Global Notation as a Tool for Cross-Cultural and Comparative Music Analysis

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THE recent resurgence of interest in cross-cultural and comparative music analysis does not yet appear to have produced a fundamental rethinking of the problem of notation. For the most part, studies appearing in the present journal and in books on world music analysis (e.g., Tenzer 2006a; Tenzer and Roeder 2011; Hijleh 2012) continue to use staff notation, modifying it only enough to represent features discussed in the analysis that the notation would not otherwise capture. The most recent in-depth examination of issues in cross-cultural transcription, a 2005 issue of *The World of Music* on the theme of "Notation, Transcription, Visual Representation" (Marian-Bălaşa 2005), predates any of these publications and has made no discernable difference to them. Ter Ellingson wrote in 1992 that "alternatives to European notation are only beginning to be explored" (1992a, 143), but in retrospect it seems that, on the contrary, the exploration was then coming to an end. Even the need to justify and defend the use of staff notation for non-Western music seems to be felt by fewer and fewer writers as time goes by. Essentially, twenty-first-century ethnomusicologists and world music analysts are still following the "Suggested Methods for the Transcription of Exotic Music" proposed by Otto Abraham and Erich M. von Hornbostel ([1909] 1994) in 1909: keeping their transcriptions as close to conventional staff notation as the music and the analysis allow.

It might be countered that ethnomusicologists are still following another century-old paradigm—the Sachs-Hornbostel system of instrument classification (Hornbostel and Sachs [1914] 1961)—and doing so for a good reason: because it works. But if the Sachs-Hornbostel system still works (with later refinements such as the addition of a category for "electrophones") despite the invention or discovery of countless new instruments since it was first formulated, it is probably because the system was conceived from the beginning as a new way of describing and classifying all known (or even all possible) sound-producing devices. The Sachs-Hornbostel system would be more analogous to the Abraham-Hornbostel transcription paradigm if it had started by retaining the established orchestral instrument families of strings, woodwind, brass, and percussion, and attempted to classify all the world's instruments by defining subcategories under those headings.

Hornbostel and Sachs did not have to work within the established instrument categories because instrument classification required only words and numbers, both of which were easy to write and print, and so they were free to define their categories in any way they chose. Hence they could start, not from the vaguely defined Western instrument families, but from a set of instrument categories derived from ancient Indian ones, which they found more consistent and universally applicable (Jairazbhoy 1990). Musical transcription, on the other

hand, required notation that was complex to print and far more limited by technological constraints. Hence Abraham and Hornbostel recommended that "standard notation should be modified as little as possible. If the transcription is to be printed rather than written, and if printing costs are to be kept low, it is important that whenever possible only the symbols which the printer has readily available be utilized" ([1909] 1994, 427).

But for these technological and economic constraints, Hornbostel and his contemporaries could have laid a different foundation for the discipline of world music analysis by devising, from scratch, an efficient notation system for all musical sounds, as the International Phonetic Association had already done for speech sounds.[1] They could have begun by asking: for purposes of world music analysis, what do we require our notation system to be able to do?

The answer, at least from today's perspective, must surely be that, since both musical sound structures and analytical agendas vary so widely, the notation should be able to convey *any* information about sound that could conceivably be relevant to an analysis—which probably means any information about sound whatsoever. Since that could easily result in an unmanageable mass of detail, the notation should also be able to exclude any information that is *not* relevant to the analysis at hand. To convey the selected information efficiently to readers who specialize in different kinds of music and analysis, or even to those who don't specialize in music at all, the notation should be consistent as to *how* it conveys any given kind of information, and should be no more difficult to learn than the above requirements dictate. Having defined these desiderata, our hypothetical forebears could then have reflected on how short staff notation falls by all these criteria, and could have set about devising a new visual code to meet their requirements without being limited to the symbols that music printers already had available.

Today, we are in a better position to attempt this because we are largely free from the practical constraints that Hornbostel faced: it is reasonably cheap and easy to produce whatever graphic images we want using affordable computers and printers. Meanwhile, we like to think that we have left behind many of the biases and assumptions of Hornbostel's generation and started asking very different questions about musical sound organization. Some of these questions reveal the limitations of modified staff notation all too clearly, as I will try to illustrate in this article. But now that many of the barriers in the way of developing a more universally valid notation system have been removed, the main obstacle that remains is the very inertia that the Hornbostel paradigm has built up over the last hundred years. Staff notation has come to be so widely used around the world, and for such a wide range of purposes, that any call for a new alternative struggles even to be heard. Yet I, for one, think it is worth trying, because when it comes to visualizing musical sound organization across

1. It is true that the International Phonetic Alphabet was developed from a European script, the Roman alphabet, but in being adapted and redefined as symbols for one sound only, the letters lost their ties to any particular (phon)emic system in a way that the notes of staff notation never did.

cultural boundaries, I am not satisfied that adapting staff notation is the best we can do.

This article describes an attempt to imagine what notation could be like if it were developed from scratch for the purpose of supporting analysis of any kind of music, without being constrained by an established system originating in a particular music-making tradition, by a limited set of available graphic symbols, or by a habit of thought that envisages musical sound as necessarily consisting of "notes." I propose a basis for such a system in the "global notation" that I have been developing and disseminating through my website globalnotation.org.uk. To illustrate some of the capabilities of global notation, I use it to notate examples from selected Western and Asian traditions, usually in comparison with staff notation of the same music and with particular analytical angles in mind. The examples are intended to suggest the possibility of providing the discipline of world music analysis with an equivalent of the International Phonetic Alphabet or the Sachs-Hornbostel instrument taxonomy: a purpose-made and comprehensive system that can represent examples from any culture on an equal basis and with any desired degree of precision. My contention is not that global notation can provide such a system now, but that it (or a future system founded on similar premises and goals) has the potential to do so if developed with sufficient input from fellow scholars who share my view of the need and the potential for such a "global" form of music notation.

The Need and the Potential for a "Global" Music Notation

Dissent from the view that staff notation "works" for all music has never been lacking. Hornbostel himself recognized the distortions that can be introduced by having to break sound down into "notes": "The unpsychological view that music assembles itself out of tones is reinforced by notation" (Hornbostel 1913, 13, translated in Ellingson 1992a, 138). Charles Seeger wrote of the "riot of subjectivity" that results when "we single out what appear to us to be structures in the other music that resemble structures familiar to us in the notation of the Occidental art and write these down, ignoring everything else for which we have no symbols" (1958, 186). Perhaps the most extensive critique came from Mantle Hood in *The Ethnomusicologist* (1971, 61–90). Troubled by "the disparity between a culturally-determined system of notation and the musical sounds of some other culture it was never intended to represent" (89), Hood thought hard about what had already become "the chronic problem, transcription of non-Western music, and the chronic solution, 'doctored' Western notation" (62).

Rather than rehearse the well-known objections to the "chronic solution" in detail, let us consider the alternative solutions that Hood (1971, 90–122) envisaged, and the timescale within which he thought they would become available. A solution that he felt was "available now" was what he called the Hipkins Solution, a knowledge and (if necessary) adaptation of existing indigenous notation systems. "Available soon" would be the Seeger Solution, the use of technology to produce transcriptions mechanically (in graphic form, not in staff notation as is

now becoming possible). "Available in the distant future" was the Laban Solution, the invention of a new notation system that could represent any form of musical sound as clearly and efficiently as Labanotation represents bodily movement (Guest 2005). Beyond even this, Hood's ultimate hope was for the development of a Composite Solution that could integrate all three. Half a century after the publication of *The Ethnomusicologist*, I suggest it is time to consider whether Hood's "distant future" has now arrived.

Of the solutions that Hood described, the Hipkins Solution continues to be used among specialists in musical traditions that have indigenous notation systems, while the Seeger Solution has benefited from open-source sound analysis software and is widely used especially in the study of Indian classical music. In contrast, the possibility of a Laban Solution remains largely unexplored. Remarkably, in the 45 years after Hood issued his call, there does not appear to have been any serious attempt to invent a notation system intended from the outset to be suitable for any music and any approach to analysis. Hood's own hints as to what form such a notation might take are limited to suggesting Labanotation-like symbols for instrument types (1971, 103–13) and identifying certain kinds of information that elude staff notation and that a Laban Solution should be able to convey, without indicating specifically how this might be done (114–19). The nearest I can find to a concrete proposal as to what a Laban Solution for music might look like is James Reid's article "Transcription in a New Mode" (1977), which proposes the combination of a pitch-time graph with numbers and dotted lines identifying the scale degrees; but Reid applies his solution to only one form of music (the *hichiriki* part in Japanese *gagaku*) and admits that "many more such solutions, and refinements of the solutions, will be required before we finally arrive at a universal music notation system" (431).

Otherwise, when new forms of notation have been devised, they have generally been designed for some particular form of music and/or some particular practical or analytical need. Examples include the Time Unit Box System (TUBS) often used for African percussion-based music (Koetting 1970) and the text-based abc notation used primarily for traditional music of the British Isles (Walshaw 2020). The large-scale adoption of these systems among specialists in the relevant traditions indicates that the new systems are felt to have advantages over alternatives such as staff notation, yet if used for communication or comparison beyond their "home" traditions, the incompatibility of the notation systems gives the impression that the musics themselves are incommensurable. Meanwhile, the need to explain the notation system to non-specialists takes up words and space that one would rather devote to discussing the actual music. If world music analysts could arrive at a consistent set of visual conventions for giving information about musical sound, while leaving each notator free to give whatever such information was wanted, they would surely be able to communicate with each other more efficiently while improving their chances of avoiding the pitfalls identified by Seeger, Hood, and others.

For reasons like these, ever since I first read *The Ethnomusicologist* in the mid-1980s, it has seemed to me that a Laban Solution to the transcription problem would be a great thing for

ethnomusicology if it could ever be achieved. I kept wondering whether it was really possible, or whether the sound structures of music were simply too diverse to be embraced by any common notation system. Not until thirty years later was I led to attempt my own response to Hood's little-heeded call. The impetus came when I began writing a book (still in progress, perhaps unsurprisingly) in which I wanted to discuss examples of musical sound organization from many different traditions without requiring readers to know staff notation. To convey these "musical ideas" with sufficient specificity, some form of visual representation was required, but no existing system seemed suitable. In experimenting with visual conventions that could be applied to any way of organizing time, pitch, and other musical parameters at any level of detail, I gradually came to realize that what I was working toward was in effect a Laban Solution. The further I developed it, the more clearly I perceived that it had the potential to meet some of the needs that Hood identified and to offer some advantages as a vehicle of analysis even for those who do know staff notation. Not being sufficiently sure of a positive reception to name the system after myself, I have called it "global notation."

If there was a breakthrough for me, it was the realization that a "global" notation system need not mean that all music will be notated in the same way. I believe a major reason why Hood and Reid didn't get any further with their proposals is that they envisaged a universal notation system as a standardized procedure for "translating" any example of musical sound into a visual form, conveying the same "order of information" and the maximum possible "amount of information" in all cases (Hood 1971, 103). Pursuing such a goal was bound to lead to a dead end because different orders and amounts of information will be relevant to different music and for different purposes. For similar reasons, Labanotation, the International Phonetic Alphabet, and the Sachs-Hornbostel instrument classification system all allow different levels of detail or "granularity" in their application. Global notation aims for flexibility in the order or type of information as well as the amount, providing a means of *specifying* whatever information may be needed for the purposes of any given piece of notation while omitting any information that would not be helpful for those purposes.

To do this, global notation assumes as little as possible about what musical sound "normally" consists of and how it is "normally" organized, and allows any form of pitch scale and metrical framework (including none) to be depicted as itself and not as an approximation of something standard staff notation can represent. In offering a consistent set of graphic conventions for specifying information about any form of musical sound without assuming any existing type of music as the norm, global notation attempts a Laban Solution to the transcription problem. It also pursues the ability to incorporate the contributions of the Hipkins and Seeger Solutions in moving toward the ultimate Composite Solution that Hood dreamed of.

While still in development (and perhaps perpetually so), global notation is now sufficiently developed in its general principles and modus operandi to be brought before the public and assessed for what it has to offer to the advancement and dissemination of knowledge on how the world's music organizes sound. Some practicing musicians have

suggested that global notation might also be useful for purposes of composition and performance, especially where cross-cultural collaboration is involved, but this paper considers the system only as a vehicle for music analysis. The paper gives the briefest possible explanation of the notation system before "trying it out" on a sample of musical forms and analytical agendas.

With the whole world's musical practice and theory to choose from, the selection of examples was a quandary. I approached it by considering that a vital test for a purportedly "global" music notation must be its ability to support comparative analytical studies of music from different traditions. One such study was published in the inaugural issue of this journal: Michael Tenzer's article "Temporal Transformations in Cross-Cultural Perspective: Augmentation in Baroque, Carnatic and Balinese Music" (2011). Tenzer presents examples from all three traditions in annotated staff notation, using the common notation system to highlight similarities and differences in the way listeners experience temporal augmentation of melodic material. It could be objected that notating three forms of music in a system designed for one of them puts the other two at a disadvantage, but it is hard to see what alternative would have been available to Tenzer given his need to notate all three forms of music in the same system. I decided to see whether global notation could provide that alternative and what might be gained by doing so. This article therefore centers on re-notating Tenzer's examples in global notation and exploring some further analytical avenues that this might open up.

Although I will claim some advantages for global notation over the "chronic solution," my criticisms of the latter are aimed at the practice in general and not at Tenzer's particular application of it. Far from intending to detract anything from Tenzer's achievements and insights, I hope to build on them and if possible to make such insights accessible to a wider range of readers—specifically readers who are less familiar with staff notation and the many modifications that ethnomusicologists have applied to it. For instance, psychologists and anthropologists are often interested in music as a facet of human mental functioning and behavior, but are largely barred from understanding research on musical sound organization by the forbidding notation that is used. If a different notation system can make such research more accessible to non-specialist readers without compromising the rigor of the research itself, this should help bring the best analytical music research to the wider audience it deserves.

After a brief introduction to the principles of global notation, I reflect on its usefulness in relation to a concern that Tenzer shares with many recent music analysts: a concern with the perspective of listeners rather than composers or performers, or what might be called (after Nattiez 1990) an "aesthesic" rather than a "poïetic" orientation. In the central section I present the re-notation of Tenzer's examples and what it suggests of the broader applicability of global notation. I then extend the discussion of one of those examples—the South Indian vocal music—into other realms to illustrate how global notation might draw on the Seeger and Hipkins Solutions as well. My conclusion reflects on the potential for global notation to

form the basis of a Composite Solution such as Hood hoped for, and on what would be needed to make that solution a reality.

Attempting a Laban Solution: Principles of Global Notation

The global notation system as it currently exists is fully explained on its dedicated website at globalnotation.org.uk. The present article explains the aspects of it that are needed for the examples of analysis to be discussed. This in itself speaks for the simplicity and "learnability" of the system: by contrast, if we had to explain how staff notation works within each article that uses it, there would not be much room left for analyzing the music notated.

