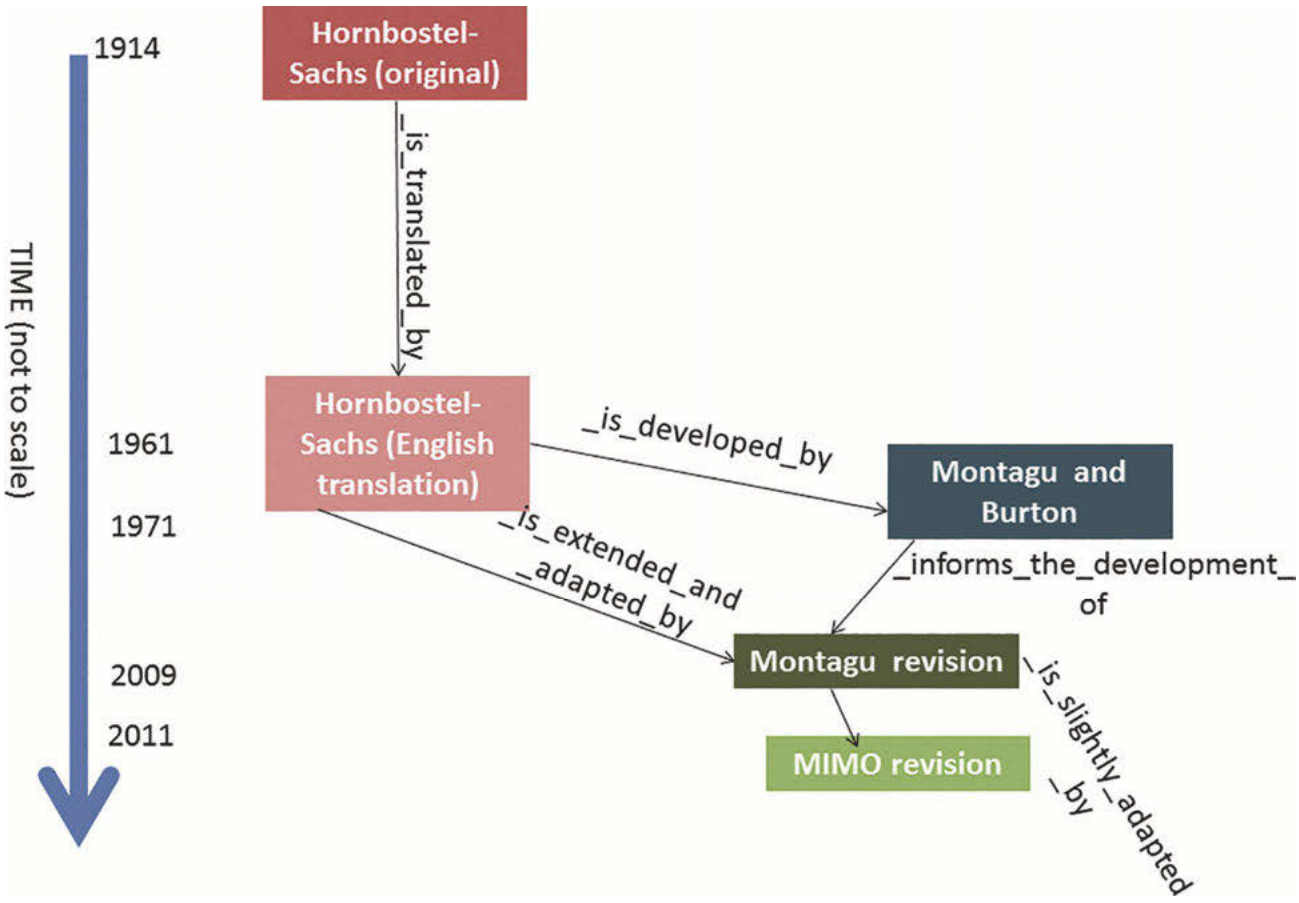

Figure 8. The relationships between MIMO version of Hornbostel-Sachs and its antecedents.

MIMO version are illustrated in Figure 9, although note this figure only contains highlights of this development. The schedules of electrophones in MIMO are based on the work of Maarten Quanten (Musical Instruments Museums Online 2011).

