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## Suggested Methods for the Transcription of Exotic Music

OTTO ABRAHAM AND ERICH M. VON HORNPOSTEL

BERLIN

### Translators' Preface

The authors of the following article, Otto Abraham (1872–1926) and Erich M. von Hornbostel (1877–1935), were prominent members of what is usually referred to as the Berlin School of Comparative Musicology. This work represents the first comprehensive effort made to codify the methods and symbols employed in the transcription of traditional music. It has had a lasting influence upon comparative musicologists and ethnomusicologists. Indeed, it has formed an indispensable basis for further efforts in this direction. (See, for example, the recommendations of a committee of experts convened under the auspices of UNESCO, International Music Council ["Notation of Folk Music," CIAP, No. 15–16, November–December, 1949].)

The article contains a number of penetrating observations whose value time has not diminished. There is, for example, the insistence that the melody of a song cannot be fully understood without the consideration of the text to which it is sung (Hornbostel was also active as a philologist) and the corollary necessity of considering the modifications of phones produced in the process of singing. Many field workers still need to heed the authors' warning that performers are often unable to disassociate song text and song melody and thus one should record the former independently of the latter. Many of the suggested techniques are still applicable and can be adapted to electronic equipment. A recording can be listened to at different speeds on both the tape recorder and the cylinder phonograph. Abruptly stopping the former is as useful as quickly raising the stylus in the latter for determining the pitch of the tone just heard. The methods suggested for the notation of African drumming are still widely used. They have been amplified but not replaced.

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Translated by George and Eve List from "Vorschläge für die Transkription exotischer Melodien," *Sammelbände der Internationalen Musikgesellschaft*, 1909–1910: 1–25.

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While the development of electronics has rendered some of the authors' suggestions obsolete, they are of historic importance in reminding us of the many difficulties we no longer must face. That is not to say that the tape recorder, the videotape recorder, the stroboscope, and fundamental analyzers such as the melograph have solved all our problems. The authors also included materials concerning the development of scales and the classification of musical genres which many would not now consider part of the transcription process as such.

The references given in the Notes are, in general, unmodified although in some cases their accuracy is doubtful. Additional information believed to be useful to the reader is provided in translators' notes. Unless octave register was indicated in the original, letters representing pitches are given in capitals. This translation is partially based on an incomplete version previously prepared by Judith Binkle McCulloh. We also acknowledge Franziska von Rosen's suggestions for the improvement of the translation.

### **Authors' Prefatory Note**

The increasing interest of ethnologists and musicologists in the music of non-European cultures has stimulated more and more field workers, missionaries, and colonial officials to make acoustical recordings of the songs and instrumental music of natives and to turn over the results of these activities to scientific institutions for study. Thus the collections in the Phonograph Archive increase daily.<sup>1</sup> No matter how large the collections become, if they are not properly utilized they remain of little value. The continued preservation of the wax cylinder recordings can of course be assured by means of galvano-plastic reproduction.<sup>2</sup> Even then it would be disadvantageous to postpone the scientific study of the material *ad calendas graecas*. Through this very study, knowledge is gained which must be utilized by collectors while the type of materials originally recorded is still available for collection.

As more material is collected, and more investigators are involved in its study, it becomes more difficult and, indeed, more urgent, to establish an adequate methodology for the study of such materials. Only by establishing such a methodology can the results of the investigations of individual scholars be readily compared and serve as a basis for the development of general theories. Considering the present stage of development of comparative musicology as a discipline, it may seem premature to endeavor to establish a scientific methodology. Nevertheless, it seems valuable even at this time to offer some suggestions for discussion. Otherwise the diversity of the methods of work now developing will render it impossible to reach some agreement on procedure.

In comparative linguistics there exist side by side today so many systems of phonetic writing that standardization can no longer be expected. Due to the use of an abundance of varying diacritic forms of equal meaning it is becoming enormously difficult for the linguist to follow the writings of other linguists. Likewise, the peculiarities of musical expression of differing cultures can be reproduced more or less faithfully only by European notation which is appropriately modified and supplemented. It is indispensable to notate the melodies whether the purpose is to study them or to convey them to others.

## **I. Choice of Notation**

### **1. General Aspects**

Modifications and extensions of the standard notation should be so chosen that they make it possible to represent as accurately as possible the music being transcribed. At the same time, the 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. Simplicity and accuracy of notation should not be obscured by a mass of diacritic marks. Those diacritic marks which are utilized should be of the type that can be learned and remembered with facility. A compromise must be made between clarity and objective accuracy.

### **2. Pitch**

#### *A. Staff*

It is recommended that the customary five line staff be retained with the customary space between lines expressing the usual interval relationships. This arrangement has established such strong perceptual associations that any change would be confusing and there would be great difficulty in adapting to it. For example, we are accustomed to thinking that any two adjacent lines or spaces represent the interval of a third. If, for the purpose of indicating quarter tones, one were to insert auxiliary lines, no matter how faint, between the customary staff lines, our eye could then easily perceive the seconds as thirds. In fact, the increase in the number of lines could produce utter confusion (see Example 1). If one wished to record in manuscript form those fine and precise distinctions which it is possible for a mechanical device to discriminate, it would require an unlimited number of lines. To make the indication of eighth tones feasible, two adjacent lines would need to represent the interval of a quarter tone. We would then need twenty-seven lines instead of the present five!

The addition of further lines to the staff in the same spatial relationship would produce equal confusion. The combination of both means of extending the system, added lines between the usual five lines and added lines above and below the staff, produces a notational image which probably cannot be read. Instead, one would have to study it as one does a table. We therefore are not very happy with the method of notation utilized by B. I. Gilman in his latest publication.<sup>3</sup>

In the same publication Gilman employs another method of indicating pitch values in which he not only utilizes note heads placed in their customary positions but also notes placed slightly higher or lower in such a manner that they touch the adjacent lines (see Example 2). This approach is applicable when all distances within the lines represent equal intervallic relationships. This is not the case in our customary staff. The adoption of this method would cause many difficulties in the publication of music. Writing, engraving, and proofreading are rendered more difficult. The reproduction of such a score is possible only at considerable expense.

**Example 1****Example 2**

When indicating rhythm accompaniment in which the same tone is sounded (drum, handclapping, etc.) one can simply indicate the beats by notes placed below the staff without the use of a line. When two or three different pitches or timbres are utilized one line placed below the staff is sufficient. The notes may be placed above, on, or under this guide line (see Example 3).

**Example 3**

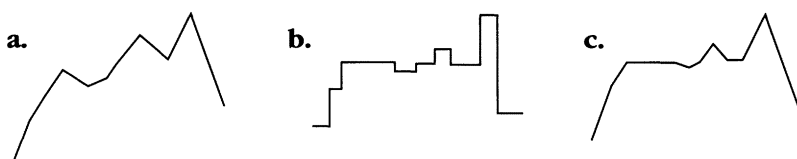
In making a comparison of the similarities and differences exhibited by a number of melodies, it is useful to compare them by means of curve or contour forms. Pitch is indicated by the ordinate [vertical] and duration by the abscissa [horizontal]. When the purpose is to present an overall view of the melodic movement without regard to precise pitch or duration of specific tones, one can follow Gilman's procedure and utilize a graph which represents tones in equally spaced intervals without indicating repetitions of the same tone (see Figure 1a).

E. Lineff proceeds in a different manner.<sup>4</sup> His graph does not indicate individual tones by points but rather by horizontal stretches whose length

represents the durational values. (Such horizontal stretches parallel the abscissa.) The end points of the horizontal stretches are connected by vertical lines (see Figure 1b). The resulting right angles produce a visual impression of angular movement which does not always adequately represent the aural impression made by the melody. One must constantly remind oneself that although the vertical lines are of varying lengths, they are not indicative of durational values.

It may be appropriate to combine elements of both methods, that is, to indicate pitches as points in the abscissa which represent durational values and to connect these points with lines (see Figure 1c). However, one should remember that this manner of representing a melody cannot be expected to reproduce every detail of the acoustical impression. It conveys only a general picture of the melodic movement.