Global notation starts from the principle that notation is a way of *specifying* certain things about a set of musical sounds. No notation can specify *everything* about the sounds, even if that were desirable, and the particular features to be specified will depend on the characteristics of the music and the purposes of the notation. Therefore, a truly "global" notation system should allow the notator to specify whatever features are required and to leave other aspects unspecified. For example, if we wish to represent pitch organization based on a continuum rather than a scale, or time organization without a pulse, then it should be possible to do that without having to "doctor" a system that assumes all music uses distinct scale steps and proportional durations.

Duration is, in fact, an example of a feature that would often be better left unspecified. To notate a sound in conventional staff notation, we have to choose some note value that implies a duration relative to other notes in the same piece. But many sounds have no meaningful duration, especially "impulsive" sounds such as drum strokes that die away rapidly and without the player's control. In such cases, the note value does not actually represent the duration of the audible sound, but the length of time until the next sound in the same "layer," i.e., the "inter-onset interval." Yet for "sustained" sounds such as those of singing voices or wind instruments, the audible duration of the sound may indeed be musically important, and its end may be a rhythmic event. The use of proportional note values to represent both durations and inter-onset intervals can produce ambiguity in the notation and consequently in any analysis based on it. It also fails to capture how we *hear* musical rhythms: not as an adding-up of time values, but as a succession of events (primarily onsets) in relation to a pulse or to the passage of time.

Global notation therefore allows the timing of onsets to be specified independently of duration. Its most basic symbol is for a sound of unspecified duration, derived from the typical waveform of an impulsive sound with rapid decay, which is stylized into a triangle or "wedge" (Figure 1). The vertical left-hand edge of the wedge (as of the waveform) represents the moment of onset, and inter-onset intervals can be specified by the positioning of these edges along a horizontal axis that, by default, represents time as flowing from left to right. There is, however, nothing to prevent the whole system from being mirrored for notating songs with lyrics in a language that reads from right to left, or rotated, so that a transcription of dance

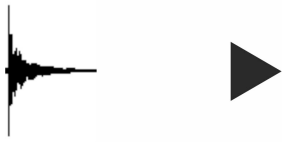

Figure 1. Typical waveform for a drum stroke and global notation symbol for a sound of unspecified duration.

music can be aligned with a corresponding piece of Labanotation that reads from bottom to top.

If on the other hand it is desired to specify the audible duration of the sounds, then the basic wedge symbol is modified, keeping the triangular outline while removing the diagonals so that the symbol looks like an upper-case letter T turned on its side (Figure 2). The stem of this rotated T can then be extended horizontally in proportion to the duration of the sound. It can also be angled or curved up or down to specify changes of pitch, represented on the vertical axis. The cross-bar of the T can be extended vertically to connect with a preceding T symbol at a different pitch level, to show that the two pitches are articulated in a distinct but legato manner, as when successive text syllables are sung without a break between them.

Symbols for sounds of either specified or unspecified duration are placed in relation to continuous horizontal lines whose meaning varies according to whether pitch is being specified or not (Figure 3). Placing the symbols above and/or below a line indicates that pitch is unspecified and the line represents a "layer" in the texture, such as an individual instrument's "part." Placing them *on* a line indicates that pitch is specified and the line represents a particular pitch, normally one of the scale degrees. If the music doesn't use distinct scale degrees, then pitch lines are indicated only for two or more "reference pitches," such as the lowest pitch and its octave(s), and the symbols are ranged between them in proportion to pitch.

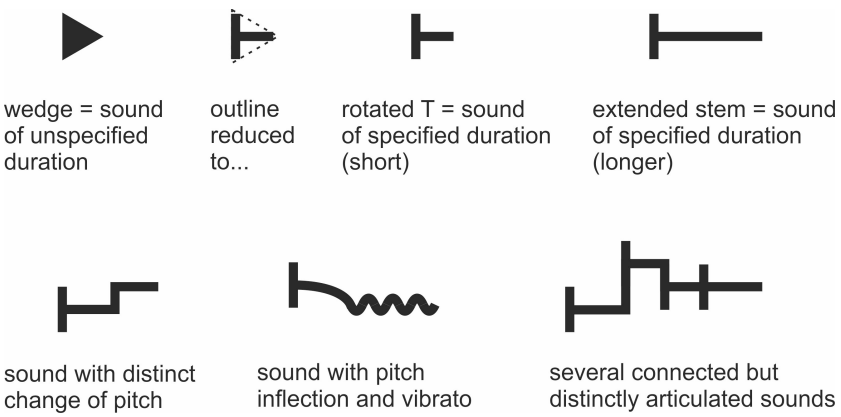

Figure 2. Wedge symbol compared with rotated capital T symbol to represent sounds of unspecified versus specified duration.

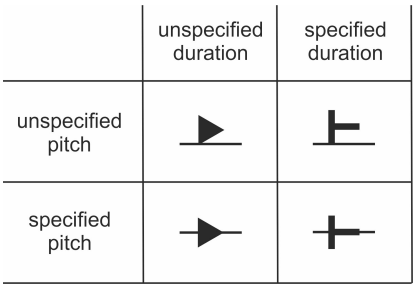

Figure 3. Positioning of symbols relative to horizontal line for unspecified versus specified pitch.

To specify a distinct scale, pitch lines for each scale degree are spaced in proportion to the intervals, which are specified at the beginning in cents above the tonic or other reference pitch, indicated by a thicker pitch line extended at each end of the system (Figure 4). To keep the number of pitch lines manageable, provision is made for octave transpositions and for occasional pitches not belonging to the prevailing scale, which can appear in the spaces between pitch lines (see http://globalnotation.org.uk/wide-pitch-range; http://globalnotation.org.uk/extra-scalar-pitch). Wherever possible, all sounds of specified pitch are notated within a single set of pitch lines, while sounds of unspecified pitch are ranged along additional "layer lines" below these.

If the music has no discernable pulse, the symbols are spaced horizontally according to a time scale in seconds. If it does have regular beats and/or bars, these can be indicated with vertical lines. The bar lines are drawn longer and thicker than the beat lines to indicate a higher-level "periodicity." The tempo and meter (including any regular division of the beats into shorter units) are indicated at the beginning over a horizontal bracket called a "hurdle" that measures the length of one beat. Figure 4 illustrates the fundamental features of the system with bracketed annotations and arrows, which of course would not normally appear in the notation.

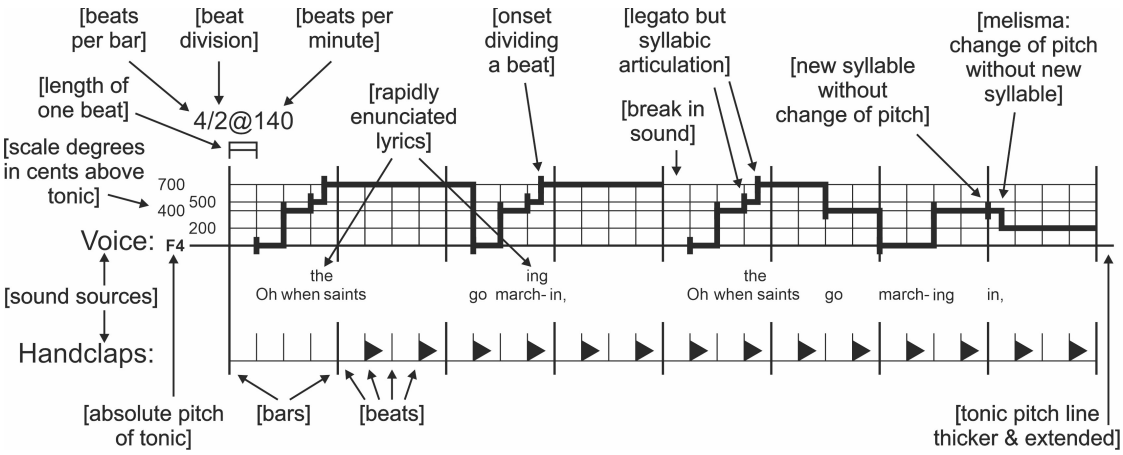

Figure 4. The melody of "When the Saints Go Marching In" in global notation, with an accompaniment of handclaps on the backbeats.

The above explanation, and the notation system itself, pays most attention to pitch and time because these have been, and will no doubt continue to be, the parameters of most interest to music analysts: the quantifiable and in some ways interchangeable nature of pitch and time intervals tends to structure sound in complex yet logical ways that offer a richer field for analysis than the patterning of other parameters. Nevertheless, the website also shows how global notation can specify many other kinds of information about sound, such as dynamics, timbre, and instrumental techniques, and several refinements will be introduced for particular purposes in subsequent examples within this article. But in allowing the notator to specify only the information that is wanted for the purposes of the notation, global notation keeps the need for complexity and explanation to a minimum.

To the same end, global notation is designed to be as intuitive as possible for the maximum number of potential users. Its overall conception, as a graph with time on the horizontal axis and pitch (if required) on the vertical axis, is shared with the most widely used existing notation systems: staff notation, MIDI "piano roll" notation, computer-generated spectrograms and pitch-time graphs, and even to some extent with TUBS notation and with the cipher notation widely used in East and Southeast Asia, both of which tend to place higher-pitched layers higher in the vertical space. Many of the specific conventions of global notation have been inspired by one or more of these existing systems. Since all of these notation systems were invented by Westerners, global notation cannot claim to avoid a Western bias in its overall format and layout. Clearly, the use of cents as a measuring unit for intervals also derives from a Western standard, the division of the octave into twelve equal parts (each measuring 100 cents), and thus constitutes the imposition of a Western yardstick onto the rest of the world's music. Global notation accepts this as a compromise worth making, given that intervals have to be measured in *some* way and that cents values give a ready impression of the size of an interval relative to the widely known standard of modern keyboard instruments. Since cents values allow any size of interval to be specified directly and with equal ease, this "bias" is of a different kind than that of staff notation, which assumes multiples (or approximate multiples) of 100 cents as the "normal" intervals and represents all other intervals as inflected versions of these. Any Western bias in *how* global notation presents its information does not automatically bias *what* information is presented.

By making all information optional and representing all ways of organizing pitch and time equally easily, global notation aims to allow any music to be notated with any desired degree of precision and compared with other music on an equal basis. It is designed to be flexible enough for different researchers to "customize" it for their chosen forms of music and analysis while retaining a degree of consistency sufficient for communication between specialists in different areas. The rest of this article explores some examples of what might be gained by adopting such an approach.

Poïetic versus Aesthesic Notation

Tenzer's analysis is concerned with "how a culturally informed listener perceives the unfolding process of augmentation, and in so doing comes to reevaluate the sense of orientation in the music's time" (2011, 159). His interest in the perceptions of listeners rather than the intentions of composers or performers is shared with a number of contemporary music theorists. Justin London, for instance, declares that his approach to meter is "squarely based on the listener's perspective" (2012, 22) and "grounded in the psychology of perception rather than musical practice" (91). Popular music scholar Philip Tagg (2013, 116–18) has proposed developing a whole theory and terminology of music from the viewpoint of perception rather than construction. Borrowing his terms from Jean-Jacques Nattiez (1990), who in turn took them from semiologist Jean Molino, Tagg calls this an "aesthesic" as opposed to a "poïetic" perspective.

Theorists interested in an aesthesic perspective are hampered by conventional notation because it was not designed to represent how listeners perceive things, but rather to give instructions to performers. Ethnomusicologists have often used staff notation in a different way: as a visual record, not of what a composer intended the musicians to perform, but of what they actually performed on a given occasion. Global notation can do either of these things, but it can also do something else. Because it makes all information optional, global notation is able to represent either the organization of the sounds as conceived by a composer or performer, or only what listeners "know" about that conception at a given moment.[2] The latter, I take it, is what Tenzer is examining, and it seems to call for a notation written from the perspective, not of composers or performers, but of listeners: what might be called an "aesthesic notation."

When performers use notation, their conception of the music's structure is likely to differ from that which is apparent to listeners. In the Western classical tradition, although every note played may be written in the score, the sounds that listeners hear are often not sufficient to convey the sonic organization represented in the notation. For example, in some modern works, the written meter serves only as a coordinating device for the performers, as the rhythms are so unpredictable that listeners don't perceive a pulse even though the performers are mentally counting one (London 2012, 22–23). Even in "common practice" tonal music, composers may deliberately obscure the tonality and/or meter from listeners (but not usually from performers, who are trained to recognize key and time signatures and modulations), or even mislead them by beginning a piece in a way that implies a different key and/or meter than the one that will govern the rest of the piece.

Leonard Bernstein discussed this phenomenon in his 1973 lecture "The Delights and

2. While aware of Jay Rahn's (1983, 7–11) critique of "mentalism" in music analysis, I take the view that music notation is *necessarily* a representation of what is in someone's mind, and suggest that the confessedly "descriptive" rather than explanatory nature of Rahn's "theory for all music" (228) stems from its refusal to speculate about mental constructs and other phenomena that are not objectively "observable" (3, 27).

Dangers of Ambiguity," later published in his book *The Unanswered Question* (1976). One of Bernstein's examples is the tonally ambiguous opening of the fourth movement (Adagietto) from Mahler's Fifth Symphony (Figure 5a and Audio Example 1; Bernstein 1976, 196–99). Performers with the score in front of them know from the beginning that this movement is in F major. The key signature of one flat narrows the tonality down to either F major or D minor, and the latter interpretation is rendered unlikely by the first note written, a C-natural. But listeners don't know which pitch will be the tonic until bar 3. Throughout the first bar-and-three-quarters, the only pitch classes heard are C and A, suggesting a tonality of A minor and with it the negative affect that minor keys tend to connote in this tradition. So far as the sustained, bowed string sounds are concerned, the lowest pitch is A, suggesting an A minor chord in root position (albeit incomplete), though the harp's addition of an intermittently audible C in the bass introduces the possibility of a different interpretation which turns out to be the right one: the chord is actually an incomplete F major chord in second inversion. When the first cadence arrives, its resolution on a full F major chord may bring a feeling of relief. The A and C, it seems, were only the third and fifth of a major chord after all. However, it is still not certain that this chord will be the tonic, because we have only heard six of the seven scale degrees so far. If the missing one turns out to be B-natural, our F major chord could still be the submediant of A minor (or the subdominant of C major). Only when the B-flat arrives at the end of bar 3 is the ambiguity finally resolved.

Figure 5a shows a condensed score of the passage aligned with a version "transnotated" into global notation. By showing the "impulsive" plucked string tones as sounds of unspecified duration and using a larger but hollow wedge for the contrabass to distinguish it from the harp, the notation is able to incorporate all of the sounds within a single set of pitch lines. But this is still a "poïetic" notation: one that represents the perspective of composers and performers rather than listeners. To produce an "aesthesic" notation, we must withhold any given piece of information about the sound organization until it becomes apparent to the listener. This is what Figure 5b attempts to do, with annotations explaining how the notation represents the process by which a "culturally informed listener" gradually comes to grasp the tonality of the piece along with its meter, which (unless we are watching the conductor) is also ambiguous at the beginning.

Sometimes the sounds heard by the listener are not just ambiguous but imply a different organization of pitch and/or time than the one written. For an example closer to Tenzer's, take the subject of Bach's Fugue in D-sharp Minor from Book 1 of the *Well-Tempered Clavier*. In this case, the tonality is unambiguous because we have just heard a prelude that we know to be in the same key; but the meter doesn't sound the way it looks. Figure 6a notates this subject with regular beats but without bar lines, to avoid pre-judging the question of meter. Notice how easy it is to suppress any unwanted information in global notation.