The MIMO version also made structural changes in other categories. Examples given in the MIMO introduction (Musical Instruments Museums Online 2011) include expansions and renaming of part of kettledrums, a different sort of division employed in the brasswinds and new categories in aerophones. Finally, the MIMO version was designed for a shared, digital environment and this has meant changes to the notation; for example, the abbreviations in notation suggested by Hornbostel and Sachs in their introduction (Hornbostel and Sachs 1914) have been omitted. For more details about the developments ensconced in the Montagu and MIMO versions, see the introductions to Montagu (2009) and MIMO (Musical Instruments Museums Online 2011).

The development of the MIMO version should not be seen as the end of the variations, amendments and versioning of Hornbostel-Sachs. Adding new classes and structural changes do not in themselves resolve issues of using a hierarchical structure, especially in an online age. For instance, Weisser and Quanten (2011), writing at the same sort of time as the MIMO revisions were published and disseminated, argue for a different format and approach to Hornbostel-Sachs. They (Weisser and Quanten 2011) do not consider forcing the classifier down a single path based on initial vibration is satisfactory for all instruments. So, like countless others before them, Weisser and Quanten (2011) suggest a new way of using Hornbostel-Sachs, with additions and amendments. Therefore, the MIMO version is not an endpoint, as the amendments, modifications and rethinking of Hornbostel-Sachs keep on coming.

4.5 Governance of Hornbostel-Sachs

As a postlude, it is interesting to briefly consider the ownership and maintenance of Hornbostel-Sachs. The original scheme was published in a journal, and the important 1961 English translation was also published within a journal and then is republished as a book chapter in 1992. Later versions were published as papers by Montagu and then as