**Fig. 1. (Mädel, ruck, ruck, ruck.)**



No matter what method is adopted as a means of representing most precisely and with the greatest clarity the music heard, the simultaneous use of our usual notational system is unavoidable. Only in this manner can the transcriber's often psychologically meaningful subjective impressions of the melody be presented.

### *B. Clefs*

One should limit the number of clefs utilized as much as possible. In most cases it will suffice to use the violin or G clef. The excessive use of ledger lines which might be caused by this limitation may be avoided by resorting to the use of higher or lower octave transposition by indicating  $8^a$  ( $16^a$ ) or  $8^b$  ( $16^b$ ) respectively. The modification of the treble clef in order to indicate the tenor voice range, i.e., the use of the tenor clef, the double treble clef,<sup>5</sup> or even *ansatzstriche*<sup>6</sup> is unnecessary.

It is best to utilize the bass clef in addition to the treble clef only in choral and responsorial song, especially when the voices lie far apart. The use of more than one treble clef simultaneously, in particular to indicate various octave positions, will not facilitate reading for one accustomed to music written for the piano; this method is not consonant with his concept of the musical score.

*C. Transposition and Use of Accidentals*

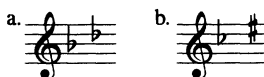
In order to make definite the actual range of vocal compositions and the normal tuning in instrumental pieces, it is of course desirable that the absolute pitch be known. However, it is not necessary to adhere to the original pitch in the transcription. On the contrary, it will simplify matters for both writer and reader if the melody is transposed into a tonality which will require few accidentals. However, it is not implied that after transposition the principal tone of all melodies should be C. Nor should transposition be applied when not needed. When transposition produces a scale with C as the main tone a great number of accidentals are often required (see Part II, Section 2). In addition, when transposition is unnecessarily made to a distant pitch level further difficulties arise. The transposed pitch level contrasts too strongly with the original. The transcriber with perfect pitch must either simultaneously transpose as he transcribes or must subsequently transpose his transcription. Both methods waste time and produce errors. It would be best to choose a pitch level adjacent to the original and one that will require use of fewer accidentals. Thus G instead of A<sup>♯</sup> and F instead of F<sup>♯</sup>. Where accuracy is of the utmost importance, the original pitches can be referred to in the accompanying text.

The manner in which we use sharps and flats is to a great degree determined by European melodic and harmonic conditions. We would not, for example, write: d<sup>1</sup>-f<sup>1</sup>-a<sup>1</sup>-d<sup>2</sup>, nor d<sup>♯</sup>-f<sup>♯</sup>-b<sup>♯</sup>-b<sup>♯</sup>. Rather we would write d<sup>1</sup>-f<sup>1</sup>-b<sup>1</sup>-d<sup>2</sup>, or d<sup>♯</sup>-f<sup>♯</sup>-a<sup>♯</sup>-b. In order to avoid application of the assumptions of European music, Gilman has attempted to restrict use of accidentals to one only, the sharp.<sup>7</sup> This procedure seems to us excessively rigid. The very purpose of transcription, the evoking of an acoustical image of the melody, would not be realized. The unusual progressions thus produced would be difficult to read and it would be difficult to grasp the significance of intervals commonly found in exotic music such as the fifth and the fourth. When spelled A<sup>♯</sup>-F or F-A<sup>♯</sup>, they would hardly be recognizable. We therefore recommend that one adhere as strictly as possible to the customary European method of notating accidentals. Thus we would utilize B<sup>♭</sup> rather than A<sup>♯</sup> in the examples cited above. In an ascending progression of a semitone we would use the sharp; in a descending progression of a semitone, the flat. We would avoid the alteration of the principal tone in writing progressions of a semitone. Thus we write G-A<sup>♯</sup>-G-F<sup>♯</sup> and not G-G<sup>♯</sup>-G-G<sup>♭</sup>. One should completely avoid the use of the double sharp and the double flat.

When a sharp or flat regularly recurs it may be written in a pitch signature following the clef. However, one should not follow the European practice, based on the concept of "key," of including an accidental in the signature whether or not this modification of a particular tone occurs in the melody.

Thus in a melody having the five-note scale F-G-A-C-D, no flat should be given in the signature. Following this method may result in such uncommon combinations in signatures as those in Example 4a and b. If the two tones found in both octaves in the treble clef (E and F) are modified in the lower octave only, they should be placed at the beginning of the line as they actually correspond to the tones of the melody, as in Example 5.

**Example 4**



**Example 5**



Should the altered tone be found in both octaves it will be sufficient to write the accidental in the upper part of the staff, as is customary.

To indicate pitches that lie between the semitones we select the tone that lies the nearest and place a plus or minus sign above the note over the staff. These diacritic marks are placed over the staff even when the stems of the notes they are placed over extend upwards. This is done in order to avoid conflicts with the song text, dynamic marks, etc. Whenever possible and technically feasible, distinctions should be made between greater or lesser raising or lowering of pitch by the use of larger or smaller plus or minus signs. The decision whether to select the nearest lower tone and raise it or the nearest higher tone and lower it to represent a pitch that lies between the semitones should be based upon comparisons of parallel recurrences and subjective melodic impressions. As a final resort one may indicate the actual pitch in terms of frequency of oscillations (see Part IV, Computation).

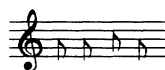
When the above occurs only occasionally it should be indicated in each place it occurs. Should such deviations in pitch occur with frequency the plus and minus signs may be indicated along with the accidentals at the beginning of the staff. Should the tone thus qualified already be preceded by an accidental the plus or minus sign should be placed above the accidental. When either sign is applied to a tone for which there is no modifying accidental in the signature, this tone is represented in the signature by a black notehead without a stem and the plus or minus sign placed above it. Such notes precede the accidentals. The use of a note stem, as in a quarter note, is confusing (see Example 6).<sup>8</sup>

#### *D. Ambiguity of Pitch*

There are many cases where pitch cannot be determined. This may be due to the quality of the recording or the manner of performance of the singers recorded. If the recording is at fault, producing scratch, resonance tones, and the like, place a question mark above the note concerned. When



pitch is imprecise, as in very short, weak, or overmodulated tones, place the notehead in parentheses. When it is completely impossible to distinguish the pitch, as in *parlando*, etc., it is sufficient to indicate the rhythm and to omit the heads of the notes. However, one may be able to indicate the approximate tonal level and melodic movement through the position of these note fragments, as in Example 7. (For the use of contours in special cases see Section 10.)

**Example 6****Example 7**














Whenever possible notes for pitches which are vague or non-existent should be supplied by comparison of a later similar passage. The fact that notes thus inserted are conjectural should be indicated by placing such notes in brackets.

### 3. Manner of Performance

Using the term in its broadest sense, we include under “manner of performance” tonal relationships (phrasing) and tone color.<sup>9</sup> So much importance is placed upon both phenomena among non-European peoples that both deserve special attention and the most accurate notation possible. But it is precisely in this respect that our European notational system is most inadequate. We therefore offer the following table of markings which will serve to indicate such phenomena (see Table 1). The table extends somewhat the methods of indication commonly used in European music and will undoubtedly need further extension to cover other eventualities.

**Table 1. Phrasing**

	to indicate separate syllables
	to indicate that both are sung to same syllable
	staccato (detached)
	portato (carried forward but not connected, between staccato and legato)
	legato (connected)
	glissando (high degree of connection, gliding)

	glissando, descending from indefinite pitch to definite pitch
	glissando, ascending from indefinite pitch to definite pitch
	glissando, descending from definite pitch to indefinite pitch
	glissando, ascending from definite pitch to indefinite pitch
	molto glissando (howling)
	rhythmic pulsation, aspirated (indicate correct number of dots)
	gentle or soft rhythmic pulsation
	sharp rhythmic pulsation
	very sharp rhythmic notation
	non-periodic tremolo
	parlando (see also under "Pitch")
	parlando with weak tonal color
	audible inspiration

### *A. Phrasing*

Other signs indicating manner of performance, such as "agitato," "emphatic," etc., and those technically characteristic of an instrument, such as "pizzicato," should be indicated above the staff in abbreviated form. When the phenomenon appears throughout it should be referred to in the documentation.