Audio Example 1. Opening of the Adagietto from Mahler's Fifth Symphony, performed by the Berliner Philharmoniker conducted by Claudio Abbado.

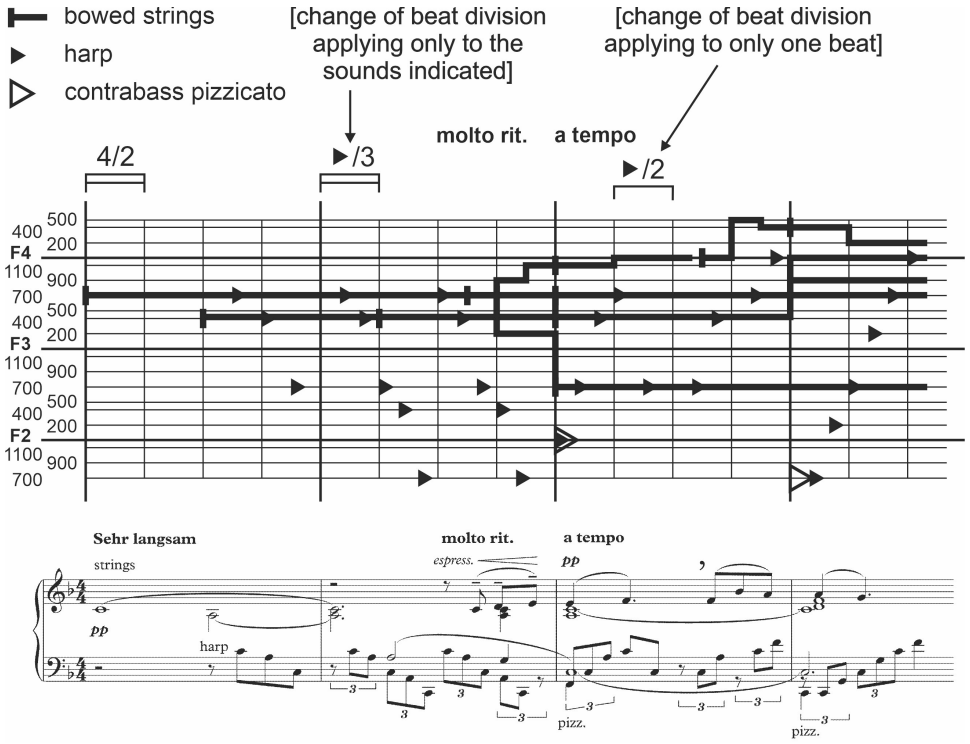

Figure 5a. Condensed score of the opening of the Adagietto from Mahler's Fifth Symphony aligned with a version "transnotated" into global notation.

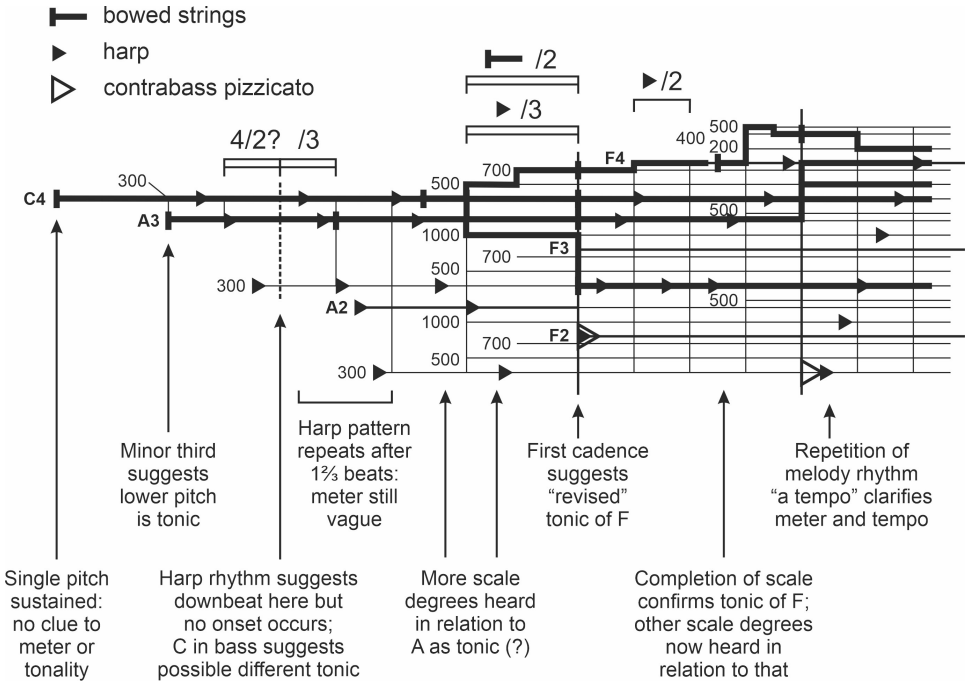

Figure 5b. Opening of the Adagietto from Mahler's Fifth Symphony in an "aesthesic" global notation representing how listeners come to grasp the meter and tonality. In this case changes of tempo are represented by adjusting the spacing of beat lines.

Audio Example 2. Subject of Bach's Fugue in D-sharp Minor from Book 1 of the *Well-Tempered Clavier*, performed by John Butt.

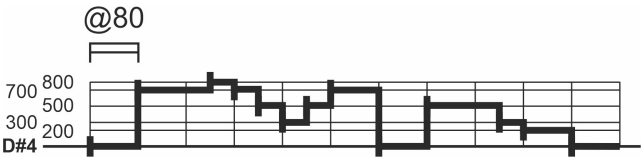

Figure 6a. The subject of Bach's Fugue in D-sharp Minor from Book 1 of the *Well-Tempered Clavier*, notated without specifying any grouping of beats into bars.

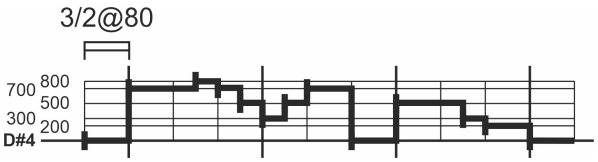

Figure 6b. The same melody as heard with a meter of three beats per bar.

I have repeatedly made the experiment of playing a recording of this melody (Audio Example 2) to students and asking them to clap on what they think is the first beat of each bar. They invariably group the beats into threes, as in Figure 6b. When the melody is played on a non-touch-sensitive keyboard instrument such as a harpsichord or organ, the impetus to group the beats in this way cannot be coming from dynamic accents. Instead, it undoubtedly comes from the way the opening upward leap from the tonic pitch is echoed six beats later, with the upper note of each leap having both a tonic and an agogic accent, so that these come to be perceived as the most likely positions of metric stress, establishing a "periodicity" of six beats. The positions three beats away from these upward leaps are not obviously accented, but both at least have onsets, and they might be posited as stressed beats by the simplest process of division: dividing the six-beat period by two. Note that the perception of meter is a retroactive process: no meter is apparent until we have heard enough to recognize some pattern of recurrence, which we then project back through time to the beginning of the music.

According to this three-beat metric interpretation, the "answer" to the subject begins on the wrong beat: as a downbeat instead of an anacrusis (Audio Example 3). As the answer proceeds, we are forced to reinterpret what we have just heard as a syncopated rhythm in a meter of two or four beats to a bar. To the listener, it doesn't much matter which—a four-beat bar could just as well be two two-beat bars—and although Bach has notated the fugue in 4/4 time, subject entries and cadences (including the final one) fall just as often on beat 3 as on beat 1. In Figure 6c I have therefore indicated a "reinterpreted" meter of two beats per bar.

Audio Example 3. Subject and answer of Bach's Fugue in D-sharp Minor from Book 1 of the *Well-Tempered Clavier*, performed by András Schiff.

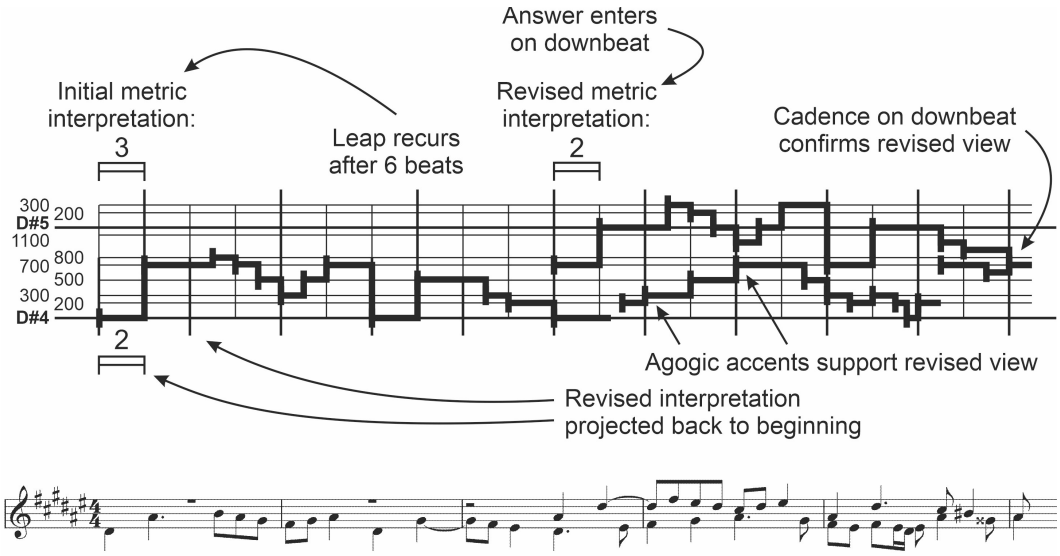

Figure 6c. The beginning of Bach's Fugue in D-sharp Minor from Book 1 of the *Well-Tempered Clavier*, representing the listener's process of metric reinterpretation.

Figures 5b and 6c illustrate how global notation can visualize a listener's experience, either by withholding information until it becomes apparent to the listener or by representing two different ways of hearing the same passage. By the same token, global notation can represent differences in the way the same passage is perceived by different listeners, if this can be known. To establish how particular listeners actually perceive a given piece of music would require ethnographic and/or experimental research that is beyond the scope of an article focused on notation as such. For the purposes of this article I follow Tenzer's strategy of discussing the perceptions of "a culturally informed listener" even if, in practice, this listener is the writer. The ability to visualize a listener's perceptions should prove useful for aesthesic analyses such as Tenzer's, which focuses on processes of temporal re-orientation like the one we have just discussed, except that in his examples it is the perceived tactus rate that changes, rather than the perceived grouping of the tactus into bars.

Re-notating a Study in Cross-cultural Analysis

Tenzer explains his approach to notation and comparison of music from different traditions as follows:

> I have separate kinds and amounts of insider experiences learning the repertoires under discussion but I cannot compare the selected compositions unless I stand outside of all three and attempt to be fair to them. A kind of neutrality . . . might be suggested by transcribing all the music into Western notation, as I have done. But this is not what is intended; rather the point is to accept the limitations of the notation technology and combine notation with listening and description in order to analyze and explain. Indeed

> neutrality is illusory or impossible, but the desire to compare is wholesome. . . . I accept the inability to fully suppress any biases the notation and my own training may suggest. (Tenzer 2011, 153)

No doubt all of us must accept our inability to suppress our biases, even when attempting to notate music in a way that assumes no norms; the Western bias in the *format* of global notation has already been acknowledged. The question is perhaps why transcribing all the music into Western notation might seem to suggest "neutrality" at all. Staff notation was evolved to notate music such as Bach's, and naturally it captures the important characteristics of that music more readily than it does those of South Indian singing or Balinese gamelan. While absolute neutrality may be impossible, I wonder if the effort to "stand outside of all three and attempt to be fair to them" might be better supported by using a form of notation that also stands outside of all three musical traditions in its impartiality to different ways of organizing pitch and time. In this section I investigate this possibility by re-notating Tenzer's examples in global notation and reflecting on the kinds of understanding and comparison that this facilitates. Of course, listening and description will still be indispensable.

A Bach Fugue for Keyboard

Tenzer's staff notation of examples from Baroque, Carnatic (or Karnatak, as most specialists now prefer to spell it), and Balinese music certainly serves his purpose of illustrating how melodies are "temporally transformed," since in each case a melody is recognizable (and recognizably transformed) when it returns with its note values doubled or otherwise multiplied or divided. His first example is a passage from Bach's Fugue in C Minor from Book 2 of the *Well-Tempered Clavier*, in which the subject appears twice in augmentation, with its note values doubled while the (written) tempo and meter are unchanged (Audio Example 4). Figure 7a presents the passage in global notation, essentially transnotated from Bach's score. The reader is encouraged to compare my global notation with Tenzer's staff notation of the same example (Figure 7b).

Tenzer argues that the augmentation causes the listener to "reset the tactus rate" (2011, 161), that is, to reinterpret the beat as going half as fast as we thought. The original subject was four beats long, matching the periodicity of the meter, and by doubling its length the augmented subject introduces a new periodicity lasting eight of the original beats. However, this interacts with other periodicities as the augmented subject in the alto voice is heard in counterpoint with the original subject in the soprano and an approximate inversion of it in the tenor, each maintaining the original four-beat periodicity. On completing the augmented subject, the alto voice then delivers the subject's answer in its original rhythm, so that "we re-entrain to the prior tactus" (161). But then successive entries appear in stretto at two-beat intervals, introducing a shorter periodicity. Three bars later, the eight-beat periodicity reappears with an entry of the augmented subject in the bass voice. Meanwhile, significant moments of arrival on the tonic chord have been spaced at uneven but increasingly close intervals, leading to a cadence at the end of the second augmented subject statement.

Audio Example 4. J. S. Bach, Fugue in C Minor from Book 2 of the *Well-Tempered Clavier*, exposition followed by the passage notated in Figures 7a and 7b, performed by Glenn Gould, as used by Tenzer. The notated excerpt begins at 0:15.