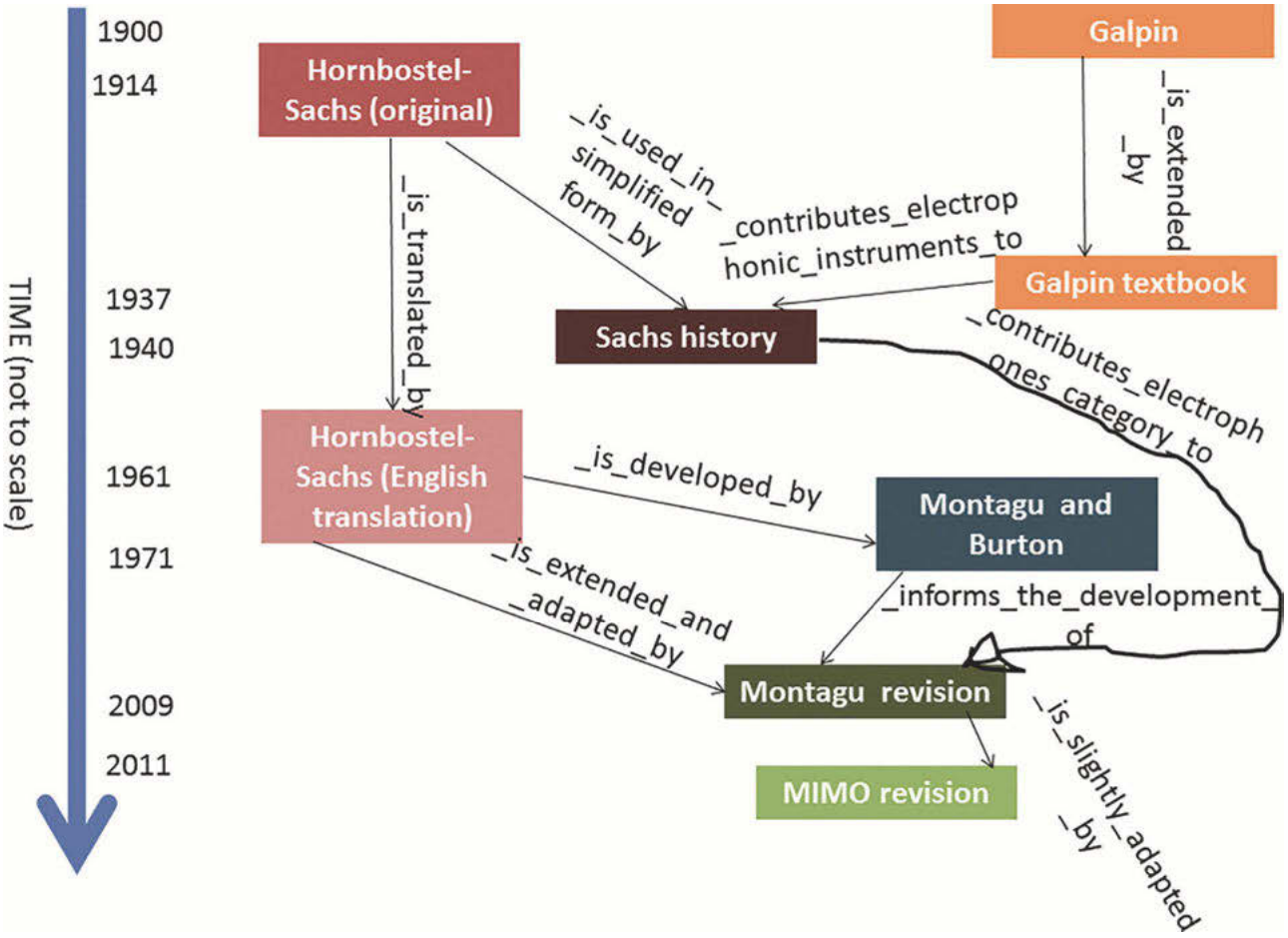

Figure 9. The relationships between MIMO version of Hornbostel-Sachs and its antecedents, including electrophones.

part of a working group for MIMO. So, there is no official ownership of Hornbostel-Sachs, other than the copyright of individual authors, translators and publishers. This places Hornbostel-Sachs in contrast with modern bibliographic schemes such as *DDC*, UDC and the second edition of "Bliss Classification," which have named editors, usually in conjunction with organisational structures of management and governance. Perhaps the closest Hornbostel-Sachs has come to such an arrangement is through the MIMO consortium working group, chaired by Margaret Birley (Musical Instruments Museums Online 2011), which worked collectively on modifying Montagu's revised version. Therefore, at least until the MIMO project, it could be argued that there was no official governance of Hornbostel-Sachs, and revision and maintenance was on an ad-hoc basis, usually determined by research interest rather than through official review.

5.0 Reception of Hornbostel-Sachs

The reception-related aspects of Hornbostel-Sachs are a significant part of this classification scheme. Lee's (2015) reception studies framework is used to delineate the different strands of reception, to consider Hornbostel-Sachs' consumption (usage), criticism and its Wirkung (the effects and influence of the scheme). The reception of Hornbostel-Sachs will be considered from the dual perspectives of its home domain (organology) and its impact on bibliographic classifications of music.

5.1 Usage of Hornbostel-Sachs

Establishing the usage of classification schemes is methodologically difficult, as this information is rarely collected in a systematic fashion (Lee 2015). Discussions of consumption of Hornbostel-Sachs in organology discourse are mixed. On one hand, scholars describe Hornbostel-Sachs as a highly used classification scheme; for instance, it is labelled as "widely adopted" (Dournon 1992, 252) and "predominant" (Kolozali et al. 2011, 465), while Gnoli (2006) describes Hornbostel-Sachs as the most well-known and used of organological schemes. A more recent source, Weisser and Quanten (2011, 122) say that "[Hornbostel-Sachs] is still used by most musical instruments museums and in large inventory projects such as the MIMO," and Koch and Kopal (2014) discuss its use at the Ethnologisches Museum der Staatlichen Museen zu Berlin and other collections. On the other hand, Montagu and Burton (1971, 49) are not alone in stating that few organizations seem to use it to actually arrange their instruments. As little quantitative evidence is used to support either side of the argument, we are left to inferences. Kartomi (1990) provides a possible explanation of the differing views: while many people use Hornbostel-Sachs, they are generally only using the first few steps or top few levels. This is illuminated by Ghirardini and Gnoli's (2005) comments on the usage of Hornbostel-Sachs, as they imply that using only the first main classes of a scheme may be typical of a general pattern of how classification schemes are used. In other words, many people are using broad ideas from Hornbostel-Sachs, but there is little evidence from secondary literature that many are using the full classification scheme. However, even with this cross-step it seems that there are conflicting accounts of Hornbostel-Sachs' actual consumption when considering secondary accounts.

