The KNIGHT SYSTEM for Musical Instrument Classification

by Roderic C. Knight, Professor of Ethnomusicology
Oberlin College Conservatory of Music

In 1914, when Erich M. von Hornbostel and Curt Sachs published their *Systematik der Musikinstrumente*, they were answering a need for museum scientists and systematic and comparative musicologists to accurately identify musical instruments from any corner of the globe. Their guiding principle was to identify the mechanism by which an instrument sets the air in motion. The idea was not new. The Indian sage Bharata, in compiling the knowledge of his era into the *Natyashastra* almost 2000 years earlier, grouped musical instruments into four great classes, or *vadya*, based on this very idea: *sushira,* instruments you blow into; *tata*, instruments with strings to set the air in motion; *avanaddha*, instruments with membranes (i.e. drums), and *ghana*, instruments, usually of metal, that you strike. Jumping from then to relatively recent times, the well-known composer Michael Praetorius published his theoretical work, the *Syntagma Musicum* in 1618. We may dub him the father of modern organology, or the scientific study of musical instruments, for in the second volume of the *Syntagma*, entitled *De Organographia*, he broadens the scope to an international scale by including illustrations of instruments from many parts of the world. Building on these materials and many others, Hornbostel and Sachs took the idea of classifying instruments several steps farther by developing a detailed hierarchy of terms that could be used to consistently and accurately identify any musical instrument, or more broadly defined, any sound-producing mechanism that mankind might have invented.

Although the *Systematik* had the subtitle *Ein Versuch*, or "an attempt," meaning it was intended to start a broad discussion among organologists, the need among museum scientists for the classification was so great that it was simply adopted and has today become the standard system, learned by all ethnomusicologists, at least in broad outline, if not in its minutiae.

The *Systematik* was translated into English as "Classification of Musical Instruments" by Anthony Baines and Klaus P. Wachsmann (the latter a student of Hornbostel and Sachs) and published in the *Galpin Society Journal* in 1961. As the decade progressed, organology became a focus of attention in ethnomusicology. Klaus Wachsmann, now a professor at the UCLA Institute, taught the organology seminar, and Mantle Hood, director of the institute, would soon present (in *The Ethnomusicologist,* 1971) his organograms, a method for encapsulating the classification, playing technique, relation of player to instrument, and other salient details about instruments into a single diagram per instrument. These events launched the present author, then a graduate student at UCLA, on his personal "*Systematik-Versuch*," culminating in the present document.

Today even elementary school children might learn the four great classes of the Hornbostel-Sachs system. To replicate the order of the Sanskrit terms presented above, they are the aerophones, chordophones, membranophones, and idiophones. The first three of these terms Hornbostel and Sachs adopted from Victor-Charles Mahillon, who used them in his catalog of the musical instrument collection at the Brussels Conservatory. Mahillon's fourth term, "autophone," was deemed potentially ambiguous by Hornbostel and Sachs, who felt it could imply "automatically sounding." In its place, they coined the term idiophone. A fifth term, electrophone, was proposed by Canon Francis W. Galpin in 1937, recognizing the emerging role of electric or electronic circuits in the production of sounds.

The Hornbostel-Sachs system (hereafter H-S) situates an instrument in the scheme with a string of numbers separated every three digits by a decimal point in the style of the Dewey Decimal System, in common use by libraries for cataloging books until the 1970s. In the *Systematik* the first number tells the broad class, or family, in this order: 1, idiophones; 2, membranophones; 3, chordophones; and 4, aerophones. Each number after the first represents the next step in the hierarchy. Some instruments require as few as two. For example, the number 22 is sufficient to designate what Hornbostel and Sachs called a "plucked drum" (a now obsolete term). On the other hand, if an instrument shares features with many others, distinguishing it may require as many as nine or more digits. A clapper bell, such as used in carillons, for example, is 111.242.122 in the Hornbostel-Sachs system. Although objections have been raised to the strings of numbers, they are undeniably a clear path to accuracy and specificity.

In the Knight System (hereafter K-S), the method of identifying an instrument with a number is retained. Likewise are the four (now five) broad classes of H-S. The manner of assigning subdivisions resembles that of H-S, but here the comparison breaks down. Those who are familiar with H-S, and especially those who might have memorized some of their favorite numbers, must abandon all memory of them in approaching the Knight System, for it was created by rethinking this material at every step of the way, making it impossible to retain the H-S numbers. In order to assure that K-S numbers are never confused with H-S numbers, in K-S the first digit is replaced with a letter. To objections that this introduces an English bias to the system, the only answer is that it is done for clarity. Thus, the five broad classes in K-S are identified as follows:

- **Y** for Idiophone – a solid or hollow body produces the sound [Y is used in place of I to avoid being mistaken for the Roman numeral I, or in some fonts, a lower-case L]
- **M** for Membranophone – a stretched membrane or diaphragm produces the sound
- **C** for Chordophone – a stretched "string" [understood to mean various materials, such as silk, hide, gut, vegetal fiber, metal wire, nylon] produces the sound
- **A** for Aerophone – the air itself is set in motion by various means
- **E** for Electrophone – electric or electronic circuits produce the sound

The Knight System is only the latest of many reworkings of Hornbostel-Sachs. Without elaborating upon them further, suffice it to note that each new proposal has in turn generated a flurry of further discussion. The best sources on the subject are the collected articles in *Selected Reports in Ethnomusicology* VIII (the organology issue, 1990), Margaret Kartomi's book *On concepts and classification of musical instruments*, 1990, and Jeremy Montagu's book *Origins and development of musical instruments*, 2007. Sandwiched between these is another, which actually served as the springboard for the Knight System. It is the chapter "Organology" in Helen Myers' excellent but out-of-print book *Ethnomusicology, an introduction* (1992). The organology chapter was written by Geneviève Dournon, at the time curator of the musical instrument collection at the Musée de l'Homme in Paris, a collection that has since been moved to the new Musée du Quai Branly. In addition to providing an excellent and concise overview of the history of organology, Dournon presents Hornbostel-Sachs with numerous changes in terminology and a reworking of certain categories in the system. In fact it was she who first dared to scramble the H-S numbers. In the 2007-08 Oberlin College seminar in organology, students sought to catalog and classify the instruments in the Roderic C. Knight Musical Instrument Collection using the Dournon version of Hornbostel-Sachs. But many of the stumbling blocks of the underlying system remained, seeming to cry out for still more revision, and thus the Knight System emerged. The RCK collection may be viewed online at www.oberlin.edu/libraries/digital/knight, and whenever possible in the following presentation, references will be made to instruments in the collection. A K-S number is assigned to every instrument in the collection, and the number may be searched, to see all instruments of a particular classification.

While fully honoring a profound debt to Klaus Wachsmann, and fully recognizing the seemingly immovable rock of Hornbostel-Sachs, the ultimate objective of the current venture is to present the Knight System as a viable 21st century answer to organologists looking for a system that shares the basic principles and philosophy of Hornbostel-Sachs, while streamlining the terminology and incorporating new findings and fresh thinking at every stage. It would be presumptuous to claim that the system as presented here has solved the Hornbostel-Sachs *Versuch*. Rather, it is best regarded as a work in progress, designed to be flexible enough to accept new findings or deeper sub-categories as they might be deemed necessary. Hornbostel and Sachs focused closely on the details that differentiate instruments, assigning numbers to each. In developing the Knight System, the approach has not been to match every H-S number with a K-S number, but rather to set the stage for doing so. Questions about various items will undoubtedly arise, and are welcome, as are any suggestions and additions. Please send them to rknight@oberlin.edu.

For electrophones, K-S adopts a classification devised by Michael Bakan *et al* in "Demystifying and classifying electronic musical instruments" (*Selected Reports in Ethnomusicology* VIII, 1990). In this work the authors present a classification system, given the acronym GAMES, for Generators And Modifiers of Electronic Sound. An

instrument is situated in the scheme in the same manner as H-S, beginning with the number 5. Simply replacing this number with the letter E translates these numbers into K-S numbers. The GAMES system has not been developed further since its introduction; this work awaits the electro-organologists of the future.

The streamlined terminologies mentioned above perhaps deserve more explanation at a general level. Everyone who has studied and used Hornbostel-Sachs knows that rattles are one of several types of instruments called "indirectly struck idiophones." Following the lead of Dournon, in K-S the overarching category is eliminated. For chordophones, H-S distinguished two types: simple and composite. Bows and zithers are simple, in that they have a string or strings, attached to a stick, frame, or box. Those with a neck and body – the lutes, harps, and lyres, are called composite. But "simple," although not intended to, can connote "simple-minded." Dournon dropped this distinction, while creating the category of variable-tension chordophones. These revisions are retained in K-S. There are many more examples, each to be explored as they arise in the separate discussions below.

A note on suffixes: At the end of each major class of instruments in H-S is a list of numerical codes that can be added to a classificatory number to give supplementary information that does not alter the classification. The most detailed of these is for use with membranophones, itemizing the methods by which drum heads are attached. The Knight System uses suffixes in the same manner. The H-S membranophone suffixes are retained intact; others have been supplanted by a letter instead of a number, and still others have been devised. In some cases, an item covered by a suffix in H-S has been elevated in K-S to sub-category status, as in plucked vs. struck zithers. The suffixes in K-S are introduced individually where they apply, then summarized in the Suffix Glossary on page 30.