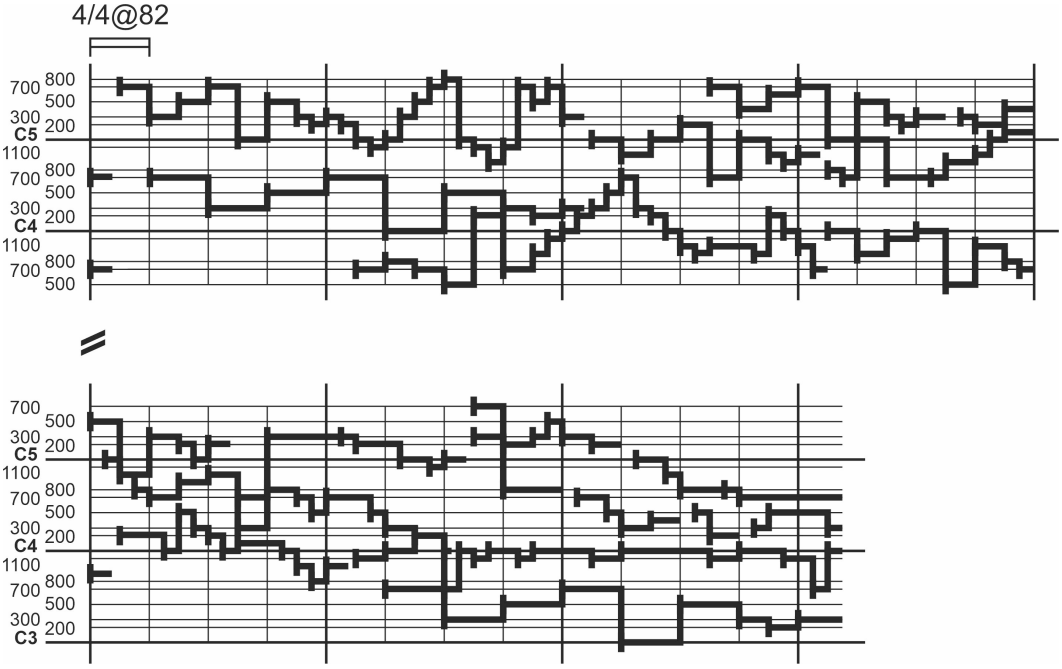

Figure 7a. J. S. Bach, Fugue in C Minor from Book 2 of the *Well-Tempered Clavier*, bars 14–21, in global notation.

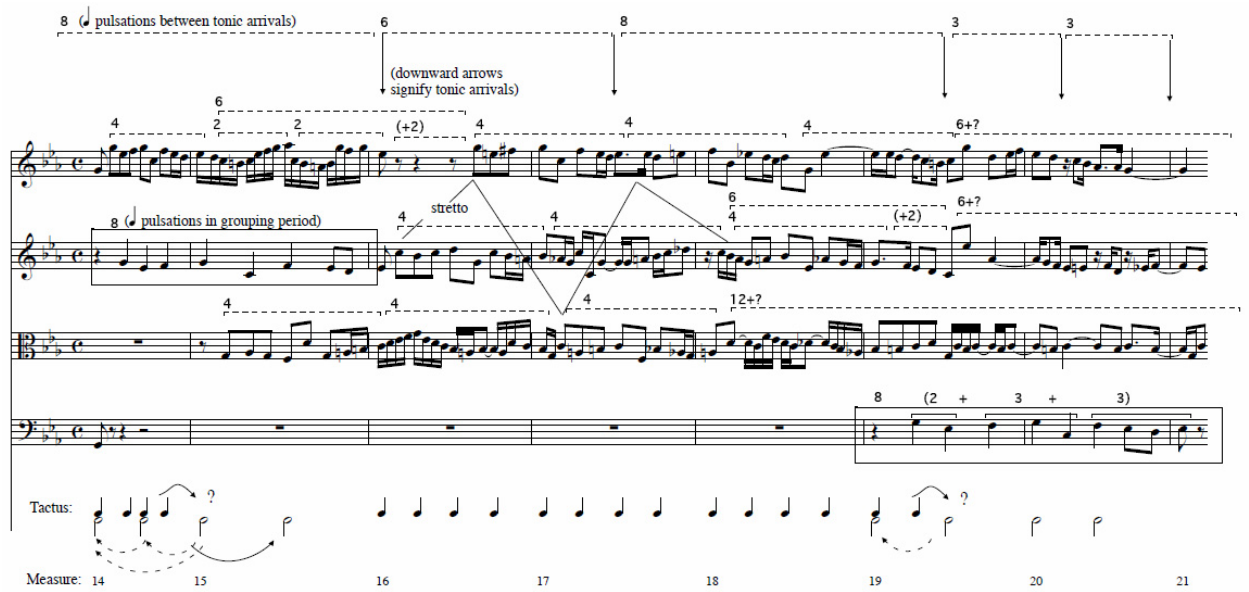

Figure 7b. J. S. Bach, Fugue in C Minor from Book 2 of the *Well-Tempered Clavier*, bars 14–21, in Michael Tenzer's (2011, 160) annotated staff notation.

While Tenzer presented an "exploded version" of Bach's keyboard score with each voice on a separate staff, I have once more combined all the voices on a single set of pitch lines. Tenzer's approach makes it easier to disentangle the individual voices and their various periodicities, but mine may be a more direct visual analog of what listeners actually hear. For instance, it graphically depicts how close or far apart the voices are in pitch at a given moment: notice the striking contrasts between "wide" and "narrow" sonorities in bars 2 to 3 of the excerpt, and the overall downward narrowing toward the concluding cadence. A single-manual keyboard instrument offers little or no differentiation of voices by timbre, and where voices of the same timbre are hard to distinguish in a visual representation that puts them in a shared space, they may well be hard to distinguish for the ear as well. However, it is possible to trace each individual voice in Figure 7a once the reader is informed that in this passage, while adjacent voices sometimes touch, they never cross.[3] The visual shape of the fugue subject makes it easy to recognize even in its augmented and inverted versions. Admittedly, the continuity of each voice is more apparent in the basically legato performance that I have assumed than it would be in the idiosyncratic spiky staccato of the Glenn Gould recording that Tenzer refers to. But on the whole I would claim that, with reasonable familiarity, this condensed notation is in most respects at least as easy to interpret and analyze as Tenzer's exploded score on four staffs with three different clefs.

I say "in most respects" because there is one respect in which staff notation has a distinct advantage: in the representation of functional harmony, without which the notation doesn't effectively illustrate Tenzer's point about the timing of tonic chord arrivals. While staff notation and (what has so far been presented of) global notation both represent chords in essentially the same way—by writing out the individual notes—I must admit that I have yet to develop any real fluency in recognizing chords from global notation despite working with the system somewhat intensively. Global notation's focus on relative pitch is in general an advantage for analytical purposes, but perhaps it is staff notation's focus on absolute pitch that gives each particular triad a recognizable "look." Perhaps it is only to be expected that any existing form of notation will have some advantages for representing the music that it was designed to notate. Or perhaps it does come down to familiarity: after all, even I have spent far more time in total with staff notation than I have with global notation. Either way, for the time being at least, global notation needs another way of representing chords than just as the sum of their parts.

Solutions for this and other requirements of specific forms of music are currently in development in the global notation project. One page of the website suggests a way of distinguishing which scale degrees (or other pitches) are chord tones at a given moment (http://globalnotation.org.uk/relating-melody-to-chords). Figure 7c illustrates another

3. If the parts did cross, and needed to be distinguished, global notation could indicate that as well, but it would involve a more complex feature of the system that need not be explained here (it is illustrated in Figures 11 and 12b below). Voices can also be differentiated by the use of color, but in this article I avoid the use of color lest it be seen as giving global notation an unfair advantage over staff notation.

approach that can be used either in combination with that one or separately: the addition of chord symbols adapted from conventional music theory (http://globalnotation.org.uk/chords). Since some chord symbols are longer than others, the convention is adopted that the *beginning* of any chord symbol is aligned with the moment where the chord begins. If the chords change frequently and horizontal space is lacking, some chord symbols can be displaced vertically to fit them in, as with song lyrics (see Figure 4). To capture all of the suspensions and local modulations, the symbols would need to be quite complex, but since the present purpose is mainly to indicate where the tonic chord appears in its various inversions, many details are left unspecified. Figure 7c is also annotated with ellipses around each statement of the subject, arrows to show the periodicities that these imply, and variable bar and beat lines to represent the temporal re-orientations that Tenzer describes. Specifically, the beat lines *below* the voice in which the augmentation occurs represent the "revised" tactus implied by the augmentation; those above that voice remain unchanged. In this way, the augmented entries can be compared directly with both interpretations of the meter. With these annotations, the essential points of Tenzer's analysis should be intelligible even to readers without a training in music theory and notation, although testing the intelligibility of global notation to non-music specialists is an area for future research.

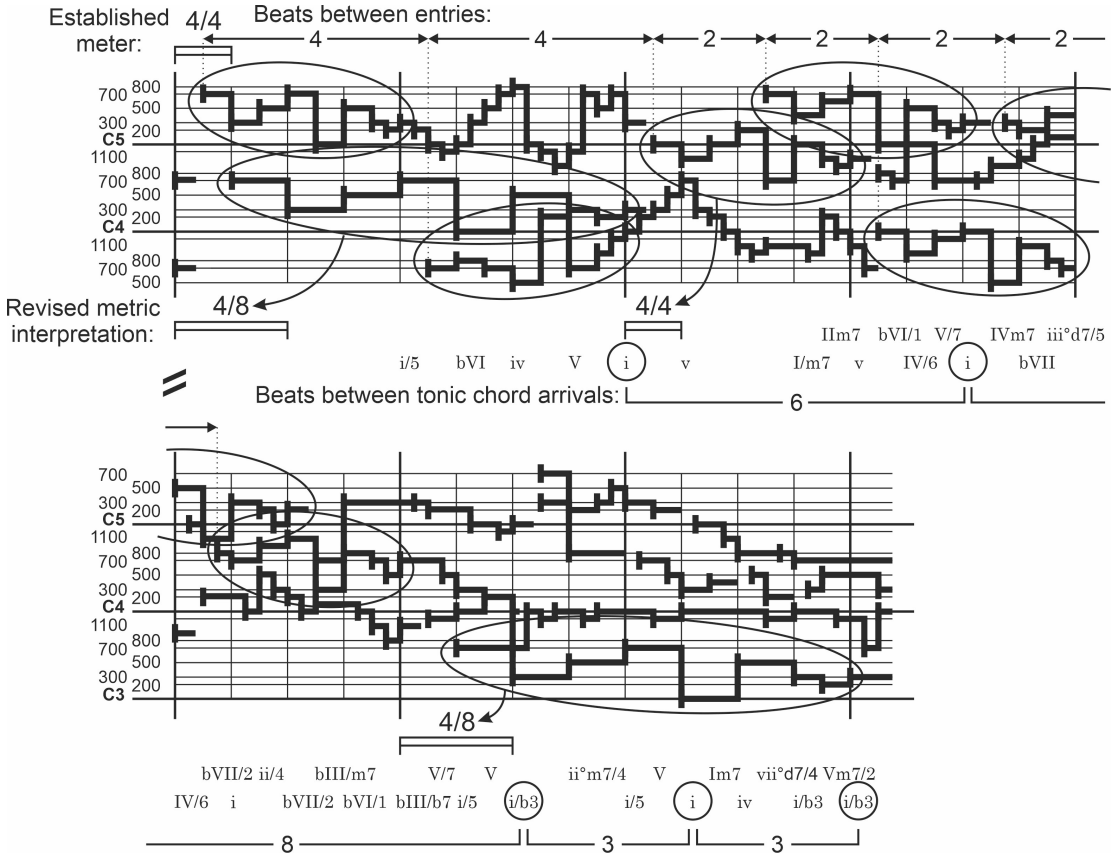

Figure 7c. J. S. Bach, Fugue in C Minor from Book 2 of the *Well-Tempered Clavier*, bars 14–21, with subject entries, chords, and periodicities labeled.

A Balinese Gamelan Piece

With the Bach and Mahler examples we have been dealing with music written down by its composer in the music's indigenous notation system. Global notation can hardly hope to improve on that as a poïetic notation, though it claims some advantages as an aesthesic one. When we turn to transcribing music that is not written down in its own tradition, global notation can compete with other notation systems on a more equal basis, and its capabilities can be compared with theirs as a means of representing whatever ways of organizing sound we may encounter in the world's music.

For our first such comparison, we'll depart from Tenzer's sequence and discuss his third example next: Balinese gamelan. If gamelan musicians use notation at all, it is usually cipher notation, and this has proved effective for some analytical purposes as well (e.g., Sumarsam 1992). Cipher notation can specify scale degrees (by number) without specifying the intervals between them, which can be an advantage for gamelan music because each gamelan is tuned a little differently while no known gamelan tuning fits the twelve (exactly or approximately) equal divisions of the octave that staff notation assumes. When scholars have put gamelan music into staff notation, they have had to "doctor" the notation or just (as Tenzer says) accept its limitations and biases. Slendro scales with their five roughly equal intervals to the octave have to be represented by a mixture of major seconds and minor thirds, misleadingly giving the impression of two distinct interval sizes. Pelog scales, though often described as heptatonic, are actually pentatonic in the *gong kebyar* form of gamelan that Tenzer deals with, but in contrast to slendro they have radically unequal intervals, in the ascending order small-small-large-small-large (Tenzer 2006b, 212). The large intervals are usually in the region of 400 cents and can be notated as major thirds. If the small interval between them is notated as a semitone (which is usually the nearest approximation among Western intervals), this leaves a residue of 300 cents to be divided between the two adjacent small intervals at the bottom of the scale. In reality, the two intervals are usually about the same size, though either one can be *slightly* larger than the other. In staff notation, the first and third scale degrees are generally written as C-sharp and E, but the second is variously given as D (Tenzer) and D-sharp (Harnish 1998, 736), in either case suggesting that the intervals differ in size much more than they really do. Together, the two ways of notating the second scale degree give the impression that two different scales are being used, which is not "emically" true. Gamelan scholars themselves have acknowledged these drawbacks of staff notation (Tenzer 2006b, 212; Sutton and Vetter 2006, 245).

Global notation, in contrast, can represent any set of intervals as easily as another, or of course can leave the intervals unspecified, perhaps just indicating the contrast between large and small ones by the spacing of the pitch lines. In Figures 8a and 8c I give the intervals identified by David Harnish in his article on Bali in the *Garland Encyclopedia of World Music* (1998, 736) as an *example* of an acceptable pelog tuning. It may be noticed that the "octave" between the outermost pitch lines is actually 1213 cents; such "stretched" octaves are common in gamelan tuning, and present no difficulty for global notation if it is considered important to

specify them. While Balinese musicians would think of the lowest pitch shown here as degree 1 of the scale, I have shown the third pitch line from the bottom as the tonic because of Tenzer's emphasis on its drone-like prevalence in his example.

To be sure, the discrepancy in tuning doesn't invalidate Tenzer's analysis, since he is concerned mainly with the time dimension. Tenzer discusses how, in the Balinese dance composition *Baris*, a repeating melody of eight tones equally spaced in time is sounded first at a fast tempo of 180 strokes per minute and then in "augmentation" at about one quarter of that rate (Audio Example 5). At the slower tempo, the melody tones are too widely spaced to be perceived as the tactus, so an additional tone is interpolated between each pair of melody tones, producing a tactus that is still only half as fast as the original one. At both tempi, the "figuration" of the fastest-playing metallophones moves four times as fast as the tactus.

Tenzer's notation shows how the original melody is expanded with interpolated tones and new figuration, and Figure 8a attempts to do the same in global notation. Yet again I have replaced multiple staffs with a single set of pitch lines (for each version) in the hope of revealing relationships between layers by putting them in the same visual space. Distinguishing the layers is once more facilitated by the use of different kinds of symbols, as in the Mahler example (Figures 5a and 5b). With music for metallophones, there is a judgment to be made as to whether to specify duration or not. The sounds are certainly "impulsive," but the decay is slow, and the audible duration can be controlled by damping. In the *Baris* melody, at least at its original speed, each tone remains audible until the next is struck, creating an effect of legato; and in the slower version, each tone of the melody remains audible until the ensuing interpolated tone, and vice versa. To visualize this, I have shown the melody and interpolated tones as sounds of specified duration, each continuing until the next. I have distinguished the two by showing the melody tones in black and the interpolated tones as unfilled outlines. The "figuration," on the other hand, seems more like a stream of onsets, best represented as sounds of unspecified duration.