So, in the absence of quantitative primary data about usage in more traditional settings of collections of instruments, broader examples of types of usage will be analysed instead to illuminate the different ways in which Hornbostel-Sachs is consumed. First, Hornbostel-Sachs is used in a number of different published resources about musical instruments. It can be used to organise lists of instruments; for instance, Blades (1982) includes a checklist of percussion instruments from a particular collection, and this list is organised using Hornbostel-Sachs, including Hornbostel-Sachs notation and extensions. This type of usage could be considered equivalent to a classified catalogue of bibliographic items, such as the British Catalogue of Music (Coates 1960). Hornbostel-Sachs is also used in ethnomusicology and organology, as a way of organising a group of instruments found in the course of research. For instance, Picken (1977) uses Hornbostel-Sachs to organise a list of instruments found during field research in Afghanistan. Interestingly, there is also evidence of Hornbostel-Sachs used as a pedagogical tool. In "Musical instruments of the world: an illustrated encyclopaedia" (1976), Hornbostel-Sachs is presented as a diagram in the encyclopaedia, as a representation of the world of instruments. In addition, the basic categories of Hornbostel-Sachs are used to arrange the knowledge in this encyclopaedia, but note the encyclopaedia does not use Hornbostel-Sachs' notation or order of classes. This use of organisation system to organise a textbook is an interesting example of KO in action, which perhaps could be related in part to Szostak's (2018) development of KO systems as pedagogical tool for world history.

Second, it is interesting to consider Hornbostel-Sachs' usage in the digital age. Perhaps the most significant example is the MIMO revision. This development of a new version of the classification scheme (see Section 4.4) was for a very specific use: an online museum of instruments, where the new version is specifically designed to work in a collaborative, digital environment. A second example of digital usage of Hornbostel-Sachs can be found in Wikipedia. For instance, broad categories such as aerophones have Wikipedia pages (List of Aerophones by Hornbostel-Sachs number 2019) which list the classes in these catego-

ries, the associated Hornbostel-Sachs notation and examples of instruments in those classes (also sometimes adding extra examples not found in Hornbostel-Sachs itself). Such examples also make good use of hyperlinks to provide what could be considered a digital, user-generated version of Hornbostel-Sachs. These lists also appear for the other three categories (List of chordophones by Hornbostel-Sachs number 2018, List of Idiophones by Hornbostel-Sachs number 2018, List of Membranophones by Hornbostel-Sachs number 2018). (At the time of writing, the article for electrophones (Electrophone 2019) for electrophone does not contain a classified list of instruments with corresponding notation, only information about this category.) Furthermore, some individual instruments have the "Hornbostel-Sachs classification" notation as a featured piece of metadata about the instrument in their Wikiepedia entry, such as the flexatone (Flexatone 2018). These examples show how Hornbostel-Sachs has transcended being a way of organising physical objects or printed information about instruments, and that Hornbostel-Sachs has been transformed for digital media and the digital age.

Finally, it is worth considering the use of Hornbostel-Sachs in the bibliographic sphere. Ghirardini and Gnoli (2005) discuss their survey of library use of Hornbostel-Sachs: they find it is little used. However, Ghirardini and Gnoli (2005) find that is Hornbostel-Sachs is used by one library, for its books about non-western music. This highlights the comparatively cross-cultural nature of Hornbostel-Sachs compared to bibliographic classification schemes, and also could be seen as a sign that the scheme's cross-cultural intentions are borne out in its reception. In addition, arguably Hornbostel-Sachs sees indirect usage in libraries through its influence on the contents and structure of bibliographic schemes for music. This "Wirkung" is discussed in detail in Section 5.4.