### *B. Tone Color*

The available means for indicating different tone colors is even less adequate than that for indicating phrasing. Our perception of timbre involves very subtle distinctions, and this element is of the greatest aesthetic significance. Nevertheless, practically all indications for tone color are derived from the tonal medium ("trumpet-like") or from other thought realms ("dark," "sharp"). The few signs for tone color in common use are primarily references to special techniques. Only secondarily do they refer to actual

timbre. We therefore can recommend for use in transcribing exotic music only signs which are symbols for specific technical devices utilized in performance. Thus the sign °, which we employ in notation for the flageolet, may be placed above tones of anomalous quality which occur only occasionally. It may also be used to represent falsetto, the natural tones of wind instruments, reverberating crashes of gongs, etc.

Should it be necessary to differentiate a special tone color, an X may be placed over the note. If several need to be differentiated, letters may be used. The technique of playing the drum with the hands, rather than with sticks, merits special attention. We distinguish between sounds produced by striking on the edge of the drum and those struck in the middle of the drumskin by a change in the direction of the note stems. Strokes with the flat of the hand we indicate by ° placed above the notes; those made with the flat of the fingers by ^; those made with the finger tips are left unmarked.

Differences in tone color in drumming may also be indicated in the same manner as differences in pitch (see Section 2, Part A).



#### 4. Melisma

The exact notation of melisma, especially the correct reproduction of their rhythmic organization, is an extremely tedious and time consuming task. It will suffice if melisma are written in notes of indefinite time value and that they be so notated only in places where it seems most appropriate to do so. In this manner the main melody in a highly ornamented composition can more easily be discerned. On the other hand, were one to omit the melisma completely there exists the danger of omitting some significant tones which may appear only among the embellishments.

In addition to the usual indications (tr, ~, ~ etc.) those in Table 2 have proved to be useful.

**Table 2. Additional notation for melisma.**

<i>tr</i>	trill with upper tone
<i>tr</i>	trill with lower tone
	grace note of indefinite pitch
	indefinite melisma chain, corresponding tonal movement contour (∩ and the like)
<i>krm</i>	guttural tremolo
<i>drrm</i>	palatal tremolo (stage - r)
<i>brm</i>	bilabial tremolo (coachman - r)

Accented grace notes are always written  or 

## 5. Dynamics

Similarly, gradations of volume which occur through the course of the entire piece, or which are caused by the special characteristics of the particular instrument, should be indicated in the accompanying text or documentation rather than in the score. Changes in volume should be indicated in the score by means of the customary abbreviations: *ppp*, *pp*, *p*, *mf*, *f*, *ff*, and *fff*. These signs should be placed as close as possible to the place in the music to which they pertain. They should be placed below the staff if they do not interfere with the song text or with other signs. The continuation of the dynamic level indicated until the appearance of a new sign and level is marked by a dotted line ... . Increase and decrease of volume is indicated by  $\langle$  or  $\rangle$  respectively, never by *cresc.* or *dim.*

Accents are marked .....  $\rangle$   
 Slightly weaker accents ..... ( $\rangle$ )  
 Medium accents .....  $\rangle$   
 Strong accents .....  $\rangle$

Accent marks should be placed above the note in question. These signs imply only the dynamic of melody. The rhythmic accentuation by handclapping, drum beats, etc., is indicated as a separate line of notation below the staff (see Section 2, Part A). To indicate *piano subito* occurring in individual tones we use a sign analogous to *sforzato*, i.e., " $p \langle$ " which is placed above the note. [ $\rangle$ ] is used to indicate accents which are subjectively perceived but are objectively vague.

## 6. Rhythm

The rhythmic organization of exotic melodies is particularly difficult to grasp. For the most part, they are rhythmically very complex. We can seldom find frames of reference which will assist us in understanding the musician's rhythmic intent.

The rhythmic implications of the music can be ascertained by a combination of the following elements:

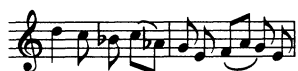
1. Dynamic accents. When these are produced by handclapping, drum beats, etc., they can serve as guides for metrical arrangement.
2. Similar rhythmic-melodic groups. These groups need not be of equal length.
3. An equal number of time units. This arrangement, according to "beats" of equal length in our sense, should be applied only if it can be achieved without appearing to be forced and only when it can be coordinated with the first two features above. In no case should this principle be handled pedantically. A motif may often appear in augmentation or in diminution and the concept of the melodic grouping would be destroyed through the strict application of division into equal beats.

Deciding which grouping to choose will result primarily from the philological composition of repetitions and variations.

Each grouping is delineated by a bar line. Whatever appears between two given bar lines represents a melodic-rhythmic unit. The upbeat, when it is necessary to characterize it as such, is placed before the bar line even though melodically it may actually belong to whatever follows it. In cases where a number of interpretations of the rhythmic grouping of a passage is possible, the differing conceptions may be indicated by notating two versions of the passage or by means of short vertical lines placed above the staff (see Example 8).

Subdivisions of larger groups can be usefully indicated by broken or dotted bar lines. When none of the means mentioned above makes it possible to secure plausible groupings, bar lines should be placed only at the cadences of the sections.

The indication of regularly recurring meter may be placed at the beginning of the piece.<sup>10</sup> The same applies in the case of consistent changes between two different meters, as in Example 9. For purposes of clarity it is recommended that individual changes of meter or irregular changes in

**Example 8****Example 9**

metrical indication be placed above the staff, midway above the measure in question. When the metrical signature at the beginning of the piece is placed in parentheses this implies that it is not fully applicable. This may be due to considerable freedom in rhythm or to certain passages where the accentual pattern contradicts that of the given meter. Various metrical indications are shown in Table 3.

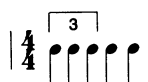
**Table 3. Metrical Indications**

$\frac{3}{4}, \frac{6}{8}$	regular alternations between these two meters
$(\frac{3}{4})$	predominantly 3/4, occasionally may be conceived as 6/8, or intermittently as 5/8, etc.
$(\frac{6}{8})$	predominantly 6/8, occasionally may be conceived as 3/4, or intermittently as 5/8, etc.
$\frac{3}{4} (\frac{6}{8})$	probably 3/4, possibly intended as 6/8.
$(\frac{3}{4}, \frac{6}{8})$	general alternation of these two meters but there is considerable variation in this.

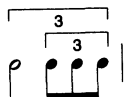
The durational values of the note groups should be written in such a manner as to produce the greatest clarity possible. For example, one should

not write  $\text{♩} \text{♩} \text{♩}$  but rather  $\text{♩} \text{♩} \text{♩}$ . (We use the double tie to indicate a duration completely lacking in pulse, i.e., syncopation.)

In the case of a predominantly triple grouping in which duple groupings are occasionally interspersed, it is preferable to write the latter as duplets, as in Example 10, not triplets, as in Example 11.<sup>11</sup>

**Example 10****Example 11**

The union of mixed groupings, containing both duple and triple divisions, should be indicated by an encompassing horizontal bracket, never by the slur used to indicate legato, as in Example 12. In the case of groupings of eighth or sixteenth notes, where the stems and beams are found above the note heads, brackets to indicate groupings should be entirely omitted, as in Example 13.

**Example 12****Example 13**

Drum rhythms should be notated in a consistent manner, utilizing the same note values, thus  $\text{♩} \text{♩}$  or  $\text{♩} \text{♩} \text{♩}$  or  $\text{♩} \text{♩} \text{♩}$ , but not  $\text{♩} \text{♩}$ .