In the fast version, the melody tones are shown as connected in legato because that is how they are likely to be perceived at this tempo. In the slow version, the melody tones and interpolated tones are shown as detached to reflect Tenzer's point that "the fourfold temporal expansion consigns the original melody to a background realm where it acquires an audible but, because of the augmentation, a rather more structural, and less immediately tactile quality" (2011, 169).

Perhaps because the original melody is now more in the background, the figuration becomes more melodic. This change is easy to see in the notation. In the fast version the figuration forms an ostinato lasting two beats that covers the full pitch range of the melody and repeats without relation to the melodic contour: visually, the melody line just seems to weave through a space that is full of wedges. In the slow version the figuration follows the contour of the melody as it rises above the "drone" pitch E and then dips below it. The interpolated tones do the same, and the visible parallelism gives a clear picture of a

Audio Example 5. Central section of the *Baris* dance at two speeds, performed by the gamelan of the STSI conservatory, Denpasar, Bali, as used by Tenzer. The fast version is heard from the beginning of the recording, the slow version from 0:25.

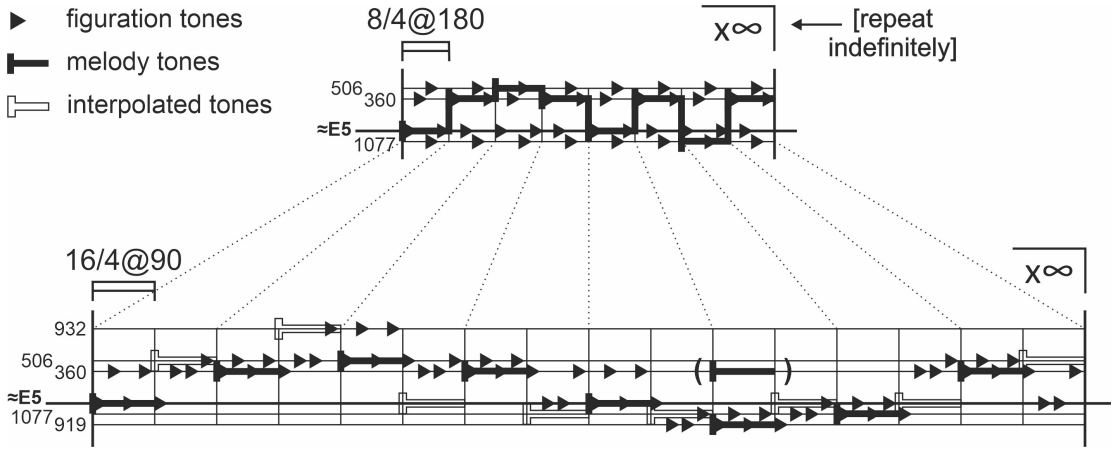

Figure 8a. Melody and figuration of *Baris* in fast and slow tempo, showing the augmentation process, in global notation. In the augmentation, the sixth note of the melody is changed for some reason that Tenzer doesn't explain.

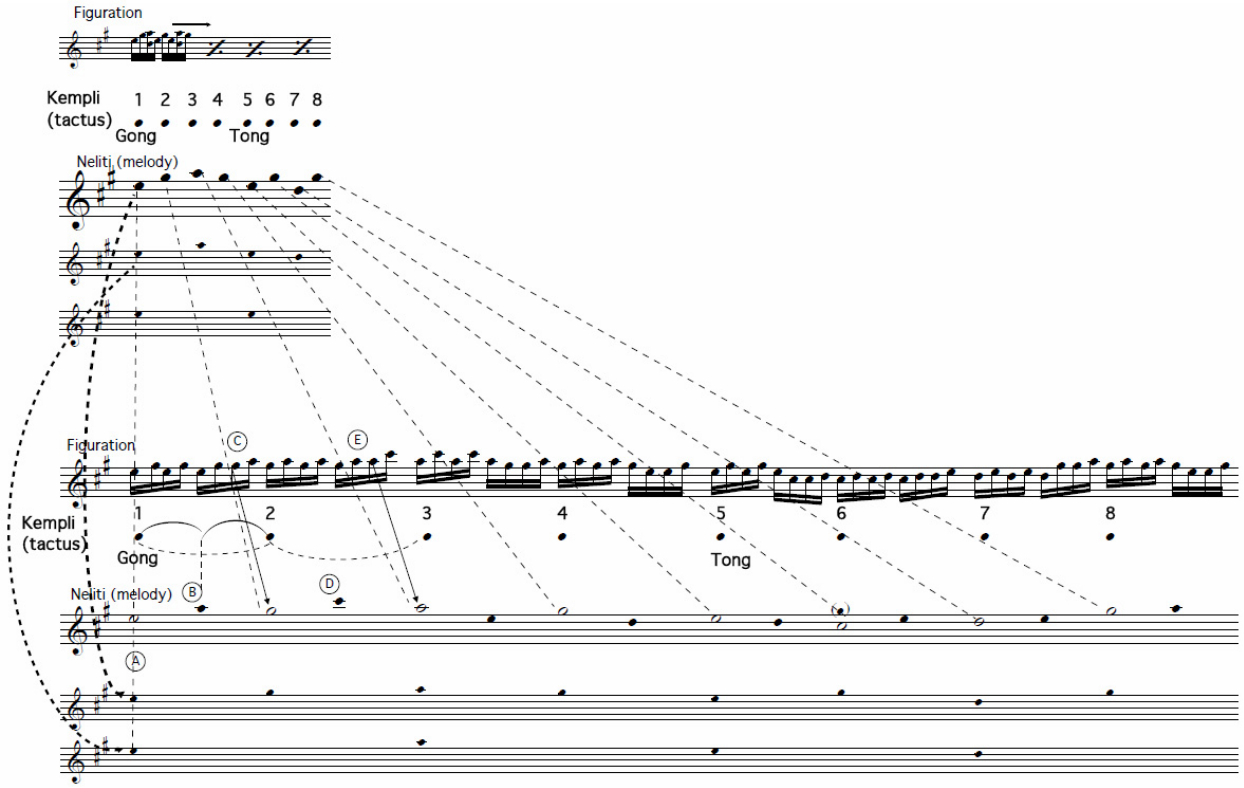

Figure 8b. Melody and figuration of *Baris* in fast and slow tempo, showing the augmentation process, in Michael Tenzer's (2011, 167) annotated staff notation.

heterophonic texture in contrast with the polyphonic texture of the Bach fugue in Figure 7a. Putting all of the sounds in the same space reveals other relationships too: for example, while all of the melody tones in the slower version are doubled at their onset by figuration tones, none of the interpolated tones are. Also, the interpolated tones are always one scale step away from the *ensuing* melody tone, except at the end of the cycle—a fact that is less apparent in staff notation, which makes wide steps look like skips.

Well did Nicholas Cook observe that notation "conceals as much as it reveals" (1998, 55). This may be true of any notation, but global notation at least allows the notator to choose what to reveal and what to conceal. Notation systems developed for particular kinds of music are designed to reveal what needs to be revealed in that music, and when applied to other kinds of music they tend to conceal certain things willy-nilly; they may even "reveal" things that are not there. Staff notation is designed to show ("reveal") seven scale degrees per octave, and when it is used for music based on pentatonic scales, some of its lines and spaces represent scale degrees that don't actually exist: what appear to be skips of a third are usually steps between adjacent scale degrees.

Also, in notating the fast "figuration" of gamelan music, the beaming of sixteenth notes in groups of four starting on a beat may obscure the real patterning of the figuration. It was only after putting this example into global notation that I noticed the "rule" or "algorithm" for deriving the figuration from the melody tones: each melody tone is anticipated and accompanied by a sequence of eight figuration tones with the contour <00101010>, with 0 being the melody tone and 1 the next scale step above, and the fourth onset coinciding with that of the melody tone. Because the figuration pattern starts *between* onsets of the melody tones, it is further obscured by staff notation's assumption that a cycle (such as a bar), and therefore a line or "system" of the notation, begins from a strong beat. To the contrary, gamelan musicians think of the strongest beat (marked by the largest gong) as coming at the *end* of a cycle; and global notation can be laid out that way, too. In Figure 8c the "end" of the cycle is interpreted as including the whole of the figuration pattern derived from the melody tone that occurs at that point, and the conformity of the figuration groups for each melody tone is highlighted by enclosing them in ellipses.

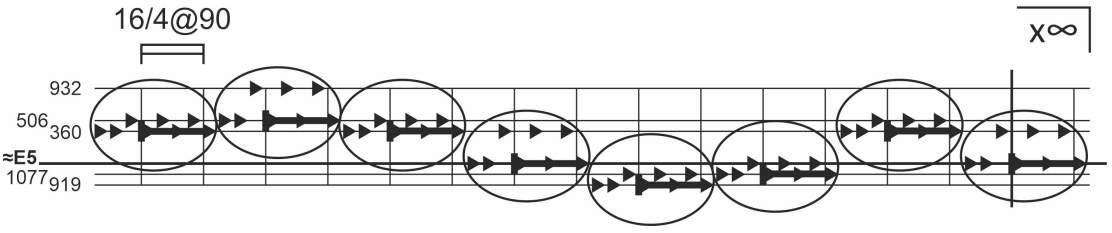

Figure 8c. *Baris* with figuration groups enclosed in ellipses. Interpolated tones are omitted for clarity.

The above examples show global notation's ability to overcome some of the limitations of staff notation by enabling the notator to specify any form of scale and tuning with equal ease, to start a cycle or pattern from any point, and to exclude any information that is irrelevant or unwanted. I also suggest that the graphic character of the notation has the potential to make insights about sound organization more accessible, even to readers unfamiliar with staff notation. Obviously, these claims need to be tested with further examples.

A Karnatak *Varnam*

Tenzer's remaining example takes us from instruments of fixed pitch and impulsive sound to the most flexible and fluid of instruments, the human voice. He finds "temporal transformations" of a different kind in a performance of *Jalajaksha*, a *varnam* (a type of concert etude) from the South Indian Karnatak tradition composed by Manambuchavadi Venkatasubbayar in the nineteenth century (Audio Example 6). In this case, a melody is performed first at a moderate tempo, then in "diminution" twice as fast, and then at two-thirds the speed of the diminution. Thus the third rendition is an augmentation in relation to the second, but is itself a diminution relative to the original melody: its speed is one third faster than the original. To put it in a way more congruent with the idea of "diminution" (i.e., things getting smaller), we might speak of durations being decreased rather than tempos increased: in the second rendition, the duration of the original melody (and of any given part of it) is reduced by half; in the third, it is reduced by one third. Meanwhile the tala (rhythmic cycle) is maintained with a repeating pattern of hand gestures at the original tempo throughout, so that its combination with each of the "diminished" versions of the melody forces the listener to "manage two time flows at once" (Tenzer 2011, 166).

In Figure 9a, the original melody is shown in the middle system (rather than the top one as in Tenzer's notation) to make it more easily comparable with each of the diminutions. The structure of the 8-beat rhythmic cycle *adi tala* is indicated by vertical lines of varying length and thickness, one for each beat. The longest and thickest of these lines represent beat 1 of the cycle, marked by a light handclap. The thinner and somewhat shorter lines that cross the outer pitch lines represent structural points in the cycle, each marked by an upward hand wave, dividing the 8-beat cycle into groups of 4+2+2 beats. The thin lines that touch but don't cross the outer pitch lines represent the other beats, each marked by the right thumb touching one of the fingers. The song is in the pentatonic raga *Hamsadhvani,* which Tenzer notates according to the usual convention for Indian classical music, writing the tonic (*sa*) as C to give the scale CDEGB. The actual pitch of the tonic in the recorded performance by Vidya Hari is around G. In global notation, the spacing of the pitch lines reflects the distinctive character of this scale with its four different sizes of interval, and as with pelog, the pitch lines make it clear

Audio Example 6. The *pallavi* of *Jalajaksha* at three speeds, performed by Vidya Hari, as used by Tenzer.

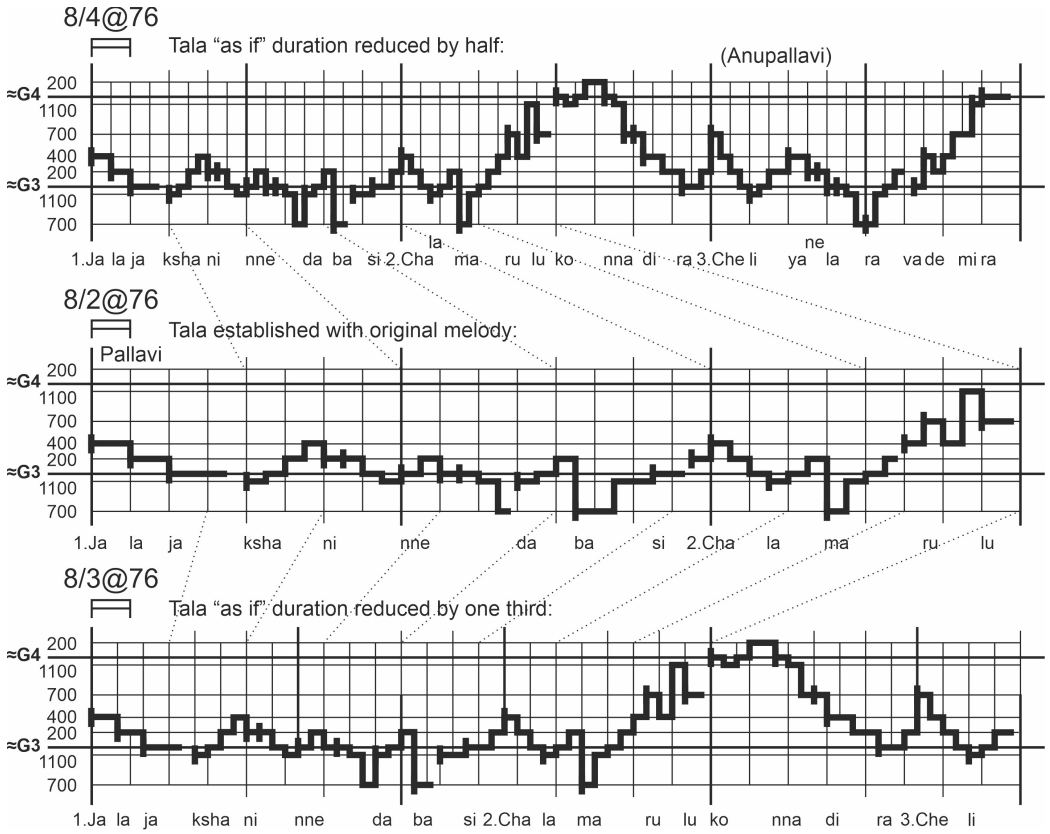

Figure 9a. Varnam *Jalajaksha*, original melody (middle system) with diminutions reducing the duration by half (top system) and by one third (bottom system), in global notation.