5.2 Criticism of Hornbostel-Sachs

Criticism of Hornbostel-Sachs is historically mixed. In positive criticism, labels such as "monumental" (Grame 1963, 138) and "best" (Hood 1971, 125, describing a comment by Kunst) are used. Furthermore, examples of Hornbostel and Sachs in textbooks of music history such as *Man's Earliest Music* (Carlin 1987) could be seen as acts of criticism; in other words, knowledge of Hornbostel-Sachs, a classification scheme, is seen as being crucial to knowledge of music history. Specific reasons for Hornbostel-Sachs' perceived goodness are less common, but include its intended multicultural reach (Kartomi 2001). This shows how the cross-cultural intentions of Hornbostel-Sachs might have been realised in the execution of the scheme and appreciated by its audience. In discussing the use of Hornbostel-Sachs in museums, Koch and Kopal (2014, 300) mentions its "…klar geregelten Charakteristika für die Ordnung von Instrumenten" (clear, regulated characteristics for the order of instruments), suggesting that its usage can be ascribed to its positive, internal and structural qualities.

However, negative comments also abound, especially about specific aspects of the scheme. The inconsistency of how the four main classes (idiophones, chordophones, membranophones and aerophones) are subdivided is a noted disadvantage of the scheme; this can be seen in comments by Wachsmann (Wachsmann et al. 1980) and Kunst (described by Hood 1971). Other criticisms are noted, such as the confusing layout instigated by the decimal notation (Jairazbhoy 1990b) and the treatment of borderline instruments (Kartomi 1990). Furthermore, cross-classification is seen as an issue in Hornbostel-Sachs, as Kartomi (1990) also talks about issues with instruments that could live in two different places in the scheme (although this last criticism is suggested as a general problem with hierarchical classification rather than specifically with Hornbostel-Sachs).

5.3. Effect and influence of Hornbostel-Sachs

The effect and influence of Hornbostel-Sachs (its "Wirkung") within organology can be seen in a number of ways. Examples already discussed in this article include the presence of the introduction as an appendix to articles on the classification of instruments in various editions of "Grove" (Wachsmann et al. 1980, 1984, 2001), the new versions and translations of Hornbostel-Sachs in the twentieth and twenty-first centuries and the numerous new instrument classification schemes in the twentieth and twenty-first centuries that are adaptations of, or reactions to, Hornbostel-Sachs. The latter type of Wirkung includes new schemes created deliberately to attempt to resolve problems of Hornbostel-Sachs, such as Sakuri's scheme, which explicitly demonstrates its disagreement to Hornbostel-Sachs by increasing the number of main categories (Dournon 1992). Lee (2014) has a longer discussion about these and other types of Wirkung of Hornbostel-Sachs.

Another way of viewing the effect of the original scheme is to reconceive it as a historical document which charts the development of discourse about instruments and culture. Koch and Kopal (2014, 301) discuss how the scheme deals with the "exotischer" (exotic) and "primitiv" (primitive), and suggest that the scheme is important to the study of scientific history. So, the qualities of the scheme that impinge Hornbostel-Sachs' modern use, are the same aspects that also add to its influence, by way of aiding the study of the historical development of ethnomusicology, ethnology and organology.

Hornbostel-Sachs has also affected bibliographic classification schemes for music, as seen by bibliographic classifications that have partially adopted Hornbostel-Sachs's prin-

ciples, terminology and ideas. Conceptually, this means that a classification designed primarily for artefacts in the form of musical instruments is being transformed to classify mentefacts such as musical scores, and resources about musical instruments.[4] The scale of Hornbostel-Sachs' infiltration into bibliographic classification is noteworthy. Lee (2017b) found that out of a group of fifteen bibliographic classification schemes for music, seven made some use of Hornbostel-Sachs. In these examples, the level and types of influence varies; sometimes the bibliographic schemes borrow Hornbostel-Sachs's terminology, while sometimes they use its structure. Some examples of these influences are given in the next section; information about the methodology of these investigations, and differences between implicit and explicit factors, can be found in Lee (2017b).

5.4 Examples of Hornbostel-Sachs used in bibliographic classification

5.4.1 Bliss Classification

The first example is taken from the first edition of Bliss Classification (Bliss 1953). There is one Hornbostel-Sachs reference in this scheme, which comes in the VWT part of the schedules. This contains a class entitled "stringed instruments, chordophones;" so, the Hornbostel-Sachs category of chordophones is given as an alternative name for string instruments. There are no other signs of Hornbostel-Sachs usage in the arrangement or terminology of this scheme, showing how Hornbostel-Sachs can be used just as a passing reference.