Since we should not make assumptions concerning subjective rhythmic interpretations of the pause, rests must be notated in accordance with the rhythmic unit,<sup>12</sup> thus  $\text{♩} \text{♩} \text{♩}$  but not  $\text{♩} \text{♩} -$ . In the same manner longer pauses occurring at cadences should be counted out to determine whether they follow the metric scheme or whether they exhibit no specific value as far as the beats are concerned. Philologically completed rests, based on analogies drawn from repetitions or variants of a passage or motif, are placed in  $[\text{♩}]$ .<sup>13</sup> We consider completion of pauses in this manner, so as to indicate the number of beats contained therein, to be invalid unless evidence derived from variants can be obtained. Short pauses which have no beat value, such as those caused by breath, should be indicated with  $\text{v}$  placed above the staff.

## 7. Tempo

Precise indications of tempo are important since the characteristic expression of a piece is significantly reflected in its durational aspects. Precise tempo indications are also useful in establishing the instrumental and vocal techniques that are employed. Whenever possible, tempo should be deter-

mined by use of a metronome, checking at random points in the melody.<sup>14</sup> Change of tempo should also be indicated by metronome markings. Even when the rhythm is very free, the beat can be determined to a great extent at some point where the music is more sharply rhythmic in character. In the latter case, the metronomic indication should be placed within parentheses ( ).

Terms such as *Allegro*, *Andante*, etc., are then superfluous. Due to their ambiguity the use of such terms should be avoided. In the description of tempo in pieces in free rhythm one must resort to such indications as "slower," "faster," etc. Such a heading as *March* can be justified only when the musicians themselves use the term in describing their performance and when it can be determined that this is the actual function of the piece (see Section 12, *Title*).

Lesser fluctuations of tempo which occur in an otherwise constant rhythm, which are the result of freedom of expression and can be recognized as such by an explanation of variants, can be usefully notated utilizing the signs in Table 4.

**Table 4. Durational indications**

ˆ	prolongation of a single tone.
(ˆ)	slight prolongation of a single tone.
ˆ⋯⋯:	<i>ritenuto</i> or <i>più lento</i> (for a short passage).
˘	shortening of a single tone.
(˘)	slight shortening of a single tone.
˘⋯⋯:	<i>più presto</i> (for a short passage).

Cadence fermatas, like pauses (see above), are counted out and the number of the units representing a beat indicated by a numeral, for example:  $\hat{2} = \circ \circ \rho$ . Slight anticipation or delay in the entrance of one voice as contrasted with the rhythm of another voice (as, for example, against a drum accompaniment) produces syncopation and, when written out, a complicated score. It is best to indicate these slight deviations by symbols placed above the staff, slightly preceding or following the notes in question (see Example 14).

**Example 14**



## 8. Construction

We understand the term “construction” to mean the grouping of melodic motifs into larger sections. The markings (, ; .) utilized above the staff in Riemann’s punctuation system do not seem to us to be sufficiently conspicuous. They do not afford a clear view of the section junctures. We therefore prefer to use modifications of the double bar  $\text{|||}$ ,  $\text{||}$ ,  $\text{||}$  according to the length of the period and the importance of the juncture involved.

In placing song text under song melody utmost clarity will be secured by distributing notes in such a manner that textual syllables coincide vertically with their corresponding notes. This, of course, requires more space and is therefore more expensive.<sup>15</sup>

The individual melodic groups and periods are designated by letters placed above the staff at the beginning of each. The longer sections are indicated by the letters A, B, C, etc., the shorter periods, motifs, and independent measures by a, b, c, etc.

Varied forms of these measures, motifs, or periods should be marked  $A_1$ ,  $A_2$ , etc. (not  $A^1$ ,  $A''$ ,  $A'''$ !). In its first appearance the section should be marked  $A_1$ , not A.

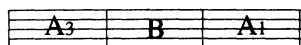
In case the drum part or another accompanying voice exhibits a different construction from that of the principal voice, this divergent construction should be indicated by letters in italics or through the use of Greek letters.<sup>16</sup> Repetitions of melodic sections are to be indicated as usual by  $\text{||}$ . The number of repetitions should be indicated above the staff at the end of sections, as in Example 15.

Reprises of melodic sections which are preceded or followed by new material or periods need not be written out. It is sufficient to represent the section on the staff with the identifying letter (see Example 16).

### Example 15

4x      4 times  
 $\text{||}$       or       $\text{||}$

### Example 16



In transcription of recordings the sign  $\text{||}$  should be placed only at the very end of the melody. Should the transcription not be completed, this fact should be indicated by “etc.”. Should the transcription not commence at the very beginning of the melody, ellipses should be placed at the beginning of the transcription.

## 9. Variants

Minor variants can be incorporated into the staff, written as small notes, and placed among the larger notes (as grace notes are commonly written).



Should the result lack clarity it would be preferable to place the variant above the staff (see Example 17 a and b).

**Example 17**



Deviations which are deemed significant because of their extension or frequency of occurrence are best given separately in the form of a “comprehensive score,” that is, the corresponding beats of the variant should be placed directly under those of the basic score but the bar lines should not be extended vertically from one staff to another. Shorter but melodically important variants which occur with less frequency may be given in footnotes below the transcription as a whole, related by reference numbers inserted in the principal melody. It is often sufficient to utilize one of the variants that occurs most frequently, the first heard, or a particularly distinctive repetition, as the “principal melody” to which is added the most significant variation. However, it is occasionally of theoretic interest to transcribe very carefully all the variations that occur.

Through the comparison of variants much can be discovered concerning the fundamental aspects of a melody. One can determine what is most persistent within it (the Indian “raga”) and simultaneously in what manner the melody may be changed by the performer without losing its characteristic form (its *Gestalt*). Variants recorded of different individuals or of the same informant at different times especially merit consideration. One should completely avoid constructing a melody type which is a composite of the most frequently occurring variants of the melody.

Slight variants, consisting of changes of individual tones only, may be indicated above the respective notes. Changes of pitch may be indicated by (#), (b), (♭), (+), (−), and dynamic accents by (>).

Should any section of a melody consist solely of recitative on one or two tones, and not display other details of interest, it will be sufficient to give only a schematic representation of this section. The principal pitches may be indicated by stemless notes, *o* for the most significant or frequent notes, and *•* for the less significant as, for example, in the representation of a recitative in Example 18.

**Example 18**



## 10. Polyphonic Pieces

When there is a pronounced interchange of voices,<sup>17</sup> or the two voices occasionally sound the same pitch simultaneously, they can be notated on the same staff but with the stems of their respective notes extending in opposite directions. Otherwise, the introduction of a new voice may be indicated by a key word or letter as, for example, "Voc" or "V" (vocal) or "Fl" or "F" (flute). The use of the score is recommended in cases of continued polyphony of more than two voices exhibiting independent contrapuntal movement. Voices which move in parallel motion, whether in unison or at the octave, are best notated in one row even though they are produced by various instruments.

When it is not possible to follow fully the course of each voice it might be helpful to notate certain distinctly heard short passages of an auxiliary or secondary voice through the use of special signs somewhat like mensural notation (♠ ♡ ♢). These should be written on the same staff as the principal voice. Harmonic intervals such as double stops or chords, even when consisting of tones produced by different instruments, should be written connecting all the notes with one stem.

In intricate, polyphonic pieces it may be useful to introduce in addition to the score an impression of the melody which will serve to indicate the ever changing predominance and subordination of the various voices.<sup>18</sup>

## 11. Song Texts

The song texts are of significance not only in their literary and linguistic aspects but also in their relationship to the melody. To accommodate the melody, syllables are frequently elongated or omitted. A musical motif may be melodically or rhythmically altered, augmented or shortened or otherwise be shaped to fit the text. In tone languages such as Chinese, Ewe, etc., the relationship of the speech pitch to the musical pitch presents a special research problem.

The formation of a melodic pattern is too often dependent upon the text. Without consideration of the text it is difficult to arrive at opinions concerning musical "ethos." Whenever possible, therefore, the text should accompany the melody. The ideal towards which one should strive is an accurate phonetic transcription with philological commentary. This should be accompanied by an inter-linear literal translation and, when possible, a comprehensible translation expressing metrical or rhythmic form.