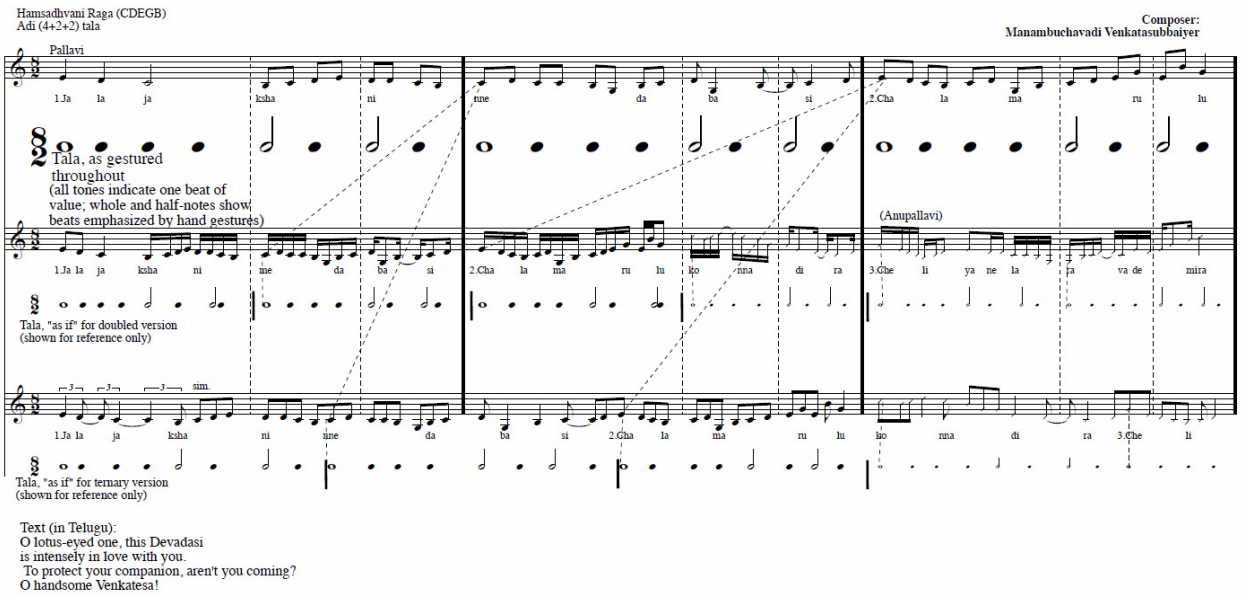

Figure 9b. Varnam *Jalajaksha*, original melody (middle system) with diminutions reducing the duration by half (top system) and by one third (bottom system), in Michael Tenzer's (2011, 164) annotated staff notation.

whether melodic motion is conjunct or disjunct whatever the size of the interval between adjacent scale degrees.

Dotted lines connect points in the original melody with the equivalent points in each of the diminished versions. With the help of these dotted lines, it should be easy to recognize the three melody lines as following the same contour but over different time spans and thus with different "gradients." Tenzer notates the hand gestures of the tala both at the "real" rate established with the original melody and at two "as if" rates that would result if the duration of the tala were reduced along with that of the melody. To show how the listener must "manage two time flows at once," I notate each of the diminutions with beat lines representing both the "real" and the "as if" tala rates. The "real" tala appears below the melody line and the "as if" tala above it. In this way, the onsets in the melody can be readily compared with both tala patterns. It can be seen, for instance, that where the melody is syncopated (notably at the text syllables "ba si") it remains syncopated in relation to both tala patterns in each of the diminutions. In this example, the syncopation is recognizable by a rotated T symbol (for a sound of specified duration) starting between beat lines and crossing at least one of them. Since the symbols of global notation can cross beat and bar lines freely, syncopations and cross-rhythms can be shown without the tied notes that are necessary in staff notation; thus the first three notes of the melody look alike in all three renditions, matching the way they sound.

Here then we have another example of global notation capturing a way of organizing pitch and time that is difficult to represent accurately in staff notation, and graphically portraying significant musical relationships without irrelevant information. Admittedly, almost all of the information in Figure 9a is already present in Tenzer's staff notation, and apart from gaps where the singer takes a breath, the melody lines above are direct "translations" from the notes that Tenzer wrote. Tenzer says that these notes represent "the essential composed melody" from which he has "remove[d] the singer's pitch and rhythmic embellishment" (2011, 163). The notes and their changing rhythmic values (in the two diminutions of the original melody) certainly convey the "temporal transformations" that Tenzer describes. For some other kinds of analysis, however, we might require a notation that shows something of the "embellishment" too. We next consider how global notation might represent this embellishment other than by simply indicating more notes.

INCORPORATING THE SEEGER SOLUTION

Listen to the recording while looking at Figure 9a, and you may well feel that the lines representing the melody are too angular. The voice doesn't often move from one scale degree to another by an abrupt step as the notation suggests: especially where no new syllable is articulated, there is usually some degree of slide. The angularity is in fact a result of deriving these melody lines from the staff notation rather than directly from the recorded sound. If the melody lines imply unrealistically distinct steps from one pitch to another, then so do the

notes from which the lines were transnotated. To specify slides and inflections of pitch, global notation can be written with curved and wavy melody lines instead of straight ones, working directly from the sound and capturing its actual pitch contours with any degree of precision that may be required.

Global notation can do this because, unlike staff notation, it does not require sound to be broken down into "notes." With the keyboard and percussion instruments of Bach and Balinese gamelan, it's clear when a note happens, but with singing, especially in a florid and melismatic style such as that of Karnatak music, it is by no means always obvious what exactly constitutes a "note." The lengths to which a transcriber must sometimes go, if the aim is to notate "every nuance of melodic ornamentation" in the notes of staff notation, are well illustrated in a transcription of another *varnam* by Robert Morris in Tenzer's edited volume *Analytical Studies in World Music* (2006, 311). Morris posits a rather different relationship between "ornamentation" and "the essential composed melody" than Tenzer does: "These nuances are integral to the composition and the ragas on which it is based, not improvisations on—or performance deviations from—a simpler compositional scheme" (Morris 2006, 311–12). To express these integral nuances in notes, Morris has to resort to rhythms based on quintuple subdivision of quadruple divisions of the beat, which he admits makes the transcription "difficult to read on first hearing" (311). The melody is indeed intricately ornamented, but one has to wonder whether the visual complexity arises only from the music or also from the notation system. Moreover, even this elaborate ornamentation doesn't capture the pitch movement by slide rather than abrupt step.

The reliance on notes is one reason why staff notation does not produce "neutrality" when used for any and all music: some forms of music are better represented by notes than others. As Bruno Nettl put it in his chapter on notation and transcription from *The Study of Ethnomusicology*:

> The concept of the articulated note works well for certain musics, especially instrumental. . . . In other kinds of music, perhaps singing most of all, notes are useful prescriptive devices, but they are not particularly descriptive. Lines may be preferable, providing opportunities to show glides and other ornaments. In fact, there may be in certain cultures segments of sound more significant than those that we label as the "notes." (Nettl 2015, 82)

An example of the last point might be found even within Western culture: in the earliest ancestors of staff notation, the manuscripts of Gregorian chant written before the year 1000, the basic unit is not the note but the text syllable (Kelly 2015, 15, 45).

Nettl's idea of representing melodies by lines rather than notes has in fact been the approach adopted by many scholars of Indian classical music of both the Karnatak and the Hindustani traditions (e.g., Kassebaum 1987; Krishnaswamy 2003; Meer 2005; Clayton 2007). One large-scale outcome has been the research project and website "Music in Motion: The

Automated Transcription for Indian Music (AUTRIM) Project by NCPA and UvA" developed in collaboration between India's National Centre for the Performing Arts and the University of Amsterdam. As of October 2019, the website (https://autrimncpa.wordpress.com) presented analyses of 86 North Indian ragas with recorded performances accompanied by scrolling transcriptions in the form of computer-generated pitch-time graphs annotated with straight lines representing the scale degrees and the main beats of the tala, rather like the pitch and beat lines of global notation. According to two collaborators in the "Music in Motion" project, Wim van der Meer and Suvarnalata Rao,

> With the help of melography, and more in particular the use of advanced models of pitch perception in computer software, we can actually "see" the precise forms of meend and other aspects of pitch bending. Generally, both musicians and musicologists agree that this graphic representation does much better justice to the music than staff notation or sargam notation. (Meer and Rao 2018, abstract)

Although Meer and Rao are referring to Hindustani music, their point would presumably apply with at least equal force to Karnatak music, in which pitch tends to be even more constantly in flux.

The use of sound-transcribing technology to help produce a form of notation was what Hood called the "Seeger Solution" (1971, 94–101), being most associated at the time with the Melograph developed by Charles Seeger. While the Melograph itself was never widely available or used extensively enough to generate a substantial library of transcriptions, Hood foresaw that a Seeger Solution in some form would be "available soon," and today it is freely available through open-source sound analysis programs such as Praat (Boersma and Weenink 2018), Tony (Mauch et al. 2015), and Sonic Visualiser (Cannam, Landone, and Sandler 2010). At the present stage of development, such programs can only produce reliable pitch-time graphs when the music is either monophonic or recorded in separate monophonic channels. Hence, melography would not have worked well for Tenzer because, for purposes of comparison, he needed to put his Indian example into the same form of notation as his other, polyphonic or heterophonic examples. But with global notation, a computer-generated pitch-time graph can be incorporated into a transcription based on the same principles as one written by hand, so that the two can be readily compared.

Figure 10 illustrates this with the beginning of *Jalajaksha* in a different performance (Audio Example 7). I chose a recording by Mysore Nagamani Srinath (2012) in which the accompanying drone is less prominent than in Tenzer's recording, reducing the risk of the Praat software mistaking a drone sound for part of the melody. Even so, I had to correct some parts of the graph in which the melodic pitch was shown as either an octave too low or as continuing when in fact the singer took a breath and only the drone pitch was heard. Such manual correction appears to be a regular part of working with melography, as described in Wim van der Meer's "Praat Manual for Musicologists" (2018), unless special purpose-made recordings can be obtained as for the "Music in Motion" project. Still, with some effort a graph

Audio Example 7. First tala cycle of *Jalajaksha* performed by Mysore Nagamani Srinath (2012) at 5:05.

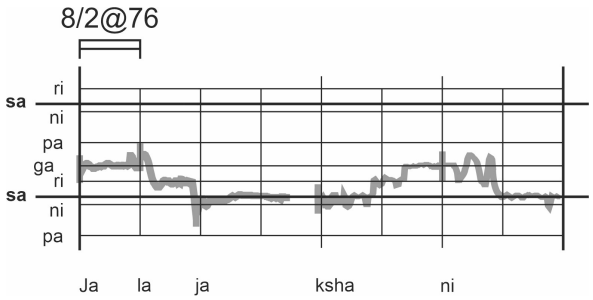

Figure 10. The first tala cycle of *Jalajaksha* as performed by Mysore Nagamani Srinath (2012) in global notation incorporating a computer-generated pitch-time graph.

can be produced that represents inflections of pitch and timing with great accuracy, and this can either be printed out and annotated by hand or imported into a graphics program and manipulated in various ways, such as adjusting the thickness of the melody line and applying "smoothing" if it shows more detail than wanted (see http://globalnotation.org.uk/producing-a-pitch-time-graph). In this case I have made the melody line grey to allow the pitch and beat lines to show through, and added short vertical lines crossing the melody line wherever a new syllable is articulated, so that the melody line in effect forms a series of rotated T symbols (albeit with curved and wavy stems), consistent with global notation's usual symbol for a sound of specified duration.

If such a graph were produced for a longer segment of *Jalajaksha* and its subsequent diminutions, it would surely illustrate the temporal transformations and the matching contours with different gradients as clearly as Figure 9a does. Meanwhile, comparison with our global notations of Bach and of Balinese gamelan (Figures 7a and 8a) immediately reveals not only the contrast of texture but also the contrast between continuous and discontinuous pitch movement, which does not appear in the staff notation. Comparison with Figure 9a also reveals some intriguing details, such as the way beats 2 and 7, both occupied by the second scale degree (200 cents above the tonic) in the staff notation, actually seem to contain very little of that pitch, while the graph reveals no obvious difference that would account for beat 2 being filled with a quarter note and beat 7 with two eighth notes. We will return to that anomaly in the next section.

Despite its advantages for capturing nuances of pitch, a purely line-based representation of Indian singing may not be satisfactory for all purposes. Indian singers and melodic instrumentalists do regard their melodies as consisting of "notes," in that every sound they make is conceptualized as belonging to one of the notes of the raga and a note is articulated (at least) whenever a new syllable is sung or a melody string plucked. To reflect that view in the notation along with the notes' evident variability in pitch, some combination of note-based

and line-based approaches would be needed. This too is something that global notation can offer.

INCORPORATING THE HIPKINS SOLUTION

Notes are essentially a way of putting sounds into categories. In staff notation, to represent a sound by a note is to categorize it as an example of a certain pitch class, register, and metrical position. This is certainly not unrelated to how listeners process sound: all hearing creatures must categorize sounds, as they must categorize other sensory input, in order to decide what parts of the mass of information coming in from the outside world are relevant to their survival (Snyder 2000, 81). To make sense of music, listeners usually have to categorize the sounds (subconsciously, unless they are music theorists) as examples of a limited number of pitch and time categories used in a given piece or repertoire, which I will call the music's "operative categories." But the operative categories are not necessarily to be *equated* with what is notated, and the categories applied by listeners may differ from those applied to the same music by composers or performers using notation. Unless they have "perfect pitch," listeners are less likely to categorize a sound (even subconsciously) as an example of a certain pitch class (such as A-flat) than of a certain scale degree (such as the tonic). This is one reason why global notation, which aims to be able to represent aesthesic categories as well as poïetic ones, allows relative pitch to be specified independently of absolute pitch.

Naturally, the operative categories (for instance, the scale degrees and types of beat, such as stressed and unstressed) vary between one form of music and another; and so does the very question of what constitutes a "category." Listeners can recognize that the items within a category are not necessarily identical: if a song contains two iterations of the tonic pitch on the first beat of a bar, we may notice that the singer is slightly flat and behind the beat the first time but right on the nail the second, without doubting that the two sounds belong to the same category. We can also notice deliberate variations of pitch or timing within a category, such as vibrato or rubato, though we are less good at making and remembering distinctions within categories than between them (Snyder 2000, 81–82). Variation within a category may be termed "nuance" (86), and as a distinction between category and nuance is often relevant both poïetically and aesthesically, it may sometimes be useful to reflect such a distinction in notation.

In the context of Karnatak music, our first instinct may be to equate nuance with the "embellishment" that performers apply to "the essential composed melody." However, the situation is complicated by the fact that, in this tradition, as in European Baroque music, the embellishments themselves are categorized and named (Powers 2020), albeit at a different level than the scale-degree categories. Hence, perhaps, the difference of interpretation between Tenzer and Morris as to the status of these embellishments and whether they need to be represented by "notes."