5.4.2 *DDC* early editions

The second examples come from the pre-twentieth editions of *DDC*; in other words, the examples are taken from editions before the revolutionary changes wrought by the "Phoenix Schedule" for music (Sweeney et al. 1980). The fifteenth edition of *DDC*, published in 1951, is the first edition of *DDC* to use Hornbostel-Sachs terminology: it chooses to describe as "membranophones" what had previously been labelled "drum" (Dewey 1951), and this label is maintained until the major changes of the "Phoenix Schedule." In addition, the fifteenth edition of *DDC* also uses the Hornbostel-Sachs term "electrophones;" however, this term is dropped in the sixteenth to nineteenth editions. In light of the revolutionary nature of the fifteenth edition of *DDC*, including its adoption of more modern terminology (Comaromi 1976), these examples of Hornbostel-Sachs terminology could be considered as a reflection on the perceived standing and symbolism of Hornbostel-Sachs. They position Hornbostel-Sachs as equating to "modern" in the eyes of *DDC*'s authors.

5.4.3 Flexible Classification

The third example demonstrates a different type of Hornbostel-Sachs usage: using Hornbostel-Sachs ideas to structure part of the schedules. The "Flexible Classification" (Pethes 1967) uses Hornbostel-Sachs especially in the percussion part of the schedules.[5] As well as using the Hornbostel-Sachs terms "membranophones" and "idiophones," these classes are also arranged in line with the Hornbostel-Sachs broad categories. Within each of the classes, various Hornbostel-Sachs ideas relating to how the sound is made (for instance, struck, shaken and friction) are used to organize the classes, albeit the ideas are not employed in the same order as Hornbostel-Sachs. It is noteworthy that it is percussion that gains the detailed, explicit Hornbostel-Sachs makeover in "Flexible Classification." Bibliographic schemes typically treat percussion instruments as being less important than the other categories, which stems from the low importance attached to percussion within earlier periods of western art music (see Lee 2017b). So, we could see "Flexible Classification" as a realisation in the bibliographic world of Hornbostel-Sachs' cross-cultural aims.

5.4.4 UDC

The fourth example is UDC, which has a fuller adoption of Hornbostel-Sachs. UDC is unusual in adopting Hornbostel-Sachs's four main categories as its structure, and the scheme includes a plethora of Hornbostel-Sachs terminology and structural aspects. For example, like Hornbostel-Sachs, UDC has no keyboard category; instead, individual types of keyboard instrument are scattered amongst the main categories. However, there are also ways that UDC does not follow Hornbostel-Sachs; for example, UDC's classes are for individual instruments rather than characteristics of instruments, and UDC does not adopt Hornbostel-Sachs' order within the idiophones category. Therefore, UDC shows how Hornbostel-Sachs can be a strong influence on structure, terminology and order of concepts, without the bibliographic scheme entirely replicating Hornbostel-Sachs.

5.4.5 *DDC* Phoenix Schedule and modern editions

The fifth example is the "Phoenix Schedule" of *DDC*, which is the basis for the *DDC* music schedules for the twentieth edition onwards. For instance, Hornbostel-Sachs terminology is used in the "Phoenix Schedule," although it deliberately sits alongside more conventional names for instruments and instrumental families; this again sets up the positioning of Hornbostel-Sachs as terminologically advanced, with terms such as "strings" situated as the popular term. It is particularly insightful to consider the influence of Hornbostel-Sachs on the "Phoenix Schedule," when read-

ing the scheme alongside the "Phoenix Schedule" authors' stated intentions to base their scheme on Hornbostel-Sachs (Methodologically, this can be seen as using part of a multiplane approach by delineating different types of information about classification schemes (Lee 2017a)). One example is keyboard instruments. These are given their own category in the "Phoenix Schedule," despite this negating the fundamental feature of Hornbostel-Sachs, which has four broad categories separated by the method of sound production (for a fuller account, see Lee 2017b). Another example can be found in the inclusion and exclusion of classes. While the authors of the "Phoenix Schedule" say they use Hornbostel-Sachs deliberately to create instrument schedules that are a "value-free basis for the classification" (Sweeney et al. 1980, xxii), so in other words will be less western-centric, actually many classes in Hornbostel-Sachs that do not have any western exemplars are missing from the *DDC* "Phoenix Schedule."

