PROCEEDINGS OF THE SAINT THYAGARAJA MUSIC FESTIVALS

Cleveland, Ohio, 1978-81

Edited by

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STRUCTURE, FREQUENCY, AND ARTIFICIALITY IN SOUTH INDIAN *MELAS*

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In a previous article, I have outlined features common to scales around the world.[1] These include pentatonic, heptatonic, and equiheptatonic scales found in the music of many cultures as well as *pelog* and *slendro* forms of Indonesia, the *in* scale of Japan, Arabian *maqamat*, and the tonal material of North Indian *rags*. A notable omission from that account was the system of *melas* found in South India. As it turns out, certain Carnatic *melas* appear at first to be exceptional if they are considered to be scales in the sense of the earlier study. However, on closer inspection, one finds that these "exceptional" scales might best be considered not scales in the sense of the previous paper but rather close variants of such scales. In every case, the scales from which these exceptional configurations could be considered to be derived bear a fixed relationship with their chromatic variants, and their special status is mirrored in the number of special forms (or *janya* ragas) which they assume. This in turn can be considered a reflection of their relative popularity among musicians and the degree to which they are considered to be "natural" as opposed to "artificial".

DATA BASE

The data used as a basis for this study consist of the almost 2,000 *janya ragas* compiled in Walter Kaufmann's book on *The Ragas of South India*.[2] The *ragas* outlined in Kaufmann's publication are based on an octave of

twelve notes, five to seven of which are used in each rāga. Only the pitch contents of individual rāgas are dealt with here. Special phrases, none of which have been subjected to classification, are not included, nor is the distinction between ascending and descending forms and various vakra (or "zig-zag") features. In short, I am concerned with what pitches are used in given rāgas, not with how they are used.

The rāgas described in Kaufmann's treatise are grouped in Carnatic theory into 72 mēlas, or familes of rāgas, depending on their pitch content (Figure 1). These 72 mēlas constitute the Kanakāngi-Ratnāngi system, dating at the latest from the closing years of the eighteenth century or the beginning of the nineteenth. According to Kaufmann, each of the 72 mēlas is a "rigid, 'impersonal' seven-tone scale form."[3] Each rāga belonging to a given mēla family represents a subset of from five to seven tones of these seven. The question to be dealt with here is as follows: In what sense are the 72 mēlas to be considered scales?

MĒLAS AS SCALES

As I mentioned above, I have described a number of features common to scales throughout the world in an earlier study. Relevant to the present discussion is a feature which I have termed "cyclic bisection." In a seven-tone scale that has the feature of cyclic bisection, any scale degree is from one-half to two-thirds an octave away from the scale degrees that are four steps away. This feature is shared by all the well-documented seven-tone scales outside South India: the equi-heptatonic, pélog, and diatonic systems, as well as the scales on which Arabian magamat and North Indian rags are based. Cyclic bisection can be considered, then, to define seven-tone scales around the world.

However, if one examines South Indian melas, one finds that some feature cyclic bisection and others do not. This raises an important question. Are South Indian melas scales or not? If they are scales, cyclic bisection cannot be a definitive feature of scales and the previous definition of scales must be withdrawn. And if they are not scales, what are they?

In order to answer these questions, one can backtrack a bit and compare two melas, one of which features cyclic bisection and one of which does not. First, consider mela Kanakangi, the first mela in Figure 1. Its tones can be arranged in a cycle such that each tone is one-half to two-thirds an octave from its neighbours. To state this another way, one can say that each tone is 6 to 8 semitones from adjacent members of the cycle (Figure 2).

For comparison, one can consider mela Ganamurti, the third mela in Figure 1. This mela does not feature cyclic bisection. As one can observe in Figure 3, the interval between e^{bb} and b in the cycle for Ganamurti is 9 semitones, in other words, three-quarters of an octave, which is larger than two-thirds. It would seem that melas like Kanakangi resemble scales throughout the world, and ones like Ganamurti are exceptional. How can this be?