Even though the transcriber possesses a knowledge of the language it is almost impossible to produce an accurate transcription from a recording. Many speech sounds undergo radical change when sung. Sibilants and fricatives disappear, the words when sung vary in pitch and intonation from

the spoken forms, etc. From so-called primitive peoples it is difficult to secure an accurate recitation of the words alone. For them the text and melody represent such an inseparable unity that they never recite the words alone and they find it difficult to do so. It is for this reason that texts taken directly from the informant in speech form often show discrepancies with what one hears in the recording.

In transcribing, text syllables or speech sounds which are indistinct or absent in the recording are placed in ( ). Those which are distinct in the recording but absent in the transcription of the spoken text are placed in [ ]. Long, drawn out vowels or sonorants are indicated by — or — — — —. Separations of words are preferably indicated phonetically rather than philologically, thus:

la - - - mpe (when there is a clear, prolonged a)

lam - - - pe (when there is a clear, prolonged m)

lamp - - - e (when the syllable is short)

## 12. Title

In choosing headings for individual notated examples, the transcriber should exercise his own subjective judgment as little as possible. Rather, the headings should represent those concepts offered by the musicians themselves. When these are not available the title should refer to the specific function of the composition as "Dance Song" or "Work Song." In other cases the heading may be drawn from the text, such as "The Fox and the Goose." The latter should not be a subjective interpretation but a literal rendering of the text. Or the heading may consist of the first few words of the text in the original language or in translation. An identification of the text based upon presumed literary or musical "ethos" as, for example, "melancholic," is therefore not justified. Should none of the categories of possible headings mentioned above be available it will then be sufficient to utilize the musical category into which the composition falls, such as chorus, song or flute solo. The latter nomenclatures should generally be included in any case as sub-headings. One should make it a rule to translate and clarify all indigenous names or at least those found in the accompanying text. Even readers possessing a broad education cannot be expected to have a knowledge of all foreign terms.

## 13. Arrangement of the Transcriptions

The lexical arrangement of melodies, even those of European folk music, is a problem that must be continuously faced. The difficulties increase when exotic melodies are being arranged since the customary means of classification, "major" and "minor," "tonic," etc., are not applicable. In most

cases the volume of material available will hardly be sufficient to warrant any type of classification. The scientific examination of this material will also yield a large number of variables as bases for classification and this will make it more difficult to determine whether an item should be placed in one category or another. Nevertheless, certain groups will become clear which, even when formed on the basis of extra-musical principles, will be generally representative of a specific musical type.

1. Material from one large geographic area should first be grouped ethnologically, according to its ethnic origins. Thus cultural homogeneity, or membership in an ethnic group, should be the principal mode of classification rather than geographic entity, political division, or physical traits.

2. Division according to the social application or function of the item: religion, war, festival, work, medicine, love, play, entertainment, etc.<sup>19</sup>

3. Classification according to tonal media: solo song, choral song, instrumental solo, orchestra, etc.

4. Classification according to degree of musical complexity is recommended when the three methods of classification given above are either impossible or meaningless, when a certain musical factor merits special attention, or when the abundance of material necessitates further subdivision. Only in each individual case can one decide which factor should be considered in assessing the degree of musical complexity: tonal material, tonal system, melodic contour, polyphony, rhythm, or structure.

## **II. Technique of Transcription**

At the present time the phonograph,<sup>20</sup> whose advantages have been frequently and extensively discussed, is generally utilized in the collection of examples of exotic music.<sup>21</sup> When for some reason recording by phonograph is impossible, one must depend upon one's ear and write down by hand what is heard. This method should not be completely ignored. When carried out with the necessary care and conscientiousness in certain circumstances it may be the preferred method. It is most efficacious when the investigator himself learns to perform the songs and instrumental pieces sufficiently well that he can recreate them to the satisfaction of the natives. In doing this one must choose as critics those natives who have special talent for music according to the judgment of their own group. One must also make certain that the approval gained is not based on politeness or lack of interest. By this means one can judge with the greatest certainty what the natives find most essential in their music. Their point of view in this regard is often quite different than that of the European. For example, to the North American Indian the manner of performance—timbre of voice, glissandi, etc.—is more important than correct intonation.

The combination of the learning method and that of recording by phonograph can produce very instructive results, particularly in the study of complex instrumental techniques such as those involved in drum rhythms. The peculiarities of such performance, and their bearing on the construction of the instrument and its music, can only be grasped by this means. Even when it is not possible to learn to execute the music oneself, transcriptions and other indications made by hand in the field can be of great value when done with care, self criticism, and controlled through repetition of the processes. However, this method requires great patience upon the part of both teacher and pupil. The investigator must possess extraordinary musical talent, excellent melody retention, and much time and money.

In transcribing recorded melodies utilizing our notational system we have developed the following useful rules of procedure:

1. One must first listen to a complete recording before making any notations. One first needs to secure a general impression of the piece as a whole and of its various aspects—rhythmic peculiarities, simplicity or complexity, frequent repetition of a short motif, variants which appear in the latter part of the piece only. The technical quality of the recording also needs to be assessed in advance.

2. One has also to select a suitable speed at which the cylinder should be played.<sup>22</sup> The speed selected should permit the proper analysis of the more rapid passages but should not be so slow as to impair the comprehension of the piece as a whole, its unity and continuity. In order to avoid complexity of notation produced by the excessive use of accidentals (see Part I, Sections 2 and 3), the transcriber who possesses absolute pitch must take this fact into consideration. He must adjust the speed of the phonograph in such a manner that he can indicate the principal melodic tone as well as the other pitches heard with a minimum of accidentals.

3. One should avoid making preliminary sketches of particular melodic fragments. The black on white that lies before one influences one's conception of the material to such a degree that it is difficult to free oneself from the previously conceived notation. We have found it impractical to notate stemless pitches and to later indicate the note values. We find it preferable to indicate durational values as we write since the comprehension of rhythmic progressions or groupings frequently facilitates the recognition of pitch.

Therefore, one should aim, from the beginning, for the most definitive results possible. On the other hand, the division according to rhythmic groups (see Part I, Section 6) should be undertaken only after the notation is completed. When parts of a recording are clear but others are not, it is advisable to begin the transcription with those tones which are outstanding in melodic or dynamic clarity. At times it is difficult to gain an adequate perception of certain passages (particularly rhythmic ones), due to their complexity. In these cases it is best to discontinue work on these passages

for the time being. During the observation of repetitions of similar passages through the subsequent course of the piece one is usually directed to the correct conception and difficulties which had seemed insurmountable then disappear (see also Rule 8, below).

4. Intervals not commonly heard, or those which are not clear, can be determined with greater ease by the rapid lifting of the stylus of the playback, suddenly interrupting the flow of the music. This isolates the pitches in question for the listener.

5. The speed of the playback should be reduced in working with unique, rapid, complex or highly melismatic passages.

6. Complex rhythms should also be examined at slow speed with the aid of the metronome. However, one should make it a rule to follow this by an examination of the passage at the normal tempo. Reducing the speed produces melodic distortion and thus conceptions which will not match those produced when listening to the passage at the normal speed. Passages which completely lack rhythmic clarity, which defy every subjective measurement of durational values, can at times be more clearly understood through the use of the metronome. The metronome should be set in such a manner as to produce the greatest coincidence between the beats and the melodic tones. When recurring dynamic accents, such as those produced by hand-clapping or a percussion instrument, are heard simultaneously with a complex melodic rhythm, it is preferable to sketch the scheme of the rhythm accompaniment first, and then to add pitch notations.

One can proceed in a similar fashion with polyphonic pieces. Here (as in Rule 3, above) one should not attempt to analyze concurrently the various simultaneously sounding voices. Rather one should focus one's attention upon a particular voice as identified by its particular timbre or, when this is not possible, upon the voice that exhibits the greatest clarity. One follows this voice throughout the entire piece, then follows the same procedure with the other voices. The circumstances will dictate whether one fills in other voices according to the organization of the first voice or whether one listens to each voice independently, transcribes it separately, and finally, after repeated and controlled auditions, combines all voices into a single score.