A note on corporeal sounds: What about the voice, handclapping, finger-snapping? Even though these are not instruments made for the purpose of making sounds, they can be used that way, and in that sense, they may be explained in terms of the system: the voice is an aerophone – see the note about it under free reed, p. 24. Handclapping is a concussion idiophone (two equally sonorous parts struck together), similar to the plaque shape, p. 7. The finger-snap, thigh-slap, and cheek-tap are all struck idiophones (not membranophones because the skin is not stretched – the variable pitch of the cheek tap is dependent upon the size of the mouth opening). Stamping your foot on the floor is also a struck idiophone, but in this case the floor is the instrument, while your foot is the beater.

In order that the forest not be obscured by the trees, an overview of the system is presented on the next page. A feature that will be readily apparent is that the subcategories vary from family to family. This was an early complaint about H-S as well, but the rationale for it remains. It is an empirical system that utilizes subcategories that make sense, family by family, rather than imposing a superstructure that would only give an artificial uniformity.

Overview of the Knight System for Musical Instrument Classification

Y Idiophones
Y1 Concussion
1 Plaque
2 Bar
3 Dish
4 Vessel
Y2 Struck
1 Plaque
2 Bar
3 Vessel
Y3 Stamped
1 Solid
2 Globe
3 Tube
4 Split
Y4 Shaken
1 Vessel
2 Sliding
3 Sheet
4 Concussion
5 Sympathetic
Y5 Scraped
1 Organic
1 Wood
2 Gourd
2 Manufactured
1 Metal
2 Cloth
3 Sandpaper
Y6 Friction
1 Solid
2 Vessel
Y7 Plucked
1 Frame
2 Board
Y8 Blown

M Membranophones
M1 Struck
1 One head, open
1 Vessel
2 Frame
2 One head, closed
1 Deep
2 Shallow
M13 Two heads
1 Vessel
2 Frame
M2 Shaken
1 Opposed hemispheres
2 Hourglass
3 Frame
M3 Friction
1 One head
2 Two heads
M4 Sympathetic

C Chordophones
C1 Variable tension
1 No neck
2 Single neck
3 Forked neck
C2 Musical bow
1 Mouth resonated
2 Gourd resonated
C3 Pluriarc or bow-lute
C4 Harp
1 Strings-over
1 Forked
2 Spike
1 Curved neck
2 Straight neck (Bridge harp)
2 Strings-in
1 Arched
2 Angled
C5 Zither
1 Stick
2 Tube
3 Raft
4 Trough
5 Box
6 Harp zither
7 Frame
C6 Lute
1 Plucked
1 One piece
2 Multi-part
2 Bowed
1 One piece
2 Multi-part
C7 Lyre

A Aerophones
A1 Ambient air
1 Beating
2 Slicing
3 Ribbon
A2 Enclosed
1 Flute
1 Vessel flute
1 No duct
2 Duct
3 Duct + chamber
2 Vertical flute
1 No duct
2 Duct
3 Oblique flute
4 Transverse flute
5 Double-layer whistle
2 Reed
1 Free (hard) reed
1 Mouth blown
2 Bellows blown
3 Transverse
2 Beating (soft) reed
1 Conical bore
1 Single reed
2 Double reed
2 Cylindrical bore
1 Single reed
2 Double reed
3 Multiple reed
3 Horn (lip-reed)
1 Limited register
1 Fixed length
2 Variable length
2 Multiple register
1 Fixed length
2 Variable length
1 Fingerhole
2 Slide
3 Valve
4 Corrugated pipe
1 Twirled
2 Blown
A3 Plosive aerophone
1 Open
2 Enclosed

Note: In the presentation below, certain words that have become familiar generic terms, in addition to the major headings, are printed in **bold**.
Sources for the named instruments given as examples are listed by country at the end; if not listed, they are from the author's own knowledge, or from the many articles in The New Grove Dictionary of Musical Instruments (GDMI).
The original *Systematik* was presented in indented format, not maintained in later versions. It is reintroduced here, albeit with abbreviated numbers, intended to be more easily read.

Y Idiophones Idiophones are instruments whose body itself, or some part of it, makes the sound. They are sometimes defined by what they are not: an idiophone does not have an air column to be set in motion directly, nor does it have a membrane or strings to set the air in motion. In general, idiophones are solid or hollow bodies with resonant capabilities. They are divided into eight classes (the first number after the Y). It will be apparent, looking at the overview above, that six of the eight (excluding friction and blown) are essentially different ways of striking the instrument. For example, when a stick is drawn across a rasp, it hits the notches in succession. For the most part, the subdivisions of idiophones in K-S resemble those of H-S, with the first distinction made on shape, the next on material. But for scraped idiophones, for example, material is more important than shape, and thus these factors trade places in the hierarchy. It is envisioned that further subdivisions, especially based on material, might become necessary as study progresses, and these may be added to the system fairly easily. The order of materials established in Y12 below – wood, metal, stone – is only intended as a model; the numbers assigned are not reserved for these materials where they are not applicable.

One might divide idiophones between those that produce only one sound and those that are multi-pitched. The Hornbostel-Sachs system carefully denotes, with separate numbers, single-pitched items versus sets of the same. In K-S this is handled with a suffix. Instruments that are designed to produce more than one sound will have a suffix appended to their number, as follows: #n, where n is the number of notes it can produce. For example, the *gambang*, Javanese trough-resonated xylophone with 19 keys would be assigned the number Y22.121 #19.

A final consideration with certain idiophones is whether the playing action is direct, or accomplished by a mechanism or keyboard. Examples are axle-mounted carillon bells with a pull-rope, keyboard-operated carillons, or the celesta, with keyboard. In K-S this is indicated with a suffix, -m for mechanical, -k for keyboard, to be added immediately after the number and before the #n suffix. For example, a 10-bell carillon operated by pull-ropes would be Y23.222.1-m #10.

Y1 Concussion, or **clappers** (in German, *gegenschlag*): two equally sonorous parts are struck together. If a non-sonorous beater is used, it is *aufschlag*, or Percussion (see Y2).

Y11 Plaque: flat (thickness 1/5 or less of width), typically wood (*paiban*, China; *thiski*, Central India)

Y12 Bar: round or rectilinear cross section, thickness and width nearly equal.

- .1 Wood (*claves*, Latin America; *khartal* (often with jingles, Y44.42 below), India)
- .2 Metal (aluminum-rod wind bells, also known as a "mark tree" by percussionists)
- .3 Stone (*ili ili*, Hawaii)

Y13 Dish (depth less than diameter)

- .1 Face-to-face
- .11 Wood (castanets)
- .12 Metal (**cymbals** of all sizes)
- .2 Back-to-back: played on the convex surfaces (spoons)

Y14 Vessel (depth equal to or greater than diameter)

- .1 Hemisphere (two coconut halves)
- .2 Tube (*wa* bamboo clapper, Myanmar; *hangar*, Philippines)

Y2 Struck, or "percussion" (Ger. *aufschlag*): a sonorous object is struck with a beater

Y21 Plaque: plaques are thin, with a thickness of no more than 1/5 of the next dimension

- .1 Wood (*han*, Japanese Buddhist temple instrument; *cartaxinho*, bamboo "woodpecker," Portugal)
- .2 Metal (*nyo*, Japanese Buddhist temple instrument)

Y22 Bar: solid round or rectilinear cross section, width and thickness nearly equal; usually in sets, to be labeled with #n suffix for number of keys.

- .1 Wood (**xylophone**)
- .11 Unmounted, or loose key: the parts are assembled for use, then dismantled again (*amadinda*, Uganda)
- .12 Mounted (fixed key or frame): the resonant components are attached to a frame
- .121 Common (trough or box) resonator (*ranat*, Thailand; *gambang*, Java
- .122 Individual resonators (*bala*, West Africa; Western xylophone & marimba). Instruments of this type from Africa and Central America usually have sympathetic membranes mounted on the resonators (see M4). If present, they should be indicated with the suffix –z.
- .2 Metal (**metallophone**)
- .21 No resonator (triangle, anvil, Glockenspiel)
- .22 Common (trough or box) resonator (*saron*, Java; celesta, toy piano)
- .23 Individual resonators (*gender*, Java; all *kantilan* instruments, Bali; Western vibraphone)
- .3 Stone (**lithophone**)
- .31 Resting (i.e., loose key) (*picancala*, Kabiye people, Togo; *goong lu* or *dàn dá*,Vietnam)
- .32 Hanging (*te qing* or *bianqing* [set of 16], China; *p'yon-gyong* set, Korea)

Y23 Vessel. The distinguishing feature for this class is where the instrument is designed to be struck: at the center, on the edge, or somewhere less critically defined on the top surface.

.1 Center-struck: the **gong**. The shape varies from a shallow pan to a deep pot, typically of metal, designed to be struck at the center, where vibration is greatest.

.11 Flat: a shallow pan with no knob or boss

.111 Hanging (*luo*, China; Western orchestral gong)

.112 Resting (or hanging horizontally), always with 2+ tone-producing segments (multiple centers) sharing the face (steel pan, Trinidad; *hang* (see Hang, 2001 in References))

.12 Bossed or knobbed: typically deeper than the flat gongs, these instruments have a raised area on the flat surface where they are struck.

.121 Hanging (*kempul*, *gong*, Java)

.122 Resting (*bonang*, Java; *trompong*, Bali; both with #n suffix for number of pots)

.2 Edge-struck: the **bell**. Most bells are designed to be struck on or near the opening, where vibration is greatest, but some, especially of the globe shape, produce the same sound regardless of where they are struck. A broad category in H-S called "indirectly struck idiophone," abandoned as a broad category in K-S, remains as an important distinguishing feature among certain bells (see Globe, Y23.21, and Bowl, Y23.22, below).