"POPULARITY" AND "ARTIFICIALITY"

A clue is offered by Kaufmann when he writes that "the quantity (i.e., the number or frequency) of janyas is a comparatively good indicator of the importance and popularity of the primary mela. Some of the frequently performed mela-ragas have large numbers of janyas, such as melas 8, 15, 20, 22, 28, and 29. These basic scales and their subordinate forms are particularly favored by South Indian performers

and their audiences. Other scales, particularly those of mēlas with a small number of janyas enjoy little popularity and are often described as being too "artificial."[4] If one checks this statement in light of the feature of cyclic bisection, one finds the following. First, mēlas 8, 15, 20, 22, 28, and 29, which Kaufmann relates are "particularly favoured by South Indian performers and their audiences," all feature cyclic bisection. Secondly, mēlas that do not feature cyclic bisection are in the minority. Of the 72 mēlas, 45 feature cyclic bisection whereas 27 do not.[5] Thirdly, those mēlas that feature cyclic bisection tend to have larger numbers of janyas. On the average, each mēla that features cyclic bisection has 32 janyas, whereas each mēla that does not feature cyclic bisection has 18 janyas. Furthermore, mēlas that feature cyclic bisection have a range of from 12 to 132 janyas apiece, whereas mēlas that do not feature cyclic bisection have from 13 to 28 (Figure 4). In other words, mēlas without cyclic bisection never have as many janyas as the average mēla that does not feature cyclic bisection. If this is expressed statistically, one finds that the probability that mēlas without cyclic bisection belong to the same population as those that do is less that 1 in 500.[6] In short, mēlas with cyclic bisection tend to be more "popular" than those lacking this feature and this difference is significant at the .002 level.

If one considers Kaufmann's remark that "mēlas with a small number of janyas...are often described as being too artificial", other avenues of explanation emerge. First, the world-wide tendency toward "cyclic bisection" in seven-tone scales can be considered to represent a psychological or perceptual universal, as I have suggested elsewhere.[7] Another way of stating this is to say that cyclic bisection

is a "natural" way of making music. Accordingly, pieces which do not feature cyclic bisection could be considered "artificial" in comparison with those that do. In this sense, Kaufmann's correlation of poularity with natural-ness appears vindicated by the figures presented above.

EXCEPTIONAL MĒLAS AS DERIVED FORMS

Within the realm of the "artificial," there is a broad spectrum of possibilities. Which possibilities are found in South Indian mēlas? This seems to be a broad, indeterminate question, for it involves defining the range of variation within "exceptional" cases. This is not a usual procedure in musical research, which typically isolates "regular" features and leaves undefined the residue of "irregular" instances. In the present situation, however, the apparently irregular cases are found to bear a strict relationship to those that are regular. This point can be illustrated with reference to Figure 3. There one can observe that if $\underline{e}^{bb}$ were $\underline{e}^{b}$ or if $\underline{b}$ were $\underline{b}^{b}$, the pitch collection would feature cyclic bisection. Indeed, the same holds for the other 26 irregular mēlas. If one or two pitches were displaced a semitone, the resulting collections would feature cyclic bisection and would be identical with "regular" mēlas. In this way, the apparently regular mēlas can be considered close variants or transformations of the regular mēlas. Moreover, the relationships between regular mēlas and their variants is uniform; the variant is always just a semitone away from the regular form.

A related regularity consists in the fact that at least one of the pitches in an "irregular" interval is always a semitone away from the next higher or lower pitch of the mēla in which it is found. Turning to Figure 3 again, one can observe that pitches $\underline{e}^{bb}$ and $\underline{b}$ form

the irregular interval of 9 semitones. As it turns out, b is a semitone from the next higher pitch in the mēla, namely, c, and e^{bb} is a semitone away from the next lower pitch, namely d^{b}. Another way of stating this is to say that b forms a leading tone to c and e^{bb} forms a leading tone to d^{b}. This can be observed more clearly in Figure 5 where the mēla pitches are arranged from low to high (Figure 5). An important fact in this regard is that this leading-tone relationship is found in all the irregular mēlas.