In a book on *Music and Memory* Bob Snyder suggests that "nuances . . . cannot usually be captured in notation, which normally represents only the basic syntax of musical categories" (2000, 88). Yet on the previous page Snyder presents a figure of his own that notates both categories and nuances, and does so, moreover, in a manner very similar to global notation. Pitch categories (in his case, chromatic scale degrees) are represented by horizontal lines, time categories (beats) by vertical ones, and sounds of specified pitch and duration by thicker lines coinciding only approximately with the grid lines and thus indicating slight departures from the "central or prototypical values of the categories." Snyder's figure represents the pitch and time categories with dotted lines, which I consider an unnecessary complication; global notation normally uses thin solid lines instead. In most cases, the proximity of the thicker lines and their starting points to certain grid lines will make it clear which pitch and time category each sound belongs to—that is, how a "culturally informed listener" would categorize it—as it does most of the time in Figure 10 above. If it doesn't—for example, if the pitch slides continuously over a wide interval, or if the music has no regular pulse—global notation allows the option of leaving the sound uncategorized with respect to pitch and/or time, as an unannotated melographic transcription does. But in some music that uses a fluid approach to pitch, such as Karnatak singing, performers and culturally informed listeners may categorize sounds in ways that would be hard to deduce from a melographic transcription. If we want to indicate this categorization in our notation, we need an approach that inscribes insider knowledge in a different way than we have seen so far. One such approach is to draw on what Hood called the Hipkins Solution.

We know that Indian musicians think in terms of pitch categories because they have names for the scale degrees and can tell us which one they are singing or playing at any given time. Sometimes they even sing the names of the scale degrees as if they were song lyrics. The seven possible scale degrees are named (in ascending order) with the solfege syllables sa-ri-ga-ma-pa-dha-ni, although not every raga uses all seven: *Hamsadhvani* uses only sa-ri-ga-pa-ni. The Indian solfège system is known as *sargam*, an abbreviation of the names of the first four scale degrees. Sargam is the main indigenous notation system of Indian music, used in theoretical discussions, teaching, and performance, although calling it "notation" should not be taken to mean that it is necessarily written down. Ter Ellingson, in his chapter on "Notation" in Helen Myers's edited volume *Ethnomusicology: An Introduction*, defines notation as "the representation of music through means other than the sound of music" and explicitly includes "aural systems representing musical sound by other stylized sounds" such as "spoken or sung syllables" (1992b, 153–54).

Knowledge of indigenous non-Western notation systems was dubbed by Hood the "Hipkins Solution" after the nineteenth-century British musician Alfred James Hipkins. In the introduction to a book on Indian music, Hipkins wrote of the need to "forget what is merely European, national, or conventional, and submit the whole of the phenomena [of music] to a philosophical as well as a sympathetic consideration" (quoted in Hood 1971, 90). Hood interpreted this as "a reminder that the music of each culture must be known and understood

in its own terms"—terms that, in a written or otherwise "notated" tradition, are inscribed in the indigenous notation (1971, 90–91). The Hipkins Solution, "a reading knowledge of the principal non-Western systems of music notation," was therefore "a first and minimal step in getting to know a given music in its own terms of reference" (91), including its operative categories of pitch and time. Yet Hood acknowledged that indigenous notations, while adequate for the purposes of practicing musicians, did not always convey the information that might be wanted for addressing "research problems" concerning "those aspects of musical performance that are dependent on the oral tradition supporting the indigenous notation" (93). Hood didn't indicate what he thought those aspects were, but it would be reasonable to suppose that they would typically involve what we are calling matters of "nuance" (Snyder 2000, 88–89). In such cases, Hood recommended either modifying the indigenous notation or adopting a different approach such as the Seeger Solution. By extension, we might consider how the insights gained from indigenous notation into its own tradition's operative categories might be incorporated into a form of notation designed to facilitate comparison with other music based on different categories. We would then be making the culture-specific insights of the Hipkins Solution intelligible in the cross-cultural language of a Laban Solution: a notation system that can represent different ways of categorizing sounds on an equal basis.

In the case of Indian classical music, sargam notation can reveal aspects of the music's "terms of reference" that would be difficult if not impossible to discern from the musical sound alone. Listening to the constant pitch-bending of an Indian singer, or looking at the sloped and wavy lines that this produces in a computer-generated pitch-time graph, it may be hard to tell what note the singer intends to sing or where a new note begins. But this information is often available from the musicians' use of sargam.

To illustrate this, the recording of *Jalajaksha* by Mysore Nagamani Srinath is particularly useful because it includes the singing of sargam syllables for the whole composition. Although sargam singing is a standard part of *varnam* performance, it is not normally applied to the melodies that have lyrics, such as the opening section *pallavi*. Srinath's recording was made for teaching purposes and features each tala cycle of *Jalajaksha* first sung by Srinath and then repeated by a group of her students. Even the melodies that have lyrics are first sung to sargam syllables in order to teach the "notes" (Audio Example 8). Srinath's sargam singing therefore tells us what notes, in her mind, the melody consists of. We are now, of course, speaking of a poïetic perspective.

It might be interesting to compare this "emic" view of the melody with an "etic" one generated by the Seeger Solution. To do this in global notation, we are faced with the challenge of showing two versions of the same melody, each requiring symbols for sounds of specified duration, within the same visual space. My solution in Figure 11 is to show the

Audio Example 8. Opening melody of *Jalajaksha* sung in sargam syllables by Mysore Nagamani Srinath (2012) at 2:25.

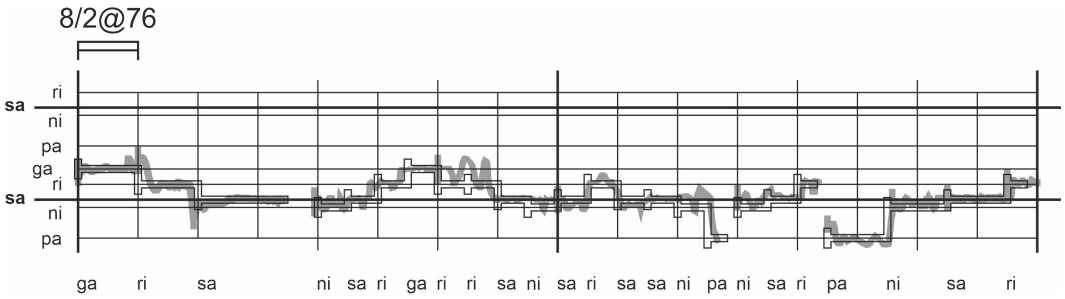

Figure 11. Opening melody of *Jalajaksha* as sung in sargam syllables by Mysore Nagamani Srinath (2012).

computer-generated melody line in grey as before, and the notes implied by the sung sargam syllables as unfilled outlines, so that neither one hides the other.[4]

While the two melody lines overlap to a great extent, there are some significant divergences. Most noticeable, once more, is the singing of (what is supposed to be) the second scale degree ri—see especially beat 7 of the first tala cycle—although we do actually hear more of that pitch here, where it is sung to its own name, than we did when it was sung to the *pallavi* lyrics as transcribed in Figure 10 (compare beat 2 of both examples).

The sargam syllables can tell us not only what scale degree is being sung, but also *when* a new note is considered to begin. In sargam singing, it would be reasonable to suppose that whatever is sung to a single syllable in some sense constitutes *one* note. In that sense, at least, the "nuances" that Morris (2006) transcribes in sixty-fourth-note quintuplets (a rate of 20 notes per beat) are not really "notes" since the sargam syllables in this performance are never articulated more rapidly than four times per beat. In the case of *Jalajaksha*, it turns out that the notes implied by the sargam syllables correspond exactly to the ones in Tenzer's notation of the "essential composed melody," and therefore to my transnotation of the latter in Figure 9a. The same sargam syllables can be found in written form, for instance in the booklet accompanying Srinath's recording and in various Indian music books such as those consulted by Walter Kaufmann, who writes the same notes as Tenzer in his staff notation of *Jalajaksha* in *The Rāgas of South India* (1976, 424).[5] It seems that what Tenzer wrote was itself a transnotation from the sargam syllables, and that it was on the basis of these that he distinguished the "essential composed melody" from the "embellishment." In other words, Tenzer himself was incorporating insights from the Hipkins Solution—knowledge of the indigenous notation.

This would explain why (as noted in reference to Figure 10 above) Tenzer wrote a quarter note in beat 2 of the first tala cycle but two eighth notes in beat 7 although neither one has a new text syllable articulated on the half-beat and the pitch contours (at least in Srinath's

4. The same strategy can be used to distinguish crossing voices in counterpoint, or parts in heterophony, if needed (see http://globalnotation.org.uk/counterpoint).
5. Interestingly, Kaufmann does write a wavy line over the repeated ri in beat 7 of the first tala cycle, presumably indicating a fluctuation of pitch such as we have observed at that point in Srinath's singing.

performance) are essentially identical. As for why the sargam notation indicates one note for beat 2 but two for beat 7, perhaps it is related to the prevailing rate of melodic motion (as established by changes of scale degree), which is at one note per beat in the first half of this tala cycle and at two notes per beat in the second half. Thus what the Seeger Solution shows to be the same pattern of pitch movement can be construed as either one note or two according to the context. We wouldn't know this without drawing on the Hipkins Solution.

While the computer-generated melody lines in Figures 10 and 11 show distinct if undulating "plateaus" that can readily be identified with notes of the scale, Indian singing may also contain passages characterized by pitch movement with few or no resting points. In Srinath's recording of *Jalajaksha*, such a passage occurs at 13:25 (Audio Example 9). This is a part of the *varnam* that does not have lyrics but was composed to be sung to sargam syllables. Nevertheless, in Figure 12a I omit the sung syllables to illustrate how challenging it would be, without their aid, to decide what notes are being sung. The melody is broken into a series of detached sounds, each sung to one or (in one case) two sargam syllables. In the first tala cycle, these sounds do settle onto recognizable scale degrees, although they set up a new conflicting time flow by spacing their onsets at intervals of one-and-a-half beats. In the second tala cycle, the contours become increasingly jagged, with single sounds sliding in pitch by as much as 800 cents. How are we to equate this with scale degrees or solfege syllables at all?

In Figure 12b, the sung sargam syllables solve the puzzle. While the notes derived from them, shown once more with unfilled outlines, often begin on a pitch different from the one sung, each sung sound *ends* on the pitch of the sargam note. That is, the pitch "notated" by a sargam syllable is understood to be the one that the note eventually *arrives at*. This may not always be true, even within Karnatak music: "embellishment" can involve ways of *leaving* the notated pitch as well as approaching it (Kassebaum 1987, 51–53). Nevertheless, the example illustrates one way in which global notation's capacity for distinguishing category and nuance through a combination of note-based and line-based approaches can shed light on the relationship between an indigenous notation and what is actually performed.[6]

6. A form of notation combining note-based and line-based approaches, while retaining the framework of staff notation, was devised for Karnatak music by Josef Kuckertz (1970) and adopted for Hindustani music by Richard Widdess (1994). In this system, Western-style note symbols (or stemless note-heads, in the case of non-metrical music), representing the pitches that would be "notated" with sargam syllables by an Indian musician, can be preceded and/or followed by diagonal, curved, or angled lines depicting pitch movement to or from the "notated" pitch. While this system succeeds in representing both "categories" and "nuances" of pitch, its precision is limited by the fact that the staff is not pitch-proportional. Since intervals equivalent to minor, major and augmented seconds between adjacent scale degrees are all common in Indian music, a diagonal line moving (for instance) from a staff line to the center of an adjacent space can represent pitch movement by any of these intervals. For this reason, the "Kuckertz solution" is really only explicit about the scale degrees or "categories" of pitch between which the sounded pitch moves, rather than the exact nuances. An earlier note-plus-line notation, Milton Metfessel's "phonophotography" (1928; Ellingson 1992a, 133), achieved pitch-proportionality (and hence the ability to incorporate a mechanically produced pitch-time graph) by abandoning the conventional staff. While Metfessel retained the use of conventional note symbols, global notation aims for greater explicitness by abandoning these too, for the reasons explained earlier: for instance, the ambiguity as to whether the note values represent duration or inter-onset interval.

Audio Example 9. Sargam singing passage in *Jalajaksha* performed by Mysore Nagamani Srinath (2012) at 13:25.

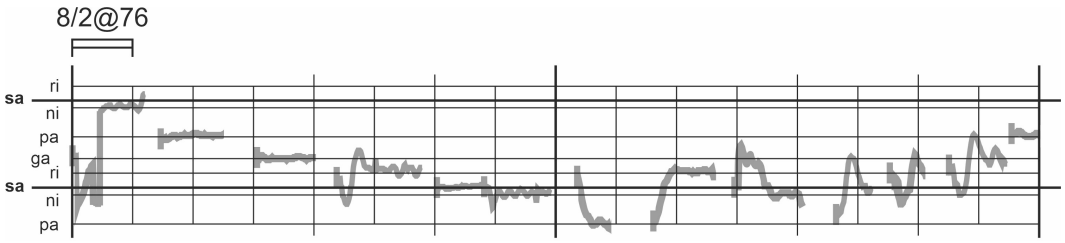

Figure 12a. Sargam singing passage at 13:25 in Mysore Nagamani Srinath's recording of *Jalajaksha* (2012), with sargam syllables omitted.

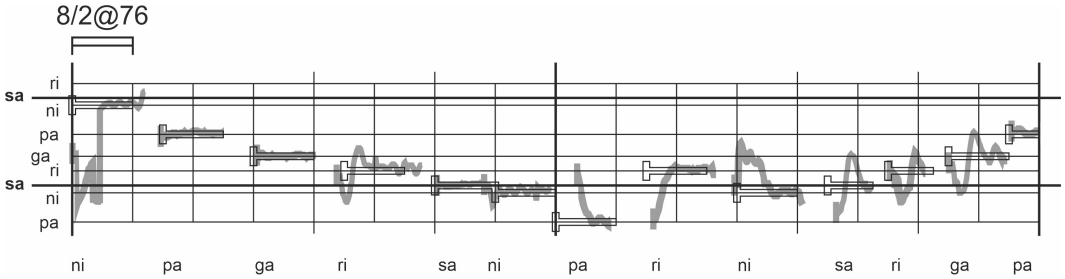

Figure 12b. Sargam singing passage at 13:25 in Mysore Nagamani Srinath's recording of *Jalajaksha* (2012), with sargam syllables and their implied notes included.

Indigenous notations, written or otherwise, provide "emic" insights into how musicians conceptualize the operative categories of their music. That is another reason why staff notation, the indigenous notation of Western classical music, does not produce "neutrality" when used for all music: staff notation brings its own preconceptions as to what constitutes a "category" and what the default categories are. As a result, the emic concepts that it reveals are those of Western music, and they often interfere with the ones that a transcription of non-Western music seeks to elucidate. As an alternative to notating the music of one tradition in a system indigenous to another, global notation offers a system that is not indigenous to any musical tradition (even if it unavoidably bears the marks of its origins in the Western academy) and that can express (only) the information required in any given case, including information derived from the music's indigenous notation.

Conclusion: Toward a Composite Solution?