.21 Globe or pod (elongated globe) shaped: closed at both ends with a narrow slit opening. Rectilinear shapes are included.

.211 Directly struck

.1 Metal (*frikyiwa*, Ghana)

.2 Wood or bamboo – the wood block and **"slit drum"** (*muyu*, Chinese temple block or fish bell; Western wood block; *keli*, bamboo with several parallel slots, Sierra Leone; *nunuha* [and three others] in the *Para ni 'o'o* ensemble, 'Are'are people, Melanesia – see GDMI; *teponaztli* [with H-shaped slot], Mexico)

.212 Indirectly struck, or **jingle bell**. The Western jingle bell or pellet bell falls here when mounted or shaken in such a manner that the sound is produced only by the pellet striking the globe from the inside. When clustered, the jingle bell becomes a concussion rattle (see Y44.22 below).

.22 Bowl, bell, or bullet-shaped: closed at one end, open at the other.

.221 Directly struck

.1 Metal. The depth varies and is noted with two sub-categories:

.11 Shallow dish (*shoko*, Japan; automobile brake drum in a Trinidad steel band)

.12 Deep (*keisu, bonsho*, Japan; *qing, bianzhong*, China; *gankogui* double bell, Ghana; Western cowbell in Latin music)

.2 Glass or ceramic (*jalatarang*, India)

Y23.22 Struck vessel, bowl shaped (cont.)

.222 Indirectly struck, or **clapper bell**: a striker, or "clapper" is attached inside (or in rare cases, outside) the bell and strikes the bell edge when either the bell or the clapper is set in motion by manual or mechanical means.

.1 Metal (*drilbu*, Tibet; Western "dinner bell" and bell-choir bells; Western carillon bells, with suffix –m or –k (see main Idiophone heading); European livestock bells.

.2 Wood (opposed double bell, Bali; cowbell, Ethiopia; animal bell with external clappers – see Dournon p. 269)

.23 Tubular: open at both ends

.231 Side-struck (*neo*, Gambia; *karinya*, Guinea; *toke*, Ghana; *ogan*, Haiti)

.232 End-struck (Western orchestral tubular bells)

.3 Top-struck, or <u>non-bell</u>: struck (virtually anywhere) on the convex surface

.31 Wood or bamboo (*jegog*, bamboo xylophone, Bali)

.32 Clay (*ghatam*, South India)

.33 Gourd (*horde*, rapped half calabash, W. Africa; *ji dundungo* (water drum), W. Africa)

.34 Plastic (tub or bucket, played by pre-Hip-Hop American juvenile street musicians)

.35 Metal (*hpà-si* bronze drum, Myanmar and formerly other areas in SE Asia, Indonesia, and China). This singular instrument, with a broad but shallow hourglass shape cast in several pieces with a flat top, is struck on the top. It does not vibrate like a gong, however, but like the membrane (or diaphragm) of a drum (See Montagu pp. 39, 212, 220). Thus the popular name for it, "bronze drum," is correct.

Y3 Stamped or tapped: the instrument itself is struck on a surface (ground, hand, thigh)

Y31 Solid, typically wood (*megomiya* stamping staff, Coptic church, Ethiopia; *jagar* (with jingles Y44.22 on top), Baiga people, Central India)

Y32 Globe, typically gourd (*ipu ipu*, Hawaii; *bollo*, FulBe people, Gambia; *shantu*, Nigeria)

Y33 Tube, typically bamboo (*tamboo bamboo*, Trinidad; *au ni mako*, 'Are'are people, Melanesia; *quitiplas*, Venezuela – the last also played with plosive aerophone technique: see A32.2)

Y34 Split. This singular instrument is a length of split bamboo. When hit on the palm, the edges of the split vibrate against each other, producing a short sustained tone. This might be understood as a concussion idiophone (Y1) except that the sound is produced indirectly, by hitting on the palm. (*balingbing*, Philippines)

Y4 Shaken – the **rattle**. In H-S, this is one type of "indirectly struck idiophone." In K-S, the broad grouping is dropped and the term confined only to certain types of bells.

Y41 Vessel rattle: a vessel, usually with a handle, is shaken to cause strikers to hit it.
- .1 Internal (**maracas** type): the strikers (seeds, beads, buckshot, etc.) are inside the vessel; when shaken, they are thrown against the inside surface.
- .11 Gourd (*saka*, Suriname; Native American rattle)
- .12 Wood (*maracas*, Mexico; Tlingit rattles, Pacific Northwest)
- .13 Cow horn (Native American rattle)
- .14 Turtle shell (Native American rattle)
- .15 Bamboo (the rain stick, originally from Central Africa)
- .16 Basket: the vessel is made of woven plant material (double baskets, Cameroon; cylindrical basket, Saramaka people, Suriname)
- .17 Metal (metal shakers, India, Central America)

- .2 External. In the "external-bead rattle" the strikers are strung on a net or individual strings on the outside of the vessel, invariably a gourd (*axatse*, Ghana; *shekere*, Nigeria; *segbureh*, Sierra Leone; half-calabash rattle, Cameroon)

Y42 Sliding Tube: tuned bamboo tubes slide in a frame moved back and forth (*angklung*, Bali)

Y43 Sheet or Plate: a rigid but flexible sheet, shaken (Western theatrical thunder sheet) This was not included in H-S but noted by Montagu, p. 212.

Y44 Concussion rattle – the **jingle**: quantities of similar or identical objects clash against each other when shaken. When the instrument is designed to sound passively, as on a dancer's arms, legs, or clothing, this should be indicated with the suffix –p.
- .1 Paired: two items connected; shaken or twirled (*bakicha* fruit shells, Gambia)
- .2 Cluster: numerous items are connected to strike each other when shaken
- .21 Organic (*chajcha* deer hoof rattle, Bolivia; Huichol spider egg case, Mexico)
- .22 Manufactured, in various shapes (*ghunguru* pellet bell clusters worn by dancers, India; clusters of two or more pea-pod shaped bells worn on wrists of drummers and xylophonists in West Africa; *jagar*, jingles mounted atop a stick, Baiga people, Central India; the "Turkish Crescent;" *Kanyelango* cap, Gambia; cone bells of rolled metal sewn on American Indian dance dress.) See Y23.212 above for the single jingle bell.

Y44 Concussion rattle (cont.)

.3 Row (concussion rattle cont.) Elements are strung in a row to sequentially hit each other when moved (*bin-sasara*, Japan)

.4 Frame – the **sistrum** or **frame rattle**: items strung on wires or posts strike each other when shaken. (They may also strike the frame in which they are mounted.)

.41 Organic (*wasamba*, w/ seed or calabash chips on a forked or curved stick, West Africa)

.42 Manufactured (*tsenatsil*, w/ metal disks, Ethiopia; the metal disks on the *khartal*, India; the jingling disks on a tambourine; *chimta* "tweezer" jingle, India)

Y45 Sympathetic rattle. Similar to the Sympathetic membrane or kazoo (see M4 below), this is not an instrument *per se* but only a sound modifier. The form, typical in Africa, is a metal plate with metal rings threaded around the edge. It is attached to an instrument and vibrates in sympathy with it (*nyenyemo* for the *kora*, Mande people, West Africa; similar mechanism on many drums and some lamellaphones). The suffix –s indicates its presence on an instrument.

Y5 Scraped – the **rasp**: a notched or rough surface is rubbed with an implement. In defining the scraped idiophone (Ger. *Schrap* or in the Langenscheidt dictionary, *Schab*), Hornbostel and Sachs describe the repeated hitting action of an implement scraped over notches. The definition needs to be expanded to include not only notches but rough surfaces as well (see Y52 below) in order to include instruments that might otherwise be mistakenly classified as Friction (Y6). In keeping with H-S, the term friction is reserved for those instruments in which a rubbing action sets up a harmonic vibration (i.e. a sustained and measurable tone).

Y51 Organic

.1 Wood [cane, bamboo], notched (*guacharaca,* Colombia; numerous SW American Indian instruments; *matraca* twirled cog-wheel [with suffix –m], Mexico)

.2 Gourd, notched (*guiro,* Dominican Republic)

Y52 Manufactured

.1 Metal (*guira,* Dominican Republic; *grage*, Haiti)

.2 Cloth: the surface, stretched on a cylindrical frame, is scraped by a drum of sticks mounted inside and cranked (Western theatrical wind machine). Montagu (p. 212) notes that Hornbostel and Sachs apparently overlooked the wind machine and suggests (following J. Blades in GDMI) including it as a friction idiophone. But this is a misnomer. See Y5 above and Y6 for clarification.

.3 Sandpaper (another variety overlooked by H-S and noted here for the first time): two blocks faced with sandpaper, rubbed together.

Y6 Friction: a smooth surface is set in harmonic motion by rubbing, producing a measurable tone. The H-S sub-categories are replaced by the following:

Y61 Solid
- .1 Plaque or plate [i.e. flat] (American musical saw, played on edge with a bow)
- .2 Bar or stick (nail violin; the *Euphon* and *Klavizylinder* of Chladni, 1790s – see GDMI). [All are multi-toned and would have the appropriate # suffix, plus –k for the latter two, with keyboards.]