In short, it would appear that the irregular mēlas can be derived from regular mēlas according to a uniform transformation such that by shifting the pitch of one or both tones in a regular interval an irregular interval results as well as a leading tone to one of the members of the regular mēla. Though the term leading-tone might seem somewhat ethnocentric, one should observe that leading-tone adjustments are found in musical cultures as widely diverse as those of Japan, Indonesia, and the West.[8] Indeed, there is an obvious parallel between regular and irregular mēlas on the one hand and the Western natural and harmonic minor modes on the other in this respect.

CONCLUDING REMARKS

In conclusion, one can note that South Indian mēlas can be dichotomized into regular and exceptional forms, depending on the presence or absence, respectively, of cyclic bisection. Regular forms represent the majority of mēlas and also tend to have more subsidiary janyas. If the latter fact is taken as an indicator of popularity, regular mēlas can also be considered to be more popular. In terms of world-wide tendencies, regular mēlas can be considered more natural and are recognized as such in South India itself. The form which artificiality

takes can be defined in terms of, a) the absence of cyclic bisection, b) a single type of transformation relationship between natural and artificial forms, and c) leading-tone relationships which result from such transformations. It would seem, then, that the regular mēlas are scales in the most determinate and universal sense of the term, and the irregular mēlas are use-scales (Gebrauchsleiter)[9] derived from the regular forms.

The data base employed here could be extended in a number of ways to develop further the ideas outlined above. Other indicators of poularity such as frequency of actual performance could be investigated, and more probing questions concerning the concept of artificiality could be asked of South Indian musicians and audiences. Finally, the model tonal systems as described here could be tested against those data which are ultimately most important, namely, actual pieces of Carnatic music. One can only hope, in the meantime, that the directions for further research provided here will prove to bear fruit.

By way of conclusion, I would like to suggest a much more general hypothesis for future research, namely, that systematically more "elegant" or "central" forms (such as scales featuring cyclic bisection) might tend to predominate in a given repertoire. With this hypothesis, one might enter realms of rhythmic theory and topics even further afield. Suffice it to say for the present that the data discussed here lend some credence to such an hypothesis and considerable hope for the union of theoretical and empirical studies.