In Figure 12b, a Laban Solution is combined with both Seeger and Hipkins Solutions in what Mantle Hood might have called a "Composite Solution." Hood recognized that "each of [these solutions] in itself is a valid solution for *particular aspects* of the notation problem" and considered that "ultimately"—that is, for solving the "notation problem" *as a whole*—"all three

are necessary as a composite" (1971, 90; emphasis added). But while Hood seems to have imagined this ultimate Composite Solution as fusing the other solutions into a single procedure for notating all music in a uniform way, global notation preserves the separate identity of each component solution and allows it to be incorporated only when it has something helpful to offer for the purposes at hand. The information contributed by each solution, like all other information in global notation, is optional and included at the discretion of the notator.

Thus, global notation allows and indeed requires choice and initiative in deciding what to "specify" about a given set of sounds in a given piece of notation. Far from imposing a fixed "algorithm" for converting sounds into shapes without having to think about them, global notation is a system designed to provide the maximum of choice. At the same time, it aims for sufficient consistency, at the level of *how* the selected information is specified, for different examples to be readily read and compared by anyone acquainted with its conventions. For maximum accessibility, it keeps those conventions as simple and economical as possible: while any desired degree of complexity and detail *can* be specified in global notation, the fact that all information is optional means that only those conventions which are needed for a particular case need be used and explained to the reader. In this way, global notation offers a means of communicating about musical sound organization without invoking more than the necessary minimum of technical concepts.

By contrast, to use staff notation for non-Western music, one must first learn a complex system of symbols involving, among other things, up to fifteen different key signatures and the need to remember which sharps or flats apply as one reads along the staff, and then learn to overcome the associations one has formed with those symbols, such as the habit of thinking that a whole note is longer than a half note which in turn is longer than a quarter note (in Tenzer's [2011, 162] transcription of the hand gestures that mark the tala cycle in *Jalajaksha*, they are all the same length) or that the interval between two adjacent lines is wider than the interval between a line and the adjacent space (in Sutton and Vetter's [2006] transcriptions from a gamelan piece in slendro, sometimes it is and sometimes it isn't). From an examination of various options for notating music based on scales that don't form any subset of twelve (even roughly) equal divisions of the octave, Rytis Ambrazevičius concluded that "Hornbostel's paradigm can be useful" for such music only "as far as the reader . . . is capable of escaping from the assumptions of Western pitch categorization" (2005, 46). The ability to escape from those assumptions while using a notation system that is founded on them can only be acquired by long training and practice. So long as we expect that ability from our readers, we can hardly complain that non-music specialists don't read music research, or that even many ethnomusicologists avoid discussing musical sound in any specific way (as noted by Gabriel Solis [2012]). What global notation seeks instead is the ability to make and understand, as easily as possible, statements equivalent to "The organization of these sounds is this" rather than "The organization of these sounds is *like* this, but different in these ways."

What then might be the arguments for continuing to rely on the "chronic solution?"

Kofi Agawu, a scholar of both African traditional and Western classical musics, has argued that using staff notation for African music has the political benefit of "bringing the music into a sphere of discourse that is enabled by a distinguished intellectual history and undeniable institutional power" (1995, 392–93). Yet in a less frequently cited part of his argument, Agawu implies that this benefit might not always require the use of staff notation, for he also considers the possibility of a different "universal" notation. After touching on the notational innovations of James Koetting (1970) and Hewitt Pantaleoni (1972), which aimed to overcome the limitations of staff notation for representing African music specifically, Agawu observes:

> The problems that Koetting and Pantaleoni wished to address, such as the importance of indicating timbre or method of playing, or of neutralizing the downbeat emphasis supposedly normative in Western music, are by no means unique to African music. In other words, Western music, too, suffers from being notated in the way that it is has been notated so far; if a new notation should be developed, it should be developed for both African and Western music [and presumably for any other kind of music as well?]. The problem of notation is a universal one. (Agawu 1995, 390)

Seen in this context, Agawu's argument is essentially an argument for notating all music in a single system, not specifically for notating African music (or other "non-Western" music) in staff notation.

Using the same notation system for all music would seem a good start toward overcoming the assumption of difference that underlies much ethnomusicological research and "proceed[ing] from a premise of sameness" as Agawu advocates (1995, 393). Almost everyone now takes it for granted that this common notation system must be staff notation. Yet for centuries many have been dissatisfied with staff notation, even when using it for what it was originally developed to do. As early as 1903, C. F. Abdy Williams wrote of what was already a long history of attempts to improve or supplant staff notation for the purposes of composers and performers (Williams 1903, 196–220). More recently, the Music Notation Project, originating in 1985 as the Music Notation Modernization Association, has also been concerned only with practical uses of notation by performers and composers of music in the Western tradition, but its website begins with the heading "Improving Upon Traditional Music Notation" and the introductory paragraph:

> Many people struggle to learn to read and play music, and many give up before they become proficient. Could a better notation system make reading, writing, and playing music more enjoyable and easier to learn? We think so. (Music Notation Project, n.d.)

Meanwhile, for analytical purposes, staff notation as written by composers often fails to capture the features of sound organization that music analysts are interested in, whether it be the expressive "nuances" of pitch and timing added by performers (Fabian, Timmers, and Schubert 2014) or the functioning of "meter" at higher levels than that of the bar (London 2012, 77, 110–120).

If staff notation has these limitations even when used for Western music, how much more limited must it be as a notation for all the world's music. In the tradition in which staff notation evolved, music was not just written down *after* being composed, like most notated music, but was actually composed *using* staff notation, and as a result this music is relatively well represented by "notes." With other music, we must first consider whether the idea of an arrangement of notes is an appropriate way to conceptualize the organization of the sounds at all, even before we consider whether the notes available in staff notation can both adequately illustrate what we want to say about those sounds and (equally important) avoid suggesting things about them that are irrelevant or untrue.

Of course, even within the Western tradition, notational practice has not been static, and both composers and theorists have innovated when they wanted to notate something for which they had no existing symbols. But (apart from some avant-garde experiments since the mid-twentieth century) these changes were incremental, and could be accommodated within the established paradigm. The "doctoring" of staff notation to represent music that had developed in quite another tradition was no mere extension of that evolutionary process: it was in many cases a confrontation between forms of music based on radically different assumptions, one or other of which had to give way for the two to work together. As Nicholas Cook points out, "a score sets up a framework that identifies certain attributes of the music as essential" (1998, 62), and even among traditions that use notation, "the pattern of what is determined by notation and what isn't, what is to be taken as given and what is a matter of performance interpretation, is one of the things that defines a musical culture" (63). When the notation system of one tradition is used for the music of another, the attributes that are regarded as essential in the former are likely to appear so in the latter, where they may not in fact be essential or even present. A simple example is the use of a five-line staff to notate a percussion part of indefinite pitch. There is no question of "neutrality": a Bach fugue is better represented in staff notation than a Balinese gamelan piece or a Karnatak *varnam*.

Hence I suggest that, if we want a single notation system for all music, the best place to start is not staff notation or any other system indigenous to a particular tradition, but Hood's idea of a new notation system designed from the beginning to be as universally applicable as possible, like Labanotion, the International Phonetic Alphabet, or the Sachs-Hornbostel instrument classification system. I am convinced that, relative to dance studies, linguistic phonology, and organology, world music analysis has been disadvantaged by the lack of a purpose-made written-descriptive system: its advances, however enlightening, have been made *despite*—not thanks to—its makeshift, needlessly biased notation. Absolute neutrality may well be "illusory or impossible," as Tenzer (2011, 153) says, but I think we can aspire at least to a degree of impartiality that minimizes the imposition of assumptions about sound organization from one tradition onto another. If the goal, as Agawu suggests, is a "postcolonial transcription" that "insists on playing in the premier league, on the master's ground, and in the north" (1995, 393), then one could wish the game to be played on a more nearly level playing field, not one on which non-Western music is placed at a disadvantage by being either

(more severely) misrepresented through the standard symbols of staff notation or made to look abnormal by a plethora of added signs and modifications.

There will still undoubtedly be a need for notation to rely on what Agawu calls a "supplement," which I take to mean the oral tradition and metamusical discourse without knowledge of which no written notation can be adequately interpreted. Agawu asserts that "notation has always been prescriptive" and that "to make it descriptive by loading it with much more information is to attempt to reduce the size of the supplement" (390). Hence "descriptive notation, whether used by Koetting, Pantaleoni, or anyone else, embodies a putative resistance to the supplement; and it is this impossible attempt to eliminate the supplement that spells the doom of advocates of new notations" (391). Yet I don't feel "doomed" by this pronouncement, because global notation does not aim to "eliminate the supplement" nor even necessarily to load itself with "much more information" than staff or indigenous notations: it may provide *different* information than other systems, but what it offers is a means of specifying just the information that is wanted, neither more nor less. It does aim, as any cross-cultural use of notation must, to be useful in communication about musical sound among people who don't carry the tradition of the music, but it doesn't attempt to do this without a substantial "supplement" of listening and description as acknowledged earlier. Even if Agawu is right that descriptive notation embodies futile "resistance to the supplement" (a claim that I think many ethnomusicologists would dispute), there seems no inherent reason why this would apply more to "new notations" than to other attempts to use notation descriptively, such as "doctored" staff notation.

Ultimately, the main argument for continuing to use the "chronic solution" appears to be the fact that it *is* the chronic solution: that is, it is already widely used and understood. Tenzer, for example, after acknowledging the mismatch between the pelog scale and the Western staff, proposes that "the familiarity of the [notation] system itself is compensation" (2006b, 212). In similar ways, the last half century of ethnomusicological history has borne out Hood's observation that "the usage of some form of modified Western notation for transcription purposes, in spite of the fact that its limitations are generally understood, tends to be self-perpetuating" (1971, 92). Hood suggested that the work of developing a more satisfactory notational practice was being perpetually deferred as ethnomusicologists (understandably) addressed their more immediate concerns with the music and its surrounding culture: "when the chips are down and that postponed deadline for the press can be postponed no longer, Western notation, with all its faults for the purpose at hand, is usually selected as the medium of representation for musical examples and illustrations" (92). The view that we need not pursue Y because X is already widely known is hardly a recipe for the advancement of an academic discipline; yet staff notation continues to be used for transcribing and analyzing the world's music, not because it is the best possible tool for the job, but because it is the one we have ready to hand.

With the availability of global notation, writers faced with the pressures Hood describes need not always feel that the "chronic solution" is their only option. Admittedly, at its current

stage of development, global notation is more laborious to produce than staff notation for a similar level of detail; but this is only because the ubiquity of staff notation has generated a demand for products that make it easier to write, such as music manuscript paper and notation processing software. If staff notation had to be typeset using only a general graphics program, as global notation currently does, the latter might well prove the easier of the two. Given sufficient interest, it may become feasible for a team of collaborators with the right combination of skills to develop a bespoke software program and mobile phone app for writing and playback of global notation, bringing the system within reach of many more potential users. Especially for younger scholars not yet too heavily invested in the technique and mystique of the "chronic solution," or for the ever-growing numbers of traditional musicians from Asia and elsewhere who come to the study of ethnomusicology without a thorough training in staff notation, global notation may then become an easier option as well as one that represents the structures of the music with less distortion or irrelevant information, with no need to explain aspects of the notation that don't mean what they normally would, and with more accessibility to non-specialist readers.

That phrase "given sufficient interest" is key. Fifty years after Hood was writing, the inertia of the "chronic solution" is formidable: for any new approach to be widely adopted, it's a pretty big ship that would need to be turned around. Nevertheless, this article has argued that, for some of the research agendas now being pursued, and with the resources now available, an alternative to the "chronic solution" is both possible and worthwhile. Specifically, I propose that the Laban Solution which Hood thought would be "available in the distant future" is now within reach. Hood may have gone too far in predicting that "by the time we have reached the Laban Solution, the last traces of doctored Western notation should fade away" and in hoping for the ultimate "abandonment of this ethnocentric crutch" (1971, 90); modified staff notation will doubtless continue to be valued, not least by the many musicians around the world who have adopted it as a prescriptive notation for their own music. But Hood's vision of a more "global" approach to descriptive notation, one that could integrate the distinctive contributions of the Laban, Hipkins, and Seeger Solutions, still has the power to inspire, and now seems increasingly achievable.

Hood was surely right about another thing, though: "No one scholar, no one center or institution, in my judgment, can achieve this final stage of the Composite Solution in isolation" (1971, 119). With the Hipkins and Seeger Solutions already well established, my hope is that this article will find readers interested in contributing to the development of a Composite Solution through the "missing link" of the Laban Solution. An article of this length cannot give a full account of either the advantages or the methods of doing so: it can only present a few suggestive examples in the hope that readers will respond, not by saying "That wouldn't work for the music I deal with" (even if that may be their first reaction), but by considering how the general principles of global notation might be creatively extended to other kinds of music and research problem in their experience, or even replaced with different principles that promise a better form of Laban Solution.

John Sloboda's conclusion to an article examining "The Uses of Space in Music Notation" from a psychological perspective, though again oriented toward composition and performance rather than analysis, makes a point that applies with full force here:

> Efficiency can only be meaningfully estimated where a reader is as familiar with the system in question as he is with the accustomed system with which the experimental system is being compared. Failure to find an immediate effect of some notational change does not imply that there will be no effect after the months or years of familiarization that has been received by the accustomed system. Any evaluation of notational reform is going to be a long-term process, and one which will require considerable commitment from musicians [or analysts, I would add] who are required to learn and operate with new systems. Any short-term experimentation is almost bound to lead to the erroneous conclusion that orthochronic notation [i.e., staff notation] as it now stands is the best of all possible systems. (Sloboda 2005, 68)

What Sloboda describes is the predicament I now face. Having worked with global notation for several years, though still far more "accustomed" to staff notation, I am familiar enough with both systems to be able to compare them on many measures of "efficiency" for my purposes as a world music analyst. This comparison has convinced me that, of the two, global notation serves most of my purposes better: I have found it tremendously liberating to be able to produce examples of notation that convey just the information that I want and are not forced to represent all music as some version or modification of what staff notation assumes as the norm. I would not want to go back to using "doctored" staff notation now that this alternative is available. Even if someone else had invented it, I would still want to use global notation in my own work and champion the system as a means of advancing the discipline and making it more intelligible to outsiders. But if someone else had invented it, would I ever have acquired the level of familiarity that enables me to make this judgment? Can I expect others, lacking this familiarity, to take it from me that it will be worth their while investing the time and effort needed to acquire it?

A predicament like this no doubt underlies the inertia of the "chronic solution" and the long absence of any effective response to Hood's call for a new symbolic notation. Any attempt to promote a new notation system must address potential users who have decades of familiarity with a different system and somehow induce them to acquire enough familiarity with the new system to give it a fair chance. I have tried to do this by making global notation as easy to learn as possible, by illustrating some of its advantages in the present article, and by explaining the system from first principles on the website globalnotation.org.uk. I hope an additional incentive to spend more time with global notation will be the opportunity to help shape its further development. The "comments" option on the website encourages users to submit responses, examples, and suggestions for improving and expanding the system. Depending on input, the result could become something quite different from global notation as it currently exists: the only essentials are that it should work from a starting point that is independent of any particular tradition's ways of organizing sound and allow users to specify,

in some consistent way, whatever information about the sounds is wanted for the purposes of the notation. If others see some mileage in setting out from that starting point, I hope they will join the journey and help to find the way forward.

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