7. Where a written song text is available it can aid with melodic transcription and in discerning details such as short notes which do not come through, weak pulsation, and the like, which may have been overlooked. In passages in the recording where the text is not clear, it is best to first write out those syllables which stand out. Only after this "acoustical" transcription is made should one turn to the original written text. The typical errors of the "acoustical" transcription will soon become obvious. The apparatus, in part, causes the distortion of such consonants as sibilants and fricatives, and some vowels. One hears, for example, "d" or "t" instead of "s", "ä" instead of "i." Errors are also caused in part by the musical performance itself. Text syllables are

“swallowed” or distorted by the pitch level at which they are sung. Finally, the errors are partially caused by the influence exerted upon the transcriber’s conceptions by the psychological effects of persistence, assimilation, etc.<sup>23</sup>

8. Difficult pieces or passages should be re-transcribed without reference to the first transcription made. It would be even more advantageous if this were done by a second individual, again without reference to the first transcription. It is recommended that one not be detained too long by a particular difficulty since it is easy to develop a concept in opposition to the first one held. It is best to return to such passages after a long pause. One is then fresh and alert and the problem may be seen in a completely different light.

### III. Measurement

In order to determine most precisely and objectively the pitches of a tonal system, and as a control over or a substitute for direct measurement by ear, the recording may also be subjected to tonometric analysis. This method is primarily applicable to instruments exhibiting relatively consistent intonation such as panpipes, flageolets, and wood or metal keyboard instruments. It possibly can be utilized in the measurement of stringed instruments, particularly those possessing frets or other firmly fastened means of fixing tones. In the case of instruments of variable intonation, tonometric measurement is the only reliable method available.

Vocal music, especially that which is unaccompanied, tends to waver in intonation. Tonometric measurement in this case is only useful in the spot checking of “the same tone” in different passages producing a tone sufficiently constant in pitch. Although the tonal system will necessarily be derived from the tones that are sufficiently definite to be measured—those that are the loudest, the most sharply delineated, or that display the longest duration—it would be best to isolate the individual recorded tones. The measurement of some melodic tones that fluctuate in intonation can be of considerable musico-psychological interest. Variability in the intervallic distance between tones should by no means be dismissed as poor intonation. Rather, it may conform to requirements of the melodic style of which the singer himself may not necessarily be conscious.<sup>24</sup>

There are various types of apparatus that can be utilized in determining frequency or cycles per second:

1. Appun’s tonometer. This apparatus is capable of distinguishing minute differences in frequency, from 2–5 cycles per second (cps). This is accomplished by means of precisely tuned and calibrated reeds which are put in motion by a common wind chamber.

*Advantages:* There is a high degree of constancy in reproducing pitch. It is not easily affected by temperature, humidity, or wind pressure. Cps are immediately readable.

*Disadvantages:* The tonal sequence is not a continuum.<sup>25</sup> The tone is harsh and the equipment is bulky and expensive.

2. Stern's variator. In this apparatus air is vibrated within a series of bottles. The volume of air in each is varied by a sinking and rising piston which forms the bottom of the air chamber vibrated.

*Advantages:* Due to the convenient method of tuning a tonal continuum is provided and almost complete freedom from beats can be achieved. The timbre is agreeable.

*Disadvantages:* It is difficult to secure accurate readings since the apparatus is highly susceptible to changes in temperature, humidity, and wind pressure. It is also bulky and expensive.

3. Hornbostel's wind tonometer. In this reedpipe the vibrating length of the reed can be varied by a moveable bar which is slid over it.

*Advantages:* A tonal continuum is produced and it is sufficiently independent of variations in temperature. It is inexpensive.

*Disadvantages:* Due to its dependence upon wind pressure it is not completely constant in pitch. Therefore it is at times necessary to repeat the measurement. The tone is harsh.

4. Monochord:

*Advantages:* It produces a tonal continuum and it is convenient to tune.

*Disadvantages:* Intonation is easily distorted in the manipulation of the apparatus. The duration of the tone produced is short and the timbre produced is quite dissimilar to those of the tones commonly measured.

5. Tuning forks with sliding weights:

*Disadvantages:* The tuning forks are difficult to handle and the tone produced is of low intensity.

6. Graphic methods offer the ideal in precision in the determination of pitch but they are overly subtle and technically complex. In addition, the interpretation of the curves of the graph is difficult and, to date, hardly reliable. This method is nevertheless important in specific types of research.

In comparing the recorded tones with the tones of the measuring apparatus the following rules should be observed:

The revolving speed of the phonograph must be absolutely constant. This can best be achieved by retaining the maximum tension of the spring of the clock mechanism during the checking.

For ease in measurement it is best to isolate the recorded tone as much as possible by abruptly lifting the head of the phonograph before the subsequent tone is heard.<sup>26</sup> In handling the head one must avoid increasing its sidewise displacement, for this may injure the track.<sup>27</sup> Cylinders are often damaged in this manner. In applying these methods it is therefore advisable not to use the original cylinders. Instead, copies made of a hard material should be utilized.<sup>28</sup> Thus the tone to be measured and the tone of measurement can be compared successively. This is more reliable than their simul-



taneous comparison. On the other hand, simultaneous comparison is useful when the recorded tone is prolonged. In this case the tone of measurement can be tuned by regulating it until no beats are heard.

The transcription in notation previously made of the recording should be at hand while the measurement device is in use and the cps of the tones measured should be indicated over the corresponding notes. By this means one can determine the melodic circumstances which govern variability of intonation.

## IV. Computation

### 1. Calculations of Cents

The determination of the absolute frequencies, as provided by the measurements, does not yet clearly present data concerning intervals. Nor are the data now available easily compared. For example, 423:634.5 and 756-1134 are equal ratios in that both can be reduced to 2:3, a perfect fifth. In order to be in a position to conveniently compare differing intervals one with another, it is customary to transpose them so they have the same lower tone. The intervals are then represented in decimals, such as 1.5 for a perfect fifth. This is often sufficient, particularly when individual intervals are being compared or when precise differentiation need not be considered. This method offers many advantages since the intervals can be compared by a definite standard of measurement.

The semitone of the tempered twelve tone scale is a particularly useful measuring device. To make it possible to express the ratios in digits only, rather than in decimals or fractions, A. J. Ellis has chosen the "cent," 1/100 of the tempered semitone, as the unit of measurement.<sup>29</sup> The octave is divided into twelve geometrically equal degrees. In the same manner Ellis divided the semitone into 100 geometrically equal degrees. Thus the "cent" does not represent a particular differential of frequencies but a particular ratio of frequencies. Our tempered intervals are in this manner represented as multiples of 100. For instance, the fifth as the sum of seven semitones equals 700. This system is convenient not only for measuring European intervals but is sufficiently precise to register the smallest difference in interval distances. However, one must be careful not to overestimate the significance of the cent as a differential in measurement. If one has been accustomed to working with frequency counts one can easily be misled.<sup>30</sup> In the full octave a cent represents approximately 0.2-0.3 cps.