Y62 Vessel or hollowed
- .1 Center-friction, analogous to a gong
- .11Wood: a block with a slotted top and cavities below is rubbed on top to produce three tones (*nunut*, *launut,livika,* New Ireland Island, Papua New Guinea – see *Musikgeschichte in Bildern* I/1)
- .12 Tortoise shell (*serakuata*, Guaymí people, Panama – see Brandt & Velasquez, 1979)

- .2 Edge-friction vessel, analogous to a bell
- .21 Gourd (*dummbo* [a half calabash inverted, scraped on a stick], FulBe people, Cameroon)
- .22 Metal: the bowl bell *qing* (China) or *keisu* (Japan), when striker is rubbed on the edge, today commonly called the "singing bowl."
- .23 Glass (the *armonica* or "glass harmonica" of Benjamin Franklin, 1761 [see GDMI, 'Musical glasses']; ordinary wine glass)

Y7 Plucked, or **lamellaphone**: a tongue fixed at one end is plucked on the free end.

Y71 Frame – the Trump: a single tongue is cut from or mounted in a frame. Its single tone is resonated with the mouth of the player to produce trumpet-like overtones (hence the name "trump," promoted by Montagu). The practice of breathing past the vibrating tongue while playing raises the question of its dual identity as an aerophone. (See Crane 1968, Adkins 1974).
- .1 Bamboo or cane. The tongue is cut from the frame, and thus termed "idioglot." The term is also used for certain reed aerophones, and is indicated with the suffix –i, but in this instance is redundant, since it is a given (*genggong*, Bali).
- .2 Metal. The tongue is a separate piece attached to the frame, thus "heteroglot." (*kach-tehendor*, Muria people, Central India; Western **Jew's harp**)

Y72 Board – the **mbira**: A set of tongues is clamped on a board or box
- .1 Bamboo (some old instruments from Central Africa)
- .2 Metal (*mbira*, Zimbabwe; *kondi*, Sierra Leone; *marimba* or *marimbula*, Dominican Republic, Jamaica; Western music box, with suffix –m for mechanical action)

Y8 Blown. This category is inhabited solely by two 19th-century bellows-operated keyboard instruments in which air was directed to thin bars to set them in motion. H-S uses the terms "sticks" and "plaques." In K-S, the material instead is specified:

Y81 Wood (*Aeolsklavier* of Schortmann, 1820)
Y82 Metal (*piano chanteur* of Baudet, 1875)

M Membranophones Membranophones are drums, with a membrane (the skin, or head) stretched over an opening. The sound is produced by setting the membrane in motion. As in idiophones, the principal subdivision is based on how this is done. For membranophones, there are four classes. The first three – struck, shaken, and friction – are true sound-producing instruments, while the fourth, included in H-S and retained here, is only a sound modifier that vibrates in sympathy with another sound – in a word, the **kazoo** (see M4). For the first three, in K-S the first subdivision is the number of heads (one or two), continuing with distinctions based on the shape of the body, or shell. Hornbostel-Sachs does not accommodate internal shape where it differs from the outside. In K-S, the internal shape, where different, may be noted as a subcategory to be added under the external shape. The material of the body, important in idiophones since it makes the sound, is a lesser subcategory for membranophones.

In Hornbostel-Sachs, a drum with a handle is assigned a separate number. In K-S, this is indicated with the suffix –h. The presence of a snare – a cord stretched diametrically or tangentially across the drum head may be indicated with the suffix –x. Details of playing technique for membranophones are not included in H-S, but may be indicated with a coded suffix (following after the –h or –x where used), as follows: -1, played with one stick; -2, played with two sticks; -3, played with one hand; -4, played with two hands; -5, played with stick-and-hand. If the technique regularly includes hitting the drum shell with a stick, as in the Ghanaian *atsimewu*, a dual classification should be given. The H-S suffixes for describing the attachment of the drum head to the shell are retained in K-S. They are listed in the Suffix Glossary at the end of the document.

Montagu notes that the movement of a drum head may be described as a diaphragm and that some other materials provide the same mechanism without a stretched membrane. The prime example is the (thus correctly labeled) bronze drum (see Y23.35 above).

M1 Struck: the membrane is struck by stick or hand or both.

M11 One head, open shell
- .1 Vessel: the depth of the shell is equal to or exceeds the radius
- .11 Cylinder
- .111 Straight
- .112 Cut-away, or footed: the shell has cut-away sections at the bottom and rests on the "feet" between them
- .12 Cone, truncated: the open end is smaller than the head (Western bongo drum)

M11 One head, open shell (cont.)

.13 Waisted: the diameter narrows at the center (*wasikor*, Torres Strait, Papua New Guinea)
.14 Barrel: the diameter increases at the center (*atsimewu, kidi, kloboto*, Ghana; Western conga drum)
.15 Goblet: the diameter cuts in below the head, then flares again at the base (*darabukka*, N. Africa; *dombak*, *zarb*, Iran; *jembe* or *djembe,* Guinea)
.16 [other shapes may be added]

.2 Frame: the depth of the shell is less than the radius
.21 Circular (*bodhran*, Ireland; American Indian drum; Western **tambourine** (also Brazilian *pandeiro*), with frame jingles Y44.42 attached; *tchauyuk* handle drum, Yupik people, Alaska) [The last is unusual: the player usually hits only the frame, but the predominant sound still comes from the head.]
.22 Polygonal (*gome* square drum, Ghana; octagonal drum, Salish, Pacific NW Indian)

M12 One head, closed shell (the "**kettle**," in various shapes – see Montagu p. 213)
.1 Deep
.11 Cylinder (*tabla*, India - the internal shape is cylindrical, even though the shell may be thicker at the base)
.12 Kettle: the shell is rounded at the base, with varying dimensions (*tinde* [a mortar with tanned goatskin], Tuareg, Niger; Western kettle drum)
.13 Barrel: as with the kettle, the shell is rounded at the base, but curves in at the head, i.e., the head diameter is smaller than the maximum shell diameter (*bayan*, India; *benda* full-gourd drum, Mossi people, Burkina Faso)
.14 [other shapes may be added]

.2 Shallow: as with the frame drum, the depth of the shell is shallower than the radius (*timki*, *kundir*, Central India)

M13 Two heads
.1 Vessel: the depth of the shell is equal to or exceeds the radius
.11 Cylinder (*davul*, Turkey; American Indian drum)
.12 Cone, truncated (*bata*, Nigeria)
.13 Hourglass: the shell is dramatically smaller at the center
.131 Fixed pitch (*ko-tsuzumi*, Japan; *parrai*, Muria people, C. India)
.132 Variable pitch, by squeezing the cords (*o-tsuzumi*, Japan; *donno*, *tama*, West Africa (the "**talking drum**")

M13 Two heads, vessel (cont.)

.14 Barrel: the diameter at center is larger than the heads

.141 Symmetrical: the widest diameter is centered (*dholak*, India)

.142 Asymmetrical: the widest diameter is offset (*kendhang*, Java; *mandar*, India; *maddal*, Nepal)

.15 Angular barrel: the widest point is an obtuse angle rather than a curve (*mridangam*, India)

.2 Frame. The two-headed frame drum is always circular (*rnga* handle drum, Tibet; shaman handle drum, Nepal, both with –h suffix)

M2 Shaken – the **rattle drum**: always two-headed, the heads are struck by pellet-tipped strings set in motion by shaking, or more precisely, twirling.

.1 Opposed hemispheres (dual cranium drum, Tibet)

.2 Hourglass, with variable tension (*damaru*, India)

.3 Frame or barrel, with handle (shaman drum, Korea)

M3 Friction: the head is set in motion by a string or stick attached to or in contact with the head. (In H-S a separate class (233) is geven for drums in which thumb friction is used directly on the head. This is not included in K-S because it is not the sole tech-nique on any drum but rather an alternative technique used on various hand drums.)

M31 One head

.1 Internal: the string or stick is attached to the drum head inside the shell. The player reaches inside to pull on the string or rub the stick back and forth (*cuica*, Brazil; *moukouiti*, Ba-Lari people, Congo Brazzaville)

.2 External: the string or stick is in contact with the outside surface of the drum head.

.21 Hand-rubbed: wetted fingers pull on the stick attached to the head (*zambomba*, Spain)

.22 Twirled: a string attached to the drum head is looped in a groove in a wooden handle. Twirling the drum at the end of the string transmits friction between the string and the handle to the head (*Waldteufel* ["forest devil"] children's toy, Germany)

.23 Stick-rubbed: a stick is attached to a cord stretched across the head and is rubbed on the head (*furruco*, Venezuela – see Aretz 1967, 101)

M32 Two heads: cylindrical drum with a string attached to each head (Senufo, Ivory Coast – see Dournon 1992, 271)

M4 Sympathetic membrane (the **kazoo**). The kazoo or singing membrane is not an instrument – it only modifies another sound. Nevertheless, it is a man-made mechanism

for use in sound production, whether it be the impromptu paper-and-comb variety or the device used for voice disguise by African masked dancers. Hornbostel and Sachs included it, and their categories are maintained here, coincidentally, with matching numbers. In addition, if such a mechanism is part and parcel of another instrument, as in the resonator membranes of the West African *bala* or *balafon*, or the membrane-covered hole on the Chinese *dizi* and Korean *taegum* flutes, it should be so identified with the suffix –z for those instruments.