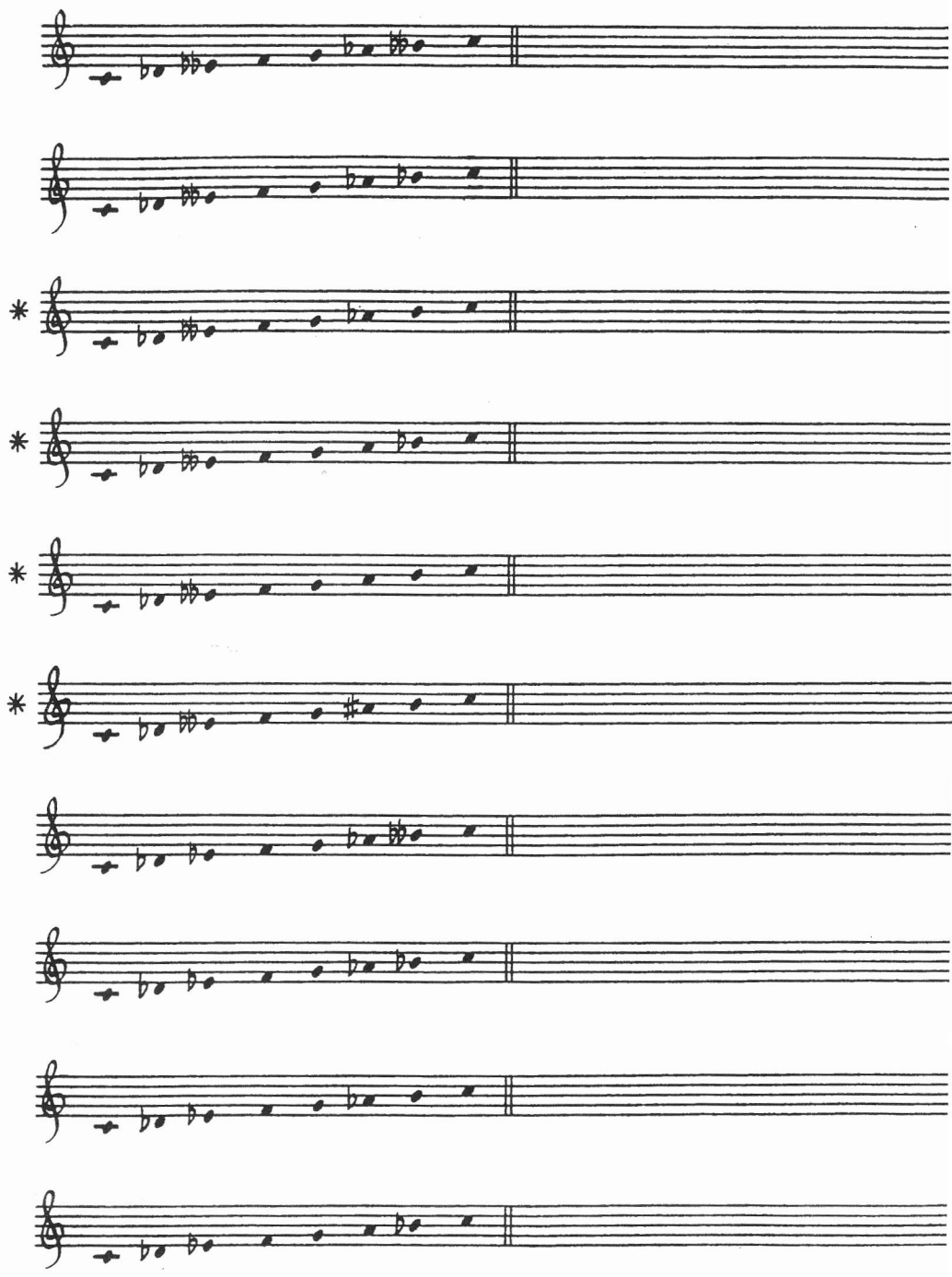
NOTES

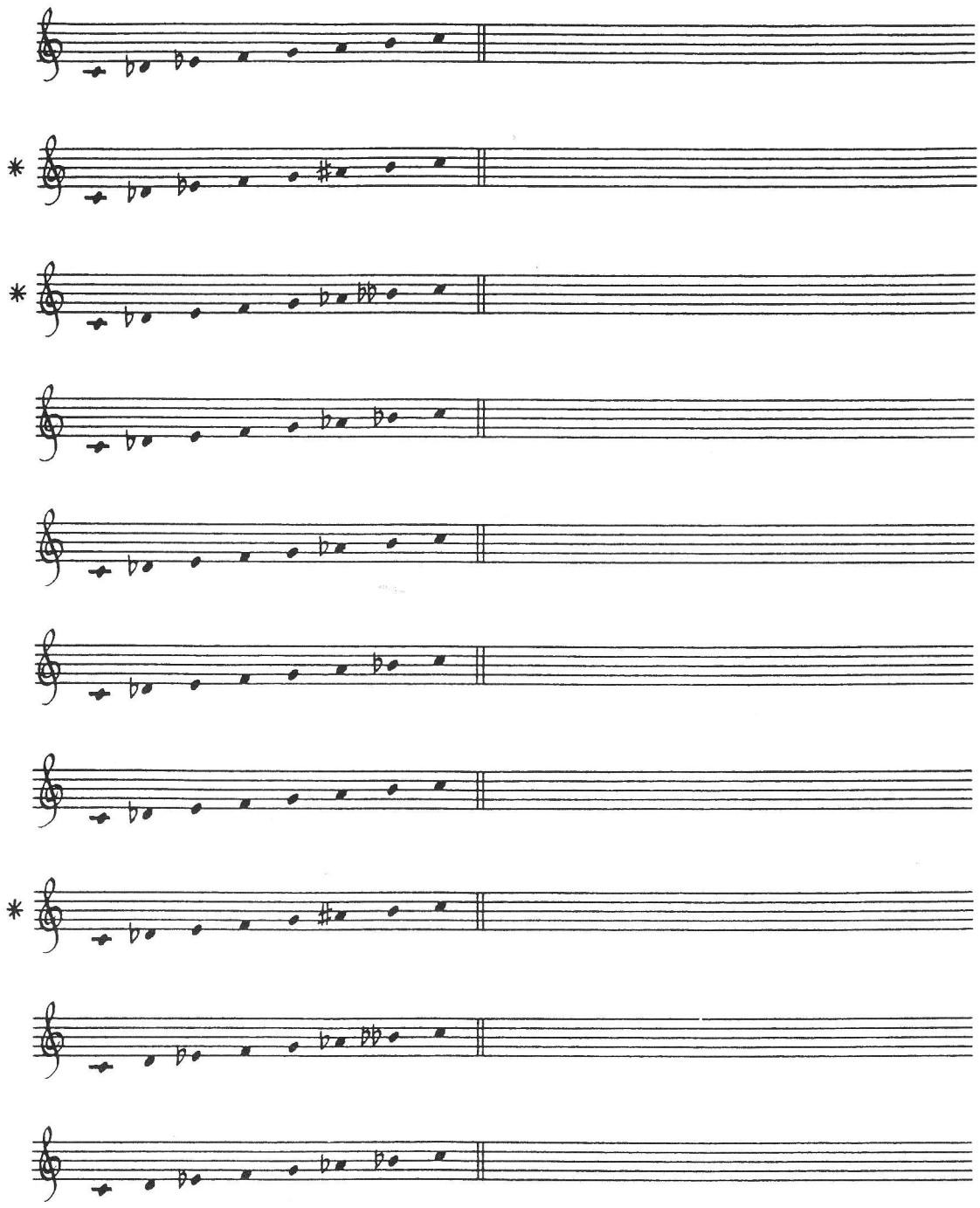
1. Jay Rahn, "Some Recurrent Features of Scales," In Theory Only, Vol. 2, Nos. 11-12 (Feb.-Mar., 1977), pp. 43-52.
2. Walter Kaufmann, The Ragas of South India, Bloomington, London, Indiana University Press, 1976.
3. Ibid., p. xxv.
4. Ibid., p. xxxiii.
5. Those melas that do not feature cyclic bisection are marked with an asterisk (*) in Figure 1.
6. Note that a number of janyas (of five or six notes) in melas without cyclic bisection could be grouped with regular melas instead (e.g., nos. 4: 2, 10, 17, 19; 12: 3, 14; 13; 2, 4, 7, 11, 12, 14, 20, 21, 22, 23, 25, 26; 18: 3, 17; 24: 7; 25: 5, 6, 10, 18; 31: 10; 32: 13; 33: 6, 16, 20; 37: 6, 8, 9, 10, 19, 23, 26; 39: 22; 41: 12; 43: 1, 13; 48: 6; 49: 13, 17; 54: 5, 17; 55: 5, 7, 11, 12; 60: 3, 5; 61: 5, 8; 67: 16, 19; 68: 8, in Kaufmann's numbering). This would reduce the average number of janyas in irregular melas and heighten the correlation between popularity and regularity. As Kaufmann points out (passim), a number of janyas could be grouped under more than one mela.
7. Rahn, op. cit., pp. 51-52.
8. Cf. Jay Rahn, "Javanese Pelog Tunings Reconsidered, "Yearbook of the International Folk Music Council, Vol. 10, 1978 (in press).