6.0 Conclusion

Hornbostel-Sachs is a highly significant classification within the theory and practice of organology. The scheme drew upon developments in instrument classification, such as Mahillon's division into four categories, while purposefully designing a scheme that moves away from single-culture, western-centric structures of instrument classification. Furthermore, the scheme was highly original in its borrowing of the bibliographic idea of decimal classification, creating what the authors believed to be a culture-free notation as well as a way of representing the hierarchy of the scheme within its notation. While aiming to be universal in the cultures it covered, the extensions and alternatives offered by Hornbostel-Sachs hint at strong localisation in the intended usage of the scheme.

Exploring the versions of Hornbostel-Sachs shows the establishment of the contents of the 1914 original as a monument of music and organology history. This is evident from the translation of the original scheme nearly fifty years later after it was published and the inclusion of a translation of the 1914 scheme in a late twentieth century anthology of key texts in ethnomusicology. However, this article has shown that the representation of classification information by typographical means was not sacred, as this was generally not transmitted into translations or later versions.

An examination of the reception of Hornbostel-Sachs highlighted some interesting contrasts between perception and reality, especially in terms of its actual usage. While Hornbostel-Sachs seemed to be used for arranging collections of instruments in the twentieth century, scholars such as Koch and Kopal (2014) have reservations about its suitability for this purpose. Furthermore, examining Hornbostel-Sachs' reach into bibliographic classification, illustrates the symbolism of Hornbostel-Sachs, showing how the scheme signifies technical knowledge and modernity. Perhaps the only true new "version" of the scheme is the MIMO version, although examining the germination of this version shows a complex and intriguing web of influences and relationships. The MIMO version is particularly exciting for showing how a scheme from 1914 designed to organise physical collections of instruments, can be significant, dominating and versatile enough to be reimagined for a digital collection of instruments nearly a century later. Above all, Hornbostel-Sachs is shown to be a central classification scheme for curating and studying instruments, as well as playing a central role in musical instrument research and practice.

Notes

1. Kartomi (1990) discusses how Galpin's 1900 scheme also utilises Mahillon's four-category system, albeit with different names; however, as the next levels of hierarchy within these categories did not follow Mahillon, and it is Mahillon that is mostly mentioned by Hornbostel and Sachs, Galpin's 1900 scheme will not be discussed further.
2. According to Gnoli (2018), a decimal classification is usually associated with ten divisions, so there is a question about whether Hornbostel-Sachs's notation can be called a "decimal notation" in the purest sense of the term.
3. Note that there is also, at the time of writing, an open access copy of this paper available from Montagu's website dated from 2008, which is almost identical to the 2009 publication. For simplification, only the 2009 paper will be cited, as this is the published format.
4. Although, it should be noted that while primarily designed for the classification of instruments, Hornbostel-Sachs was also intended by its authors to be used for treatises and similar about instruments.
5. "A Flexible Classification System of Music and Literature on Music" was written by the Hungarian music librarian, Ìvan Pethes, based on the UDC schedules and initiated by the International Association of Music Libraries, Archives and Documentation Centres (IAML). The "Flexible Classification" aimed to be a universal classification for music literature and scores, which would bring together disparate classification practices into one scheme but appears to have resulted in little usage in libraries.

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Letter to the Editor

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Popularity of entries in *ISKO Encyclopedia of Knowledge Organization*

The *ISKO Encyclopedia of Knowledge Organization (IEKO)* was launched in 2016 by Birger Hjørland, its Editor-in-chief, as an official ISKO initiative; Claudio Gnoli joined soon as co-editor and web editor. Peer-reviewed articles are published online at http://www.isko.org/cyclo/ then printed in the *Knowledge Organization* journal (Dextre Clarke 2017).

Since 2018, the Web version of new entries includes a counter of independent visits provided by Digits.net; the counter has also been progressively introduced for all previously-published entries, keeping track of the date when the count has started. After a couple of years, such statistics offer an interesting hint to assess which topics are the most popular in our field. Obviously, this is not an objective measure of the absolute relevance of a topic or quality of a page: for example, an entry on a very specific topic can be expected to be consulted less often than those on more general topics, yet still be a necessary component in the documentation of knowledge organization (KO) concepts.