M41 Free kazoo: the membrane is set in motion directly, without the air first passing through a chamber (comb-and-paper)

M42 Tube or vessel kazoo: the membrane is mounted in the wall of a tube or box; the person sings into it (Western kazoo, "eunuch flute" (see GDMI); voice disguiser for African masks)

C Chordophones Chordophones are instruments with a string or strings stretched over the body. Setting the strings in motion produces the sound. For chordophones, the method of setting the string in motion is not the primary subcategory as it is for the idiophones and membranophones. Instead, body shape and string alignment are the principal distinguishing features. In H-S, the first subclass was "simple" versus "composite." This has always been problematic and is abandoned in K-S. Retained are the familiar categories of musical bow, harp, zither, lute, and lyre. The multiple bow (pluriarc or bow lute) is given a separate category, and several instruments that have always been problematic but happen to share one feature are assembled in a new category proposed by Dournon, the (always monochord) variable-tension chordophone. Suffixes relevant to chordophones for added clarity or distinctions between instruments are -c, crank action (as on the hurdy-gurdy); -k, keyboard; -f, frets on the fingerboard; -mm, membrane-faced where not the norm; -w, wood-faced where not the norm.

C1 Variable tension. This term, coined by Dournon, defines instruments in which a string is attached to a membrane or diaphragm. The pitch is varied by changing the string tension, either by direct pulling or by a mechanism – an arm or neck. The flexibility of both string and diaphragm contribute to the pitch. All are plucked.

C11 No neck: a string is attached to the head of a small drum. With the drum tucked under the left arm, the string is pulled to vary the pitch (*ananda lahari*, India).

C12 Single neck: the string is attached at one end to a diaphragm of wood, metal, or skin. At the other end, it is attached to a stick. The stick is pulled or bent to alter the pitch (earth bow, Africa; *tiki berenge*, Burkina Faso; *dan bau*, Vietnam; washtub bass, USA)

C13 Forked neck: Two arms in a V shape are attached to the open end of a small drum. The string is stretched from the inside head of the drum to the tip of the V. Squeezing the arms lowers the pitch (*gopi yantra*, India). C11 and C13 were the "plucked drums" of Hornbostel-Sachs – a picturesque but misleading term.

C2 Musical bow: a stick is pulled into a bow shape by the tension of a string, or in some cases, more than one string (the latter to be indicated with the #n suffix, as for idiophones). Bows fall into two sub-families, mouth-resonated or gourd-resonated. Various configurations and techniques produce one, two, or three tones from the string(s), which are in turn modified by the isolation of harmonics or overtones. In H-S, the musical bow is a sub-class of stick zither, other examples of which are straight rather than curved (see C51 below). Hornbostel and Sachs went to great pains to include many varieties of idiochord and heterochord bows and stick zithers. The detailed concordance between H-S and K-S has not been worked out for these instruments.

C21 Mouth-resonated musical bow. The instrument is held near the face; the string is set in motion by striking, bowing, or plucking. Harmonics are isolated by different means.

.1 Proximity resonation: The player holds the string near parted lips and taps it with a thin wand. The other hand stops the string to produce a second fundamental. Forming the lips into different vowel sounds isolates harmonics to produce a melody over the fundamental tones (*koningei,* Sierra Leone, *kankarma*, Gan people, Burkina Faso; *mungongu*, Gabon; Nahuatl bow, Mexico).

.2 Contact resonation: the player holds the back of the bow with the mouth. Most of these instruments are obsolete. The first two were included by name in H-S.

.21 Plucked (*kalove*, with two strings, Guadalcanal, Solomon Islands)

.22 Struck (*pagolo*, with two strings, one with a tuning loop, New Britain Island, Papua New Guinea)

.23 Rubbed: a stick or stretched string is rubbed on the bow to produce a sound.

.231 On the string, i.e., "bowed" (*umqunge*, Xhosa people, Swaziland)

.232 On the notched wood surface of the bow (*chizambi*, Zimbabwe)

C22 Gourd-resonated musical bow. A resonating gourd is attached at its apex along the back curve of the bow. Some have a tuning noose pulling the string toward the gourd and dividing the string into two segments, others do not. The opening of the gourd is pressed or released from the player's body to isolate different overtones.

.1 Open string (*uhadi*, Xhosa people, *ugubhu*, Zulu people, S. Africa; *mbítí* two-string bow, Ba-aka people, Central African Republic. In this instrument, the resonator is a large leaf rather than a gourd.)

.2 Divided string (*makhweyane*, Swaziland; *munahi*, Hutu people, Rwanda; *berimbau*, Brazil; *malunga*, Sidi people, India). Note: The divided string has acquired the nickname "braced." In H-S the term is *Mit Stimmschlinge*, with tuning noose. The

term "braced" may have been coined by Hugh Tracey and presumably stems from the old word for suspenders, or "braces" (a tuning noose resembles a brace in the way it loops over the playing string). Given the obscure nature of this simile in the 21st century (at least in the U.S.), K-S recommends dropping the term "braced" in favor of "divided." The terms "tuning noose" (or "loop" as appropriate) remain valid as more detailed descriptors.

C3 Pluriarc: a set of bows, each with its own string, attached to one resonator. The terms "bow-lute" or multiple bow also describe this instrument, but the French-coined "pluriarc" is the preferred generic term (*ndang*, Bambara people, Mali; *nsambi kizonzolo*, Ba-Lari people, Congo Brazzaville; *ngwomi*, Mitsogho people, Gabon).

C4 Harp The harp is often regarded as a development of the bow or the C12 variable-tension chordophone. In H-S the term "bow harp" was used to describe one typical shape – a bow with several strings attached to a resonant body at one end. To avoid confusion, the term "arched harp" is preferred for this shape. The defining feature of a harp is that the plane of strings (envisioned as a piece of paper lying flat on the strings) is perpendicular to the sound table or top surface of the body. Another feature is that the strings are played "open," i.e., they are tuned to the pitches needed and not altered by stopping the strings with the fingers to change the playing length, as is done on many zithers and all lutes. To better accommodate all harp configurations, in K-S a new distinction is introduced: either the strings pass over the body, or they pass into the body – C41 and C42.

C41 Strings-over: the strings are aligned vertically over the body but do not touch it.

.1 **Forked Harp**: the strings are stretched between two arms in a V or U shape, with a body mounted at the bottom—the "frame zither" of H-S (*towa*, Sierra Leone; *do*, Guéré people, Ivory Coast; *juru,* Baule people, Ivory Coast; *waj,* Nurestan in Afghanistan)

.2 **Spike Harp** (coined by DeVale, 1989): a stick or pole pierces the body to form both the neck and tailpiece. All are membrane-faced.

.21 Curved neck, with upright string holder: the strings are stretched between the neck and a second entity, the string holder, standing upright on the sound table (*bolon* and *simbingo,* Mande people, W. Africa)

.22 Straight neck, strings pass over a bridge – the **Bridge Harp**. This term (coined by Knight, 1971) replaces the "harp lute" of H-S, which unfortunately allowed speculation about whether it was a harp-type of lute or a lute-type of harp. It is the latter, a harp with a lute feature (the bridge). If there is still question, the open-string playing technique noted above further confirms its harp identity (*kora*, Mande of W. Africa).

C42 Strings-in: the strings are stretched between the neck and the string holder (usually a second entity) that is mounted in, on, or behind the sound table. Membrane-faced is the norm.

.1 Arched: the neck curves toward the face of the instrument. Three construction types as identified by Wachsmann 1964 are incorporated here:

.11 Spoon-in-a-cup: the neck rests inside the resonator, pulled into place by the strings (*ennanga*, Uganda; *bin-baja*, C. India). The latter has a one-piece neck/string holder (see Knight 1985).

.12 Cork-in-a-bottle, or tanged: the neck is inserted in a socket in the body (*kinde,* Lake Chad region, W. Africa)

.13 Shelf: the neck is attached to a shelf at the back of the body (*ngombi,* Gabon)

.2 Angled: the neck forms an angle with the body, or incorporates an angle (as between a tree stem and branch) rather than forming a smooth curve. Membrane-faced is the norm.

.21 Open, no pillar

.211 Spoon-in-a-cup (*ardin,* Mauritania; harps of ancient Egypt)

.212 Cork-in-a-bottle (various, Central Africa; ancient Mesopotamia and Assyria (see Harp in GDMI)

.213 Shelf (*gonfi*, Gabon)

.22 Pillar: the extremities of body and neck are joined by a third member, the "pillar" (European concert harp, with –w suffix to note the wood-faced body)

C5 Zither: the strings are stretched from end to end of the body; there is no neck; the string plane is parallel to the sound table or top surface. The first three types (stick, tube, and raft) may be (or may have been in the past) idiochord, meaning the strings are cut directly from the surface of the body. If so, this should be indicated with the suffix –ic. Without the suffix, heterochord (with separate strings attached) is assumed. Thr other zithers and all other chordophones are heterochord. The norm for zithers is wood-faced.

C51 Stick or bar: cousin to the musical bow, but with nearly straight stick (*gora*, Khoi Khoi people South Africa, *lesiba*, Sotho people, Lesotho) In both of these, the string is set in motion by blowing on a flat blade at one end of the string.

C52 Tube

.1 Body-alone resonator: the tubular body alone is the resonator

.11 Idiochord (guntang, Bali; *cing boong rlaa*, Mnong Gar people, Vietnam; early *valiha*, Madagascar)

.12 Heterochord (*valiha* and *marovany*, a "squared-off " *valiha*, Madagascar)

.2 Added resonator: gourds or other hemispherical objects are attached to the tube for additional resonance (*kinnari*, C. India; *rudra vina* or *bin*, North India)

C53 Raft: the body is made of small canes bound together as a raft. It is usually idiochord, with the strings cut from the surface of the cane itself and raised under small bridges. (*hanhye*, Mahi people, Benin; unnamed, India, as pictured in Fox-Strangways). For clarity, the idiochord nature may be indicated with the suffix –ic.