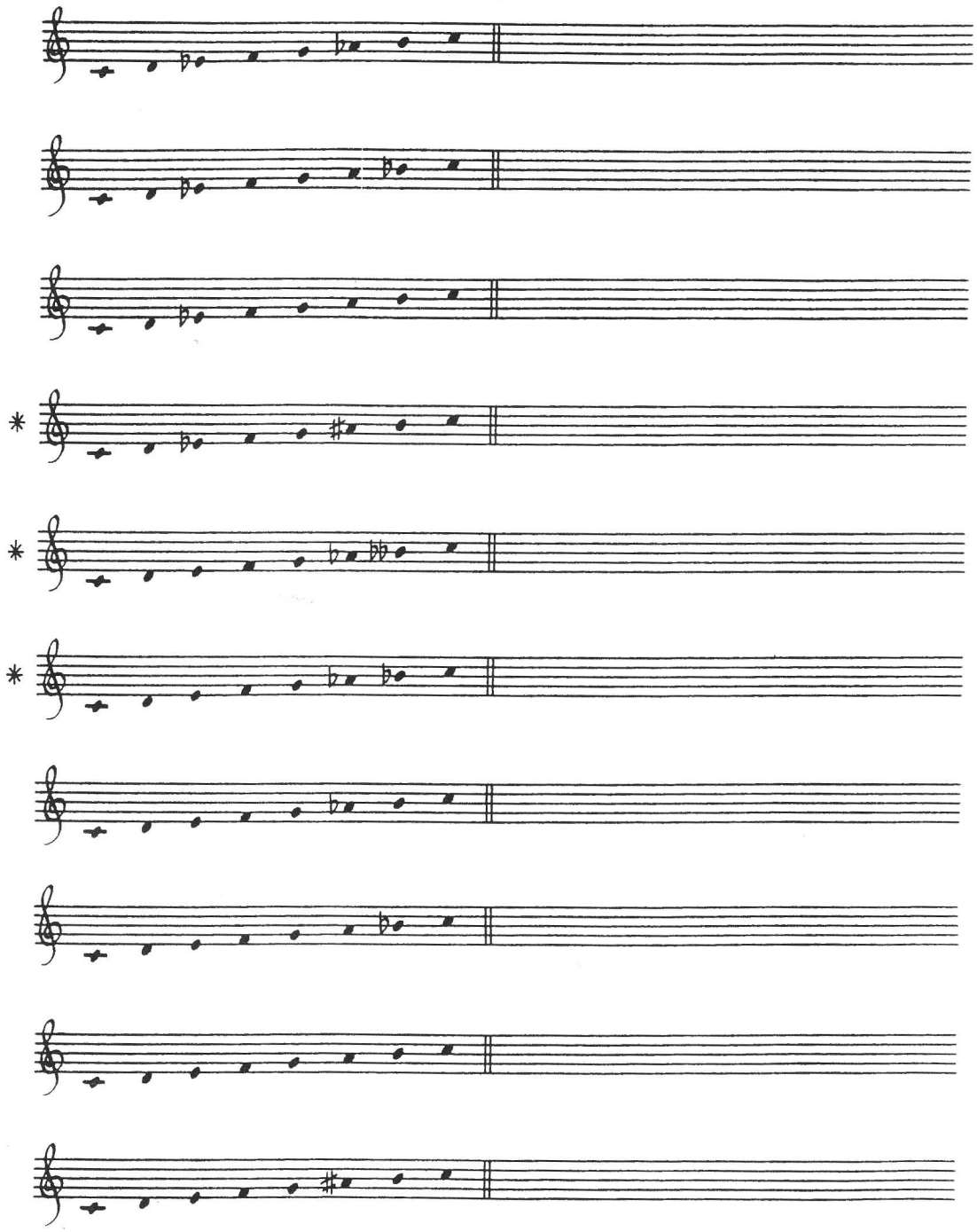
9. On Gebrauchsleiter, see Erich Maria von Hornbostel, "Studien uber das Tonsystem und die Musik der Japaner," Sammelbande der Internationalen Musikgesellschaft, vol. 4 (1902-03), pp. 302-60 (repr. and trans. in Klaus P. Wachsmann et al., eds., Hornbostel Opera Omnia, The Hague, Martinus Nijhoff, 1975, vol. 1, pp. 1-84, esp. p. 7 and Rahn, "Some Recurrent Features of Scales," p. 52.