In dealing with cents one works with concrete numbers which represent intervals. The totals of these numbers, and the differences between them, also represent intervals. This fact is particularly useful in the computation of scales since an interval produced by any two consecutive tones can be calculated by simple addition.<sup>31</sup>

The following example will serve to illustrate the process of converting a frequency ratio into cents. The frequencies established through the process of measurement are  $n_1 = 527$  cps,  $n_2 = 344$  cps. Thus  $527:344 = x$  cents. Since the cent is defined as  $1/100$  of the tempered semitone, the semitone of the tempered scale  $= \sqrt[12]{2}$ . In further calculation  $1 \text{ cent} = c = \sqrt[1200]{2}$ . Accordingly,  $x \text{ cents} = c^x = \sqrt[1200]{2^x}$ . Thus, we compute the interval as follows:

$$\begin{aligned} c^x &= \frac{527}{344} \text{ and } \log. c = \log. 2 : 1200 = \frac{0,30103}{1200} = 0,000251 \\ x \log. c &= \log. 527 - \log. 344 \\ x &= \frac{\log. 527 - \log. 344}{\log. c} = \frac{2,7218-2,5366}{0,000251} = \frac{0,1852}{0,000251} = \frac{185200}{251} \\ \log. x &= \log. 185200 - \log. 251 = 5,2676 - 2,3997 = 2,8679 \\ x &= 737,8 \text{ Cents.} \end{aligned}$$

To avoid the necessity of calculating  $c^x = \sqrt[1200]{2^x}$  Table 5 is given in which  $x = 1-9, 10-90$  (for tens),  $100-1200$  (for the hundreds). In order to facilitate the calculations, and to produce useful results, irrelevant mantissas are omitted.

**Table 5. Conversion of Logarithms into Cents**

Log.	Cents	Log.	Cents	Log.	Cents
251	100	25	10	3	1
502	200	50	20	5	2
753	300	75	30	8	3
1003	400	100	40	10	4
1254	500	125	50	13	5
1505	600	151	60	15	6
1756	700	176	70	18	7
2007	800	201	80	20	8
2258	900	226	90	23	9
2509	1000	—	—	—	—
2759	1100	—	—	—	—
3010	1200	—	—	—	—

The following rules apply in calculations utilizing this table. The process has already been illustrated in the example given above.

1. Subtract the logarithm<sup>32</sup> of the smaller frequency number from that of the larger (without regard for the mantissa).

$$\begin{array}{rcl} \log. 527 & \dots & 7218 \\ - \log. 344 & \dots & \underline{5366} \\ & & 1852 \end{array}$$

2. Subtract from the remainder the logarithm in the table which is the next lowest in number, from the new remainder, etc.

$$\begin{array}{r}
 1852 \\
 - \underline{1756} \dots 700 \text{ Cents} \\
 96 \\
 - \underline{75} \dots 30 \text{ Cents} \\
 21 \\
 - \underline{20} \dots 8 \text{ Cents} \\
 1
 \end{array}$$

Since the decimals of the cents have practically no value, the final remainder (1) may be ignored.

3. Add the figure for cents as found in the logarithm table.

$$\begin{array}{r}
 700 \\
 + 30 \\
 + 8 \\
 \hline
 738 \text{ Cents.}
 \end{array}$$

To facilitate the comparison of newly calculated intervals, and those already familiar, we have constructed a table in which values are given in cents for the twelve tone temperament, the just intervals (including the "seventh intervals"<sup>33</sup>), the Pythagorean, and finally the intervals of the Siamese seven tone temperament and the five tone Javanese slendro temperament.

Two examples will serve to illustrate the convenience of working with cents. As is well known, as one proceeds from the basic tone through the Pythagorean circle of perfect fifths the intervals produced deviate further and further from just or natural tuning. The computation in cents below follows this principle, that is, the transposition by perfect fifths within the octave.

$$\begin{array}{l}
 c = 0 \text{ (Root)} \\
 g = 702 \text{ (Perfect fifth)} \\
 d = (2 \times 702 = 1404) - 1200 = 204 \text{ (Major second)} \\
 a = 204 + 702 = 906 \text{ (Major sixth)} \\
 e = (906 + 702 = 1608) - 1200 = 408 \text{ (Major third)}
 \end{array}$$

After twelve progressions within the circle of fifths one reaches a tone, B<sup>♯</sup>, which exceeds the octave, c<sup>1</sup>, by one Pythagorean comma:  $702 \times 12 = 8424 - (1200 \times 7 = 8400) = 24 \text{ cents} = \text{Pythagorean comma}$ .

A second example: The Siamese scale contains seven geometrically equal degrees within the octave. Thus a single scale degree is represented by  $\sqrt[7]{2}$ . In computation by cents  $1200 : 7 = 171.4 = \text{an individual Siamese}$

scale degree. The value in cents of the other intervals in the Siamese scale can be computed by multiplying 171.4 by 2, 3, 4, 5, and 6 (compare with cents values in Table 6).

**Table 6. Important Intervals in Cents**

	12 tone tempera- ment	Just	Pythago- rean	7 tone temp. (Siam.)	5 tone temp. (Jav.)	Ratios
		70				24:25
Minor second (semitone)	100	112	90			243:256
		182		171		15:16
Major second (whole tone)	200	204	204			9:10
		231 <sup>x</sup>			240	8:9
Minor third	300	267 <sup>x</sup>				7:8
		316		343		6:7
Major third	400	386				5:6
			408		480	4:5
Fourth	500	498	498			64:81
		583 <sup>x</sup>		514		3:4
Tritone	600	590				5:7
Fifth	700			686		32:45
		702	702			2:3
Minor sixth	800				720	
		814		857		5:8
Major sixth	900	884				3:5
			906		960	16:27
Minor seventh	1000	969 <sup>x</sup>	996			4:7
		996				9:16
Major seventh	1100	1088		1029		8:15
Octave	1200	1200	1110 1200	1200	1200	128:243 1:2

## 2. Computation of Mean Values

The tonometrically determined frequencies of individual melodic tones may be established by simple arithmetic means. However, this can be done only if the deviations of these “same tones”—as found in various repetitions of the same passage, and considered in isolation of neighboring tones—are so slight that despite the variability in cps the result cannot be questioned. In melodies not accompanied by an instrument of fixed pitch, the psychological characteristics of the musical performance—melodic movement, accents, anticipations, etc.—play a greater role than the tonal system. For this reason, what is presumed to be the same tone in different places within the same melodic section may display a great variety of absolute pitches. Thus there would be little sense in applying an arithmetic mean in determining its frequency. On the other hand, in many cases consistency in size will be found among analogous intervals and thus it will be possible to apply the same “cents figure” to them.<sup>34</sup>

Should, however, the melodically analogous intervals differ more markedly one from another, one must then assume that the most frequent “cents figure” secured represents the pitch the performer intended to produce. Should it not be possible to clearly establish a maximum occurrence of a particular frequency ratio among the analogous intervallic distances, then it is not possible to draw any conclusions concerning the underlying tonal system.

## 3. Computation of Scales

Having established a serviceable tonal system through the measurement of the frequencies of instrumental or recorded pitches, and having calculated the intervals lying between the scale degrees in cents, one must compare these intervals not only with each other and with other familiar intervals, but also with the larger intervals of the tonal system. The size of the latter is calculated by the addition of the cents numbers assigned to each individual degree. It is useful to calculate the sum sequences not only on intervals based on the lowest tone but also from every degree present. There are three reasons for following this procedure: (1) the lowest tone is not always the one which is the most melodically significant; (2) in instruments the lowest tone may be completely foreign to the tonal system; (3) patterns of conformity can often be recognized in later sum sequences which were not clear in the earlier calculations of deviating pitches, etc.

We illustrate this with the following rough table (Table 7). The first column presents the pitches as subjectively heard by the investigator. In the second column are the tonometrically measured frequencies of these pitches. The third column presents the intervals lying between these degrees in cents.