C54 Trough (*inanga,* Tutsi people, Rwanda)

C55 Box

.1 Convex-top (in H-S, these were termed "half-tube" zithers)

.11 Plucked (*qin*, *zheng*, China; *koto*, Japan; *kayageum*, Korea)

.12 Bowed: the strings are set in motion by friction with a rosined stick or bow (*komungo*, Korea)

.2 Flat-top

.21 Plucked (*zither*, Germany; Western autoharp, harpsichord; *kanun*, Turkey, with –mm suffix to denote the membrane-covered bridge section of the sound table)

.22 Struck (*santur*, Iran; *yang qin*, China; Western hammer dulcimer, **piano**)

C56 Harp Zither: The body is a tube or stick, but the strings are thrown into a vertical plane by one or two notched bridges. The bridge aligns the strings in a plane perpendicular to the top surface, or sound table, as in a harp. In H-S, considerable confusion was evident in identifying these instruments. One was identified as a poly-idiochord musical bow or "harp-bow," H-S number 311.112, of the Fang people of Gabon. A name was not given, but this is clearly the *mvet*, more usually idiochord, and more straight than a bow shape, with one or more gourd resonators. The smaller *bogongo* of the Babinga people, Cenral African Republic, is a better example of the idiochord variety. Another instrument, specifically called "harp zither" in H-S, was described as a board zither with a notched bridge, number 314.22, from Borneo. These are united in the K-S category for harp zither.

.1 Idiochord (*bogongo*, Babinga people, Central African Republic)

.2 Heterochord (*mvet*, Fang people, Gabon; [name], with two bridges, Dayak people, Kalimantan (island of Borneo).

C57 Frame: the "Aeolian Harp" (but not a harp), sounded by wind blowing across strings in an open frame.

C6 Lute: the strings extend beyond the body along a neck; the string plane is parallel to the sound table. Lutes and zithers are "cousins," one with a neck, one without.

C61 Plucked lute: The strings are plucked or strummed with a plectrum, and with one or two exceptions, the pitch of the strings is altered by stopping along the neck.

.1 One-piece: the body and neck are carved from one piece of wood, normally membrane-covered (*sarod*, India; *rabab*, Afghanistan; *pipa*, China, with –w suffix)

.2 Multi-part

.21 Neck attached to body, normally wood-covered (Western guitar, lute; *baglama*, Turkey; *tambura* (no stopping of strings), India; *sitar* and *vina*, India)

.22 Neck pierces the body: **spike lute**, normally membrane-covered (*shamisen*, Japan; *sanxian*, China; *dotar*, India; banjo, USA)

.23 Neck inserted part way into body—the "half-spike lute," always membrane-covered (ngoni, Mali; *xalam*, Senegal; *keronna*, Sierra Leone; lutes of ancient Egypt)

C62 Bowed lute – the **fiddle**: The strings are set in motion by friction applied by a "bow," usually strands of horsehair stretched on a stick; the pitch of the strings is altered by stopping the strings along the neck.

.1 One-piece: the body and neck are carved from one piece of wood, normally membrane-covered (*gusle*, Croatia; *sarinda* and *sarangi*, India; *kemence*, Turkey, with –w suffix)

.2 Multi-part

.21 Neck attached to body, normally wood-covered (Western violin; hurdy gurdy, with suffix –c for crank-driven disk in place of bow; *bana*, C. India, with –mm suffix)

.22 Neck pierces the body: **spike fiddle**, normally membrane-covered (*erhu*, China; *rebab*, Indonesia; *rafon*, Sierra Leone; *masinqo*, Ethiophia; *ch'uniri*, Georgia; *haegum*, Korea, with –w suffix)

C7 Lyre or Yoke Lute: in place of the neck are two divergent arms (the yoke). The strings, lying parallel to the sound table, extend beyond the body to a crossbar at the extremity of the arms. As with the harp, the strings are played open (*krar* and *bägänna*, Ethiopia; *nyatiti*, Kenya). Lyres are typically membrane-covered. If the face is wood, add the suffix –w.

A Aerophones Aerophones are instruments in which the air is set in motion directly, rather than by the intermediary of a struck body, a membrane, or a string. In K-S as in H-S, the primary subdivision is based on whether the air involved is ambient air or enclosed air. The enclosed aerophones branch into the familiar categories of flute (edge blown), reed, and horn (lip-reed). The subdivisions within these have been considerably reworked for K-S, each to be explained further below.

A1 Ambient air or free aerophone: the instrument functions in the open air

A11 Beating: a blade or plaque twirled on its long axis at the end of a string beats the air, creating a roaring sound (**bull-roarer**)

A12 Slicing: the object slices the air on edge

.1 Hand held (sword blade)

Note: the whip crack, included with the sword blade in H-S, has been shown to be a miniature sonic boom, caused when the tip exceeds Mach 1 (see Flying Circus of Physics, p. 170, or www.flyingcircusofphysics.com, §3.59, Popping bullwhips).

.2 Rotating: the instrument rotates in its flat plane (fan, siren, whizzing disc toy).

A13 Ribbon reed (the interruptive free aerophone of H-S): a grass blade or leaf is held taut between thumb knuckles in front of the mouth; varying the tension alters the pitch. Tlingit culture has incorporated this mechanism into a vessel (see *My music reaches to the sky*, 1973:43), and the human vocal folds function in a similar manner (see note under A22.1, free reed).

A2 Enclosed in a tube or vessel

A21 Flute, or Edge-blown. In H-S, flutes are divided between those with a duct to direct the air stream, and those without. But it may be observed that virtually all duct flutes are vertical, whether held to the player's mouth or mounted on the wind chest of an organ (with some modern exceptions). Also in H-S, vessel flutes are split between ducted and ductless. In K-S, the shape, then the position in relation to the player constitute the principal subdivisions of the flutes, resulting in four sub-classes – the vessel, vertical, oblique, and transverse – followed by two that were perhaps unknown or at least overlooked in Hornbostel and Sachs' time. As with idiophones, if an instrument consists of a set of pipes rather than a single pipe, the #n suffix is used to identify it. If the pipes are in ranks, as in some panpipes, this may be shown using the format #n+n. Two additional suffixes have potential use with flutes: -z for the presence of a sympathetic membrane (see M42), and –n to indicate nose flute.

A21.1 Vessel: the instrument has a closed globular or tubular shape

.11 No duct: the player directs an air stream across the embouchure hole at the top (*xun*, China; *kokwi,* Sierra Leone; *fetango*, Gambia)

.12 Duct: the air stream is directed by a mouthpiece to the embouchure hole (the Western **ocarina**; Humanatone, toy nose flute in which mouth is vessel)

A21.1 Vessel (cont.)

.13 Duct and oscillating chamber: a globe inside the vessel contains a double-layer whistle (see A21.5 below) that sets up a pressure oscillation (Pre-Columbian Central America)

A21.2 Vertical: the instrument is held or mounted in an upright position.

.21 No duct: the player directs an air stream across the top of the pipe

.211 Straight cut

.211.1 Closed pipe (*hindewhu*, C. Africa; **panpipes** (*siku, rondador*, Ecuador; *'au tahana* ensemble, 'Are'are people, Melanesia; *fozhobel*, Germany. The #n suffix or #n+n is used to specify the number of pipes and number of ranks. Further subdivisions may be established for the shape of a set of pipes – straight, curved, bundled, etc.

.211.2 Open pipe, always paired with closed pipe ranks (*siku,* Bolivia)

.212 Notched: the front edge is cut away to produce a knife edge

.1 Internal: the inside of the bore is cut away (*xiao,* China)

.2 External: the outside surface is cut away (*shakuhachi*, Japan; *kena*, Peru; African hunter's flute, Ivory Coast)

.22 Duct: the air stream is directed by a narrow passageway to a knife edge in the wall of the pipe.

.221 Internal: the duct is created by a plug or block inside the pipe.

.1 No fingerholes (Native American eagle bone whistle; toy slide whistle; Western **organ** flue pipes) The organ itself will have the suffix –k for keyboard, plus the suffix #n for the number of pipes in each stop, or this detail may be handled by a statement of the range in octaves in a verbal description.

.2 With fingerholes (**recorder**, *Blockflöte,* penny whistle)

.3 With fingerholes and oscillating chamber: a globe with a double-layer whistle inside (see A21.5 below) is mounted below the knife-edge and sets up a pressure oscillation (Pre-Columbian Central America – see Folkways recording of "compression flute")

.222 External: the duct is outside the pipe

.1 No mouthpiece: the player's lips are on the duct, created by a band around the pipe at a node at the top of the pipe (*suling*, Java & Bali)

.2 With mouthpiece: a mouthpiece directs the air to a block in the pipe which directs the air out of the pipe and back in, to the knife edge via the external duct. The duct is a narrow space under an object, usually in the shape of an animal or bird, attached to the pipe. (Plains Indian cedar flute, N. America)

A21.3 Oblique: the instrument is held at an angle to the side of the mouth; the top rim is beveled.