On 8 November 2019, we have tabulated the current value of counters for 46 *IEKO* entries. The other 11 entries available at that time have not been considered, as they still had not had a counter for a period significant enough (at least 40 days). Visits for an individual page ranged between 113 and 9010. As these values are clearly biased by the different age of each counter, we have weighed them by the number of days elapsed since the introduction of the counter (often, though not always, coinciding with the entry creation). Number of elapsed days ranged between 44 and 604.

Dividing the former value by the latter, we got a visit rate v for every entry. Resulting values of v range between 0.89 and 17.36 visits per day per entry, with a mean of 4.11. The ten most often visited entries are as shown in Table 1.

There are many possible ways to explain these results. A first observation is that the most visited entries concern very general topics in KO and the broader field of library-and-information science (LIS)—as opposed to, for example, knowledge organization systems (KOSs) in specific fields or biographical articles on individual KO authors. This may reflect a use of *IEKO* in educational contexts, contributing to a greater awareness of the basics of our field among non-specialists.

Exceptions to this are the entries on Hornbostel-Sachs and on the classification of psychology, which may have been largely used due to the popularity of the subject as taught in specific KO courses or to the renown of their authors. In general, humanities may be of greater interest to the KO community than other covered fields, such as physics or astronomy, although this hypothesis would need further evidence.

The systematic index of *IEKO* is organized by broad categories that are identified by capital letters (compatible with the Integrative Levels Classification (ILC) notational system for special and local schemes) and used in anchor links. We have aggregated data on visit rates by such categories and calculated the average v for each category and subcategory. Results are shown in Table 2.

As can be seen, general entries on the discipline itself (entry on "KO") and adjacent disciplines (entry on "LIS") have by far the highest average v, confirming that users' interests focus on introductory resources. Apart from this,

17.36	Knowledge pyramid: the DIKW hierarchy
14.83	Library and information science (LIS)
11.60	Knowledge organization (KO)
11.49	Classification
6.92	Hornbostel-Sachs Classification of Musical Instruments
6.91	Literary warrant
6.58	Citation indexing and indexes
6.27	Knowledge organization system (KOS)
6.17	Indexing: concepts and theory
6.13	Classification of psychology

Table 1.

5.53	***A***	**KO: general and historical issues**	
13.21	*AD*		Discipline and adjacent disciplines
1.68	*AR*		Biographical articles
5.35	***C***	**Core concepts in KO**	
5.46	*CC*		Theoretical concepts
4.16	*CS*		Specific document types, genres and media
3.29	***K***	**Knowledge organization systems (KOS)**	
4.98	*KA*		KOS general issues
5.21	*KD*		KOS kinds
1.87	*KG*		Specific KOSs, general/universal
2.85	*KL*		Specific KOSs, domain/specific
2.90	*KN*		KO in specific domains
2.87	*KS*		Standards and formats for representing data
4.83	***P***	**Knowledge organizing processes (KOP)**	
2.48	***R***	**Methods, approaches and philosophies**	
2.09	***T***	**KO in different contexts and applications**	

Table 2.

the average values for all broad categories do not differ very much. The low value for general KOSs can be explained by the fact that entries for the most renowned systems (*DDC*, UDC, *BC2* ...) are still in preparation or (in the case of *Colon Classification*) have lacked a counter until recently so are not included in this survey.

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Databases should Keep Pace with the Needs of scientific Exploration: "Nationality" should be added to scientific Research Databases

The rapid development of science and technology has shortened the distances among people from different countries and regions. Many people study or work abroad rather than in their home countries. According to Decoding Global Talent 2018 (https://on.bcg.com/2tB3qy7), 57% of respondents expressed willingness to work abroad. Working abroad has become a global trend. At the same time, research on countries or regions has always been a hot topic. A large number of results can be obtained when searching for a country, a region, developing country, or developed country in Google Scholar. The question arises: How do we consider the impact of those who work abroad on related research?

It is difficult to assess the specific impact of talents on national development and social progress. Even the most intuitive literature analysis work is also facing difficulties. A great deal of literature analysis is based on *Science Citation Index* and *Social Sciences Citation Index* in the *Web of Science* database. However, it should be noted that the "Count-