The following columns are the “sum sequences.”<sup>35</sup> It can already be seen that the I rubric is indicative of a tempered scale whose steps approximate a  $3/4$  tone. One deduces that the fourth and fifth are nearly perfect, the third and sixth are neutral, and the seventh slightly too large. The figures in the table represent the means in the measurement of four Siamese percussion instruments.<sup>36</sup>

**Table 7. Example of Scale Computation**

T	N	I	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>4</sub>	S <sub>5</sub>	S <sub>6</sub>	S <sub>7</sub>	S <sub>8</sub>
a <sub>1</sub>	423		0							
$\bar{h}_1$	469	179	179	0						
c <sub>2</sub> – cis <sub>2</sub>	517	169	348	169	0					
$\bar{d}_2$	571	171	519	340	171	0				
e <sub>2</sub>	629	168	687	508	339	168	0			
f <sub>2</sub> – fis <sub>2</sub>	697	177	864	685	516	345	177	0		
$\bar{g}_2$	767	165	1029	850	681	510	342	165	0	
a <sub>2</sub>	842	161	1190	1011	842	671	503	326	161	0

## V. Scale Synopses

Tones occurring in a melody, including those occurring beyond the octave, are arranged beginning with the lowest note. The rules given above concerning transcription signs such as + and – (Part I, Sections 2 and 3) still apply. We suggest that the following gradation of time values be utilized to express the melodic significance of the various tones of the scale:

- the principal melodic tone (distinguished by frequency, duration, accents, etc., the most important degree)—(“melodic tonic”)
- ◡ a principal melodic tone but of secondary significance—the “dominant”
- tones of average significance
- } auxiliaries, passing tones, cambiatas, appoggiaturas, and other embellishing or
- } ornamental tones

We designate the final by ♮, the partial closes (half or semicadences) by ♯, the beginning tone (in case this function is decisive in melodic significance) by ♮. At times it is difficult to come to a decision as to which tone should be regarded as the tonic and which as the dominant. In this case

several  $\circ$  are written next to each other. Appoggiaturas which appear only as passing tones are connected by legato ties to the tones to which they pertain. If certain tones appear only when the melody ascends, and others only when it descends, this fact is indicated by placement of stems, thus:  $\uparrow$  and  $\downarrow$ . Recitative tones (see Part I, Section 9) are distinguished by an R written above the staff. When differing parts of the scale pertain to different sections of the melody only, as in transpositions or modulations, the respective parts of the scale are separated by bar lines (see Example 19). In order that scales representing various melodies can be compared they must be transposed in such a manner that (1) the smallest possible number of transcription signs need be utilized and (2) simultaneously, having ordered them through the correspondence of their principal tones, as many scales as possible are recognizable as members of similar types.

### Example 19



When a great number of melodies are being compared, it is preferable for technical reasons that the scales be indicated by letters rather than by notes. A differentiation of melodic significance similar to that indicated in the notation above can be achieved by the use of bold type, fermatas, legato ties, etc.<sup>37</sup>

### Notes

1. *Translators' note*: The reference is to the Berlin Phonogramm-Archiv of which von Hornbostel was for many years director. See Kurt Reinhard, "The Berlin Phonogramm-Archiv," *The Folklore and Folk Music Archivist* 5, no. 2, 1962.

2. *Translators' note*: By this process permanent copper negatives were made of the original wax cylinders. The negatives were then used as casts in producing copies. See George List, "The Reproduction of Cylinder Recordings," *The Folklore and Folk Music Archivist* 1, no. 4, 1958, Vol. 2, Nos. 1-2, 1959.

3. "Hopi Songs," *A Journal of American Ethnology and Archeology*, Vol. 5, 1908.

4. *The Peasant Songs of Great Russia*, Imperial Academy of Science, St. Petersburg (English translation, David Nutt, London, 1905).

5. Commonly used in England. See Wooldridge, *Oxford Dictionary of Music* (double G clef).

6. *Translators' note*: The term *ansatzstriche* was apparently coined by von Hornbostel. It refers to a slanting line placed before the initial note of a musical line to indicate that there is a glide into this note.

7. "Zuñi Melodies," *A Journal of American Ethnology and Archeology*, Vol. 1.

8. See Dom I. Parisot, *Rapport sur une Mission Scientifique en Turanie d'Asie*, Paris, Leroux, 1899.

9. Since tone color and tonal relationship are related both concretely and psychologically, we have placed them under one heading. In most cases, in our system, dynamics and tempo play an important part in manner of performance. However, these phenomena can be more sharply delineated and are therefore dealt with in separate paragraphs.

10. We recommend the use of 4/4 rather than  $\text{c}$  and 2/4 rather than  $\text{♩}$ .
11. *Translators' note*: It would seem that the metrical signature of the first group should be 6/4 rather than 6/8.
12. *Translators' note*: Although no metrical signature is given, it is evident that the rhythmic unit is a quarter note.
13. However, (♩) refers to variants (see Section 12).
14. When recording is impossible, the rhythm should be clapped and the tempo determined by the number of beats per minute thus derived.
15. Compare Natalie Curtis, *The Indians Book*, New York and London, Harper and Brothers, 1907; and P. W. Schmidt in *Anthropos*, Vol. 1 (P. Fr. Witte, "Lieder und Gesänge der Ewhe-Negern").
16. Greek letters are not available in some printing plants and are unknown to many engravers of music.
17. *Translators' note*: The meaning of the German at this point is not clear.
18. See Carl Stumpf, "Tonsystem und Musik der Siamesen," *Beiträge zur Akustik und Musikwissenschaft*, No. 3, 1901.
19. The occasional transfer of purpose or function, i.e., from war song to work song, produces problems in this type of classification.
20. *Translators' note*: The reference is to the cylinder phonograph. The disc phonograph was not in use in field work until the 1930s.
21. Compare Stumpf, *op. cit.*; Abraham and von Hornbostel, "über die Bedeutung des Phonographen für vergleichende Musiwissenschaft," *Zeichschrift für Ethnologie*, Vol. 36, 1904; Gilman, *op. cit.*; and Ch. S. Myers, *The Ethnological Study of Music*, *Anthropological Essays presented to E. B. Tylor*, October 1907.
22. *Translators' note*: The cylinder phonograph was provided with a manual speed control. No standard rpm was in use.
23. Persistence: Once a consonant is heard that particular sound may persist in the memory. Assimilation: In similar sounding complexes one may be hearing syllables or words of one's own language or of a similar language.
24. See Gilman, "Hopi Songs," *op. cit.*
25. This fault can be overcome by counting the number of beats occurring between the tone to be measured and the subsequent attack of the reed nearest in pitch. *Translators' note*: The apparatus can only sound a particular sequence of pitches. All pitches heard on the recording cannot be matched exactly.
26. This can be done by hand or with Myers' pedal device. Complete displacement of the guiding nut will assist in this. *Translators' note*: The head of the cylinder phonograph is drawn from left to right along the side of the cylinder by a revolving screw located above the cylinder. The head is suspended from the screw by an arm attached (in this case) at its upper end to a half nut which rides the screw. The nut can be disengaged so that the head can be moved independently in either direction.
27. *Translators' note*: All but the early cylinder phonographs are provided with what is known as a "floating head." This materially improves the tone produced. However, the "floating" action permits considerable sideways displacement and care must be taken in raising the head from the cylinder in order not to break the ridges between the grooves.
28. *Translators' note*: The wax cylinder is rapidly worn by repeated playback. In making copies by the galvano-plastic process (see note 2) a harder substance more resistant to wear than the usual wax mixture was often employed.
29. "On the Musical Scales of Various Nations," *Journal of the Society of Arts*, 27th March 1885, Vol. 33.
30. When less precision is acceptable, or preferred, it is sufficient to establish the interval in terms of decimals.
31. The calculation of cents by the transcriber facilitates the measurement of intervals, but this obviously is not sufficient. A researcher must listen to the performance in going further into



the theoretic construction of scales and intervals if a more adequate representation of their technical or psychological nature is to be produced.

32. The logarithm in four digits is sufficient. The tables by S. Schubart (*Sammlung Götschen*) are very convenient.

33. These are indicated by an x.

34. In addition to the mean figures, the weight (the method used in arriving at a unified mean) and the median variant (the midpoint of deviation from the mean) should be indicated.

35. The horizontal rows read from right to left give the sum sequences in descending order.

36. Compare Stumpf, *op. cit.*, p. 83.

37. Since the purpose of this article is to achieve a consensus among those interested in its topic, we should receive any criticism or additions with gratitude. Expressions of opinion in the form of letters should be directed to the Phonogramm-Archiv, Psychologischen Institut, Universität Berlin, N.W. 7, Dorotheenstr. 95/96.