.31 No fingerhole, or harmonic flute: played by opening or closing the distal end to produce two sets of overtones, one from the closed pipe, one from the open pipe (*tilinca,* Bulgaria)

.32 With fingerholes (*ney,* Turkey; *kaval*, Bulgaria)

A21.4 Transverse or side-blown: the instrument is held parallel to the lips; air is directed to an embouchure hole in the side of the pipe.

.41 No duct (the Western flute, fife; *bansuri*, India)

.42 Duct (*seljeflöte* no-fingerhole harmonic flute, Norway)

A21.5 Double-layer whistle: air is blown through a hollow object with opposed holes at top and bottom. Laurence Picken discusses the physics of this mechanism in great detail and proposes a new H-S number for it (1975:376), but it is clearly an edge-blown sound-producing mechanism, and thus a flute. See also "Hole-tone whistle" in Walker, 2006, p. 148.)

.51 Mouth-held: the whistle is held in the mouth of the player and the pitch may be manipulated with mouth and tongue (toy whistles made of hollow fruit pits or a piece of folded metal, Turkey)

.52 Surface-mounted (whistle in teapot lid, the squeaker in rubber-ducky toys)

A22 Reed. A thin blade is mounted on the instrument or cut from the wall of the tube (termed idioglot), in such a way that one end is "clamped" or fixed in place, while the other vibrates when air is applied. There are two types: free and beating, or in a different classification used by physicists (to be explained further below), hard and soft. In K-S, subdivisions are not included for idioglot vs. heteroglot (the clamped-on variety). Rather, an idioglot instrument may be identified with the suffix –i.

A22.1 **Free reed**: A reed is made by cutting a tongue from a sheet of brass (alternatively, cane or plastic), leaving the base of the tongue intact ("clamped"). The vibrating end does not touch the frame around it – hence the designation "free." The reed is tuned during manufacture to produce a single pitch. This is the reason for the "hard" designation – the reed is hard-wired, so to speak, designed to produce only that pitch (see Hall, *Musical acoustics*, 2002, p. 264). Free reed instruments typically consist of sets of reeds mounted in resonating tubes or chambers. Two exceptions are the mouth-blown one-directional reed (A22.111), and the free reed with fingerholes (A22.13).

N.B. If the human voice were to be assigned a classification, it would fit here. The vocal folds are made of soft tissue and, viewed in a laryngoscope, resemble the opening of a double reed, such as the oboe. But Bruce Richards, Oberlin College professor of physics and

specialist in musical acoustics, notes that they function as a hard reed, tuned from moment to moment by muscle tension to produce each note desired (personal communication, 2010).

A22.11 Mouth-blown free reed

.111 One-directional: A single reed is cut from a strip of bamboo (thus idioglot) and blown in one direction to produce one note (*ngo*, or "frog," Bali). It is typically played in sets by several players. A mechanical version exists in a German-made teapot with two such reeds of metal mounted in the lid. The reeds sound when the velocity of the air (steam) escaping through them is sufficient to cause them to vibrate. The sound resembles a train whistle.

.112 Bi-directional: the **mouth organ**. The mouth organ is a set of free reeds designed to produce sound on both exhale and inhale, and to play both single-note melodies and tone clusters or chords.

.112.1 Double action. Each reed is mounted in a resonating tube with a fingerhole, and the tubes are inserted in a wind chamber made of a gourd, wood, or metal. The player blows or inhales through a mouthpiece in the chamber. Regardless of the direction of the air, if a fingerhole is closed, the reed will sound its note. This is what is meant by "double action." Picken explains this phenomenon: air is blowing past the reeds all the time, but only when a fingerhole is closed does the impedance or resistance in the pipe match the elastic force of the tongue as it is displaced by the air, allowing it to sound (1984:149). A parallel explanation is offered by Bruce Richards, comparing the fingerhole to the register key on a woodwind. On an oboe or clarinet, the fundamental register is produced with the register key closed. Opening the register key eliminates the pressure antinode for the fundamental, suppressing it. In its place is the note in the next register, supported by other resonant frequencies in the pipe. But on a free reed, "hard-tuned" to produce just one note with the fingerhole closed, when this "register key" is opened, the tone stops, because the other resonant frequencies in the pipe do not match the single frequency of the reed (*sheng*, China; *khaen*, Laos and Thailand; *sompoton*, Malaysia).

.112.2 Single action: the **harmonica**. As with its predecessor the *sheng*, the harmonica is played by pushing or pulling air past free reeds. But the reeds are not mounted in the pressure environment of resonating tubes and thus can sound only in one direction. There also is no wind chamber. Instead, the reeds are mounted in opposed pairs (the free ends facing opposite directions) in short square tubes. One reed sounds its note on exhale, the other a different note on inhale. This is what is meant by "single action." Chords are produced by blowing or inhaling through two or three tubes at once. Pitch bending is possible by cupping the hand around the instrument.

A22.12 Bellows-blown free reed. Air is pumped into a common chamber in which the reeds are mounted. Buttons or keys admit air to individual reeds or to groups of reeds for chords.

.121 One-directional. Air is pumped in one direction only (early Western reed organs and their successors, the harmonium and *sruti box* of India)

.122 Bi-directional. Air is drawn in and pushed out, replicating the effect of the mouth organ.

.1 Double action. In bellows instruments, unlike the Asian mouth organ above (A22.112.1), the reeds lack the resonating pipes that enable them to sound in either direction. Instead, double action is achieved with a matched pair of reeds for each key or button, one sounding on the push, the other the same note on the draw (English concertina; standard piano-key accordion).

.2 Single action. Like the double action instrument, the single-action accordion also has a pair of reeds associated with each button, but the reeds produce different notes on push and draw. It is thus the bellows equivalent of the harmonica (1-, 2-, and 3-row button accordions of Louisiana Cajun culture, Dominican Republic *merengue* bands, Irish pub and Mexican *conjunto* bands; the Argentine *bandoneón*; the Anglo concertina).

A22.13 Transverse free reed pipe with fingerholes. In this instrument, a free reed mounted in the wall of the pipe functions more like a clarinet [an example of the "soft" reed – see below], producing different pitches as determined by the fingerholes. It does not sound on inhale (*pi jum*, Thailand; *pey pork*, Cambodia; *bawu,* China).

A22.2 **Beating reed**. These are the clarinets and oboes. The term "beating" distinguishes them from the free reeds, but it is not completely accurate. The reed is mounted in such a way that it <u>can</u> beat against the mouthpiece or another reed [the double reed], but in reality it may not completely close the orifice. The "soft" terminology (meaning malleable or compliant) noted above portrays more accurately how these reeds function: blowing on the reed generates air waves in the pipe, but the vibration rate (i.e., the pitch) is determined primarily by the length and shape of the air column, not the reed. In Horbostel-Sachs, as in common parlance, beating reeds fall into two camps – the single reeds (clarinet) and the double reeds (oboe). But, as Montagu has noted, Hornbostel and Sachs erred in adopting this criterion for their system, because in reed instruments, it is the shape of the bore – conical or cylindrical – that has greater bearing on tone color and technique (especially fingerings, as any clarinet/sax player can explain). To rectify this, in K-S the bore shape is the primary subdivision.

A22.21 Conical bore: A beating or soft reed, even though it is does not actually close the pipe on which it is mounted, functions acoustically as a closed end to the pipe. On a conical pipe, a single or double reed creates spherical waves in the pipe. These

include both odd and even partials of the overtone series, and the pipe thus overblows at the octave (the second partial).

A22.211 Single reed (*tarogoato*, Hungary; saxophone; oboe with jazz player's single-reed; *arghul*, Egypt). [The last of these would appear cylindrical, but a stepped increase in bore size from reed to second segment to main pipe functions as a cone, and the instrument overblows at the octave.] A bus horn and toy paper horn from India in the RCK collection, although only single-note instruments, are also examples of conical bore instruments. The reed and "trumpet" pipes in a pipe **organ** are also single reeds. They are tuned to a specific pitch, and thus resemble free reeds, but physically they are beating reeds, fixed to a mouthpiece-like tube called a shallot, and usually coupled with conical resonators.

.212 Double reed

.1 Single layer reed

.11 Flattened tube: a tubular material (*pala* grass, for example) is flattened but not split; no further working of the reed is necessary (*shenai, nagaswaram*, India)

.12 Two-piece: two separate pieces of cane (*Arunda donax* or similar) are shaved thin and bound together around the staple (a small tube at the top of the instrument) to form the reed (Western **oboe**, bassoon).

.2 Double layer reed ("quadruple"): both sides of the double reed are made of a folded palm leaf bound to the staple with no further working (*zurna*, Turkey; *bee* or *pi-nai*, Thailand)

A22.22 Cylindrical bore: As with the conical bore, a beating (soft, compliant) reed fitted to a cylindrical pipe functions as a closed end to the pipe. But waves in a cylindrical closed pipe are planar (flat-surfaced) and produce only the odd-numbered partials. The fundamental pitch of the pipe is an octave lower than a conical pipe of the same length, and the first overblown note (if possible at all) is the third partial (a 12th above the fundamental) rather than the second partial (the octave). In theory, such a pipe lacks not only the second partial, but all other even-numbered partials. In practice, this is not always the case, but the octave-lower pitch and overblowing to the third partial are hallmarks. Several cylindrical bore reed instruments utilize an air reservoir. Two may be identified with suffixes: -b for bagpipe, -g for globe reservoir (see *pungi* below).

.221 Single reed (Western **clarinet**, Scottish bagpipe drone; *pungi*, India, with –g suffix; *launeddas*, Sardinia). All but the clarinet are idioglot.