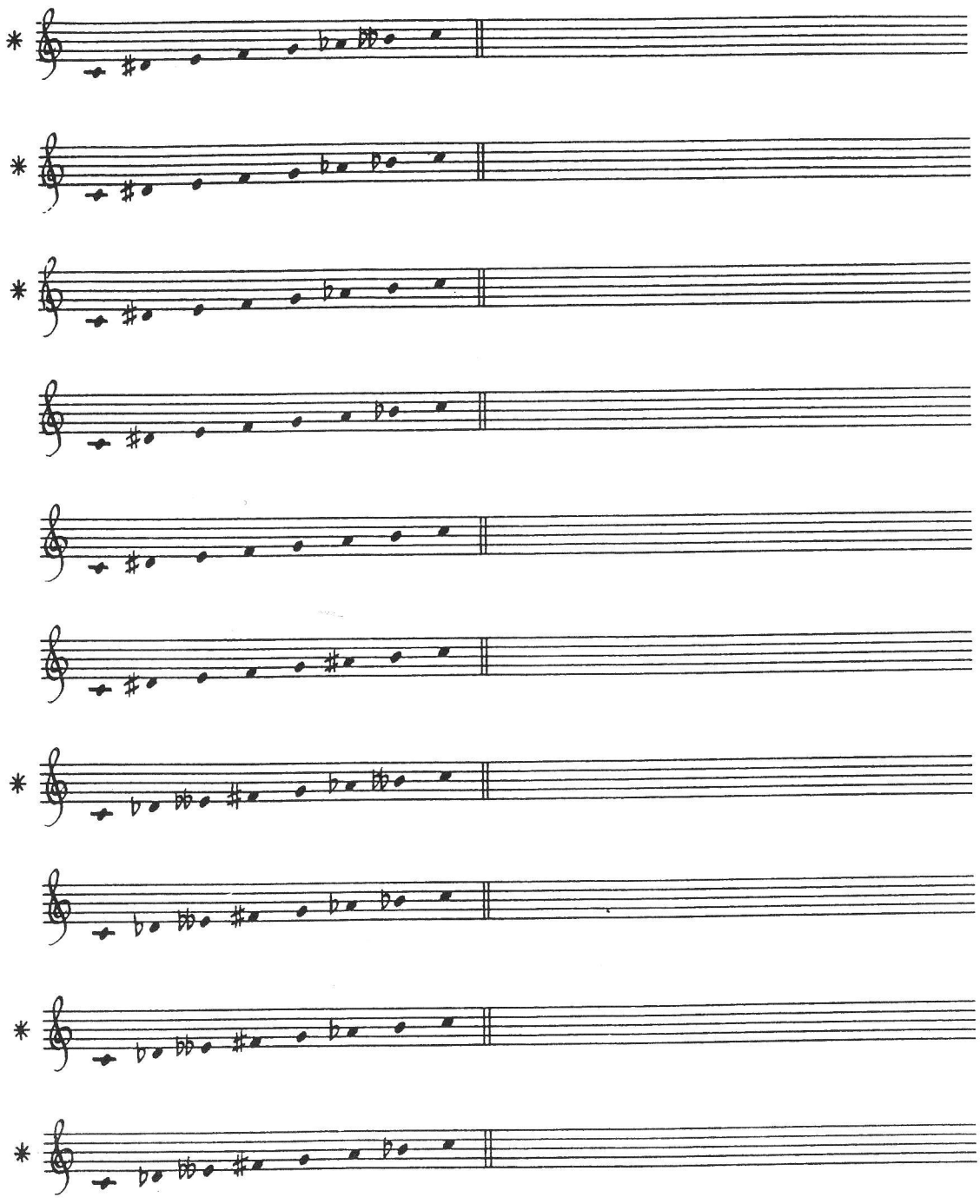
FIGURES