.222 Double reed (*piri,* Korea; *hichiriki,* Japan; *mey*, Turkey; Scottish bagpipe chanter). See Flora 1974 for an acoustical study of the first two of these.

.223 Multiple reed: crushed hollow stem (rice, for example). The "reeds" are closed slits, forced open by blowing. This is sometimes referred to as a "retreating reed." As Montagu notes (2007:219), the mechanism is actually analogous to the trumpet rather than to other reeds (child's toy, Turkey – see Picken 1975:349).

A23 Horn, or harmonic lip-reed. (The term **trumpet** is virtually interchangeable with horn as a generic term for this type of instrument and is used in Hornbostel-Sachs, but in K-S the term horn is given preference, since it represents the primordial form of the instrument.)

The player blows through pursed lips, which function as a "normally closed" reed. Using only lip tension, the overtones that define the tone color by their relative strengths may be isolated to produce a series of notes without altering the length of the pipe, as in typical bugle calls. As in reeds, acoustically the lips form a closed end to the pipe. But unlike reeds, the shape of the bore (cylindrical vs. conical) is less critical in determining which overtones (harmonics, partials) are available. This is because even predominantly cylindrical instruments such as the trumpet and trombone have a carefully-shaped mouthpiece and bell, and these features cause the bore to function as if conical, producing spherical waves with all partials represented. Some instruments are designed to capitalize more on the higher partials, while others work in a smaller range. The French horn, for example, utilizes partials 2 to 16 on the F horn (an octave to four octaves above the fundamental) and can also use the fundamental of the B-flat horn. The trombone, on the other hand, is rarely called upon to play its fundamental, or pedal tone; the orchestral repertoire demands only partials 2 to 6, although jazz players might reach partial 8. (For a thorough explanation of the physics of these phenomena, see Benade and Campbell, Acoustics §IV, in The New Grove Dictionary of Music.)

In the broader world picture, however, there are many lip-reeds that cannot be made to produce more than one or two partials. The factors that limit overtone production are a large bore size in relation to the length, and the lack of a cup or funnel-shaped mouthpiece. These factors are not spelled out in Hornbostel-Sachs, where the first subdivision of lip-reeds is between natural and chromatic trumpets. But as Montagu has noted, this invites confusion, since to most people the term "natural" would refer to instruments made of a shell or horn, and yet in H-S the category also includes "tubular" instruments, calling them trumpets if straight, horns if curved.

To circumvent these problems entirely, in K-S the primary subdivision is based on the capability for overtone production, producing the following two families: (1) instruments whose overtone production is <u>limited</u> by their physical features, and (2) instruments whose overtone production is <u>enabled</u> or even encouraged by their physical features. These are identified as limited register and multiple register instruments, respectively. As in Hornbostel-Sachs, where the conical/cylindrical bore comes into play only in limited instances, in K-S, the distinction enters only when necessary to distinguish otherwise nearly identical instruments, such as the trumpet and cornet.

A23.1 Limited register: These horns are confined to one or two notes (i.e. partials 1-2 or 2-3) because they have no cupped mouthpiece, or the bore is large for its length.

A23.1 Limited register (cont.)

.11 Fixed length

.111 Side blown: animal horn or elephant tusk trumpets without end hole (*kwatha*, kudu horn trumpet, Chwana people, South Africa – see Kirby; *hakum*, lost-wax brass horn, Muria people, Central India)

.112 End blown (*shankh* [conch], India; *dijeridu*, Australia; *vaccine*, Haiti; *rag-dung*, Tibet; *kakaki,* Nigeria). The last two are long and narrow, but lack the cupped mouthpiece. The *vuvuzela*, made famous at World Cup Soccer 2010 fits here.

.12 Variable length

.121 Side blown: animal horn or tusk trumpets with a hole in the tip (*hakum* cow horn, Muria people, Central India)

.122 End blown (*algoza* bamboo fingerhole trumpet, Ahir people, Central India)

A23.2 Multiple register: The combination of a cupped or funnel mouthpiece and comparatively narrow bore relative to length enables the player to isolate (produce) partials beyond #4 (the second octave), in some instruments up to the 12th or even the 16th partial.

.21 Fixed length, limited to one set of partials (Western bugle, Baroque trumpet, alphorn)

.22 Variable length

.221 Fingerhole (Western cornett, serpent)

.222 Slide: the tubing length is infinitely variable, with any length producing a new fundamental and its overtones (Medieval European trumpet, trombone)

.223 Valve: the tubing length is altered by the mechanical introduction of additional fixed lengths of tubing (trumpet, cornet, French horn, tuba)

A24 Corrugated harmonic pipe: a corrugated or ribbed tube produces overtones.

.1 Twirled (the "Bloogle" toy). Twirling the flexible plastic tube thrusts air out the distal end and draws it in at the proximal end. With enough velocity, turbulence (air pressure variation) develops because of the corrugated surface. When the turbulence matches the resonant frequency of the pipe, a sound is produced. With more velocity, the next partials are sounded. The practical range is partials 2 to 5. The fundamental cannot be sounded because turbulence does not develop at the low speed required for it, and partial 6 (the fifth at the top of a bugle call) requires very fast twirling. See www.flyingcircusofphysics.com §3.39.

.2 Blown (the "Corrugahorn" toy). A small-diameter corrugated brass tube is bent in the shape of a trumpet. Blowing at different velocities produces overtones. A slide also varies the tube length.

A3 Plosive aerophone (German: *explosiv-aerophone*)

A31 Open: A rose petal or leaf is laid on the "O" made by finger and thumb, hit with palm to make a "pop")

A32 Enclosed

.1 Exploding: air in a stopped pipe is compressed until the stopper "pops" open (toy pop gun, also called for in orchestral scores, such as Strauss waltzes)

.2 Entrapped: air in a vessel is entrapped by momentarily closing the opening with the palm of the hand or another object, resulting in a short, rising-pitch "dwoop" sound *shantu* [both plosive and struck tubular gourd], Nigeria).

Suffix Glossary

Suffixes are used to include supplementary information about an instrument that does not change its classification. A K-S number without a suffix where one might be applicable is not wrong, it is simply less complete than if the information were known. For example, if the playing technique for a given drum is not known, no suffix delineating this detail would be added to the K-S number. The drum would still be correctly identified by its shape and number of heads.

#n Supply a number for n to indicate the number of sounding elements in certain instruments, such as xylophones and panpipes. The format #n+n may be used to identify ranks of pipes.

-1 played with one stick (-1 to -5 are applicable to membranophones)
-2 played with two sticks
-3 played with one hand
-4 played with two hands
-5 played with stick and hand
-b bag reservoir (as in a bagpipe)
-c crank-driven, as in the hurdy-gurdy
-f frets on a stringed instrument
-g globe reservoir (as in the Indian *pungi)*
-h handle drum
-i idioglot (referring to a reed cut from the body of the instrument)
-ic idiochord (referring to a string cut from the body of a chordophone)
-k keyboard
-m mechanical activation
-mm membrane sound table (as on Turkish *kanun*) where the material is normally wood
-n nose flute (played with nasal breath)
-p passively sounded by body movements, as in leg rattles or bells attached to clothing
-s sympathetic vibrating mechanism, idiophonic in nature, as in bottle caps on an *mbira*
-w wood-faced chordophone, where it is atypical (as in the Chinese *nan hu* or Korean *haegum*, where like instruments are skin-faced)
-x snare (of any material) crossing the surface of a drum head
-z sympathetic membrane (kazoo-like), as on some Asian flutes and African xylophone

Membranophone suffixes adopted from Hornbostel-Sachs (See an example of how these may be applied in K-S at the end of the list)

-6 with membrane glued to drum
-7 with membrane nailed to drum
-8 with membrane laced to drum
-81 Cord- (ribbon-) bracing: The cords are stretched from membrane to membrane or arranged in the form of a net, without employing any of the devices described below.
-811 Without special devices for stretching (found everywhere)
-812 With tension ligature: Cross ribbons or cords are tied round the middle of the lacing to increase its tension (Sri Lanka, Dominican Republic)
-813 With tension loops: The cords are laced in a zigzag; every pair of strings is caught together with a small ring or loop (India, Nepal)
-814 With wedge-bracing: Wedges are inserted between the wall of the drum and the cords of the lacing; by adjusting the position of the wedges it is possible to control the tension (India, Indonesia, Africa)
-82 Cord-and-hide bracing: The cords are laced at the lower end to a non-sonorous piece of hide (Africa)
-83 Cord-and-board bracing: The cords are laced to an auxiliary board at the lower end (Sumatra)
-84 Cord-and-flange bracing: The cords are laced at the lower end to a flange carved from the solid (Africa)
-85 Cord-and-belt bracing: The cords are laced at the lower end to a belt of different material (India)
-86 Cord-and-peg bracing: The cords are laced at the lower end to pegs stuck into the wall of the drum (Africa)

NB -82 to -86 are subdivided as -81 above

-9 With membrane lapped on by ring of cord (Africa)
-92 With membrane lapped on by a hoop
-921 Without mechanism (European drum)
-922 With mechanism
-9221 Without pedal (Machine timpani)
-9222 With pedals (Pedal timpani)

Example of the full application of suffixes for a membranophone:

The *djembe*, West African goblet drum played with both hands (-4), cord-and-belt bracing (-85), with sympathetic vibrators (-s): M11.15 -4 -85 -s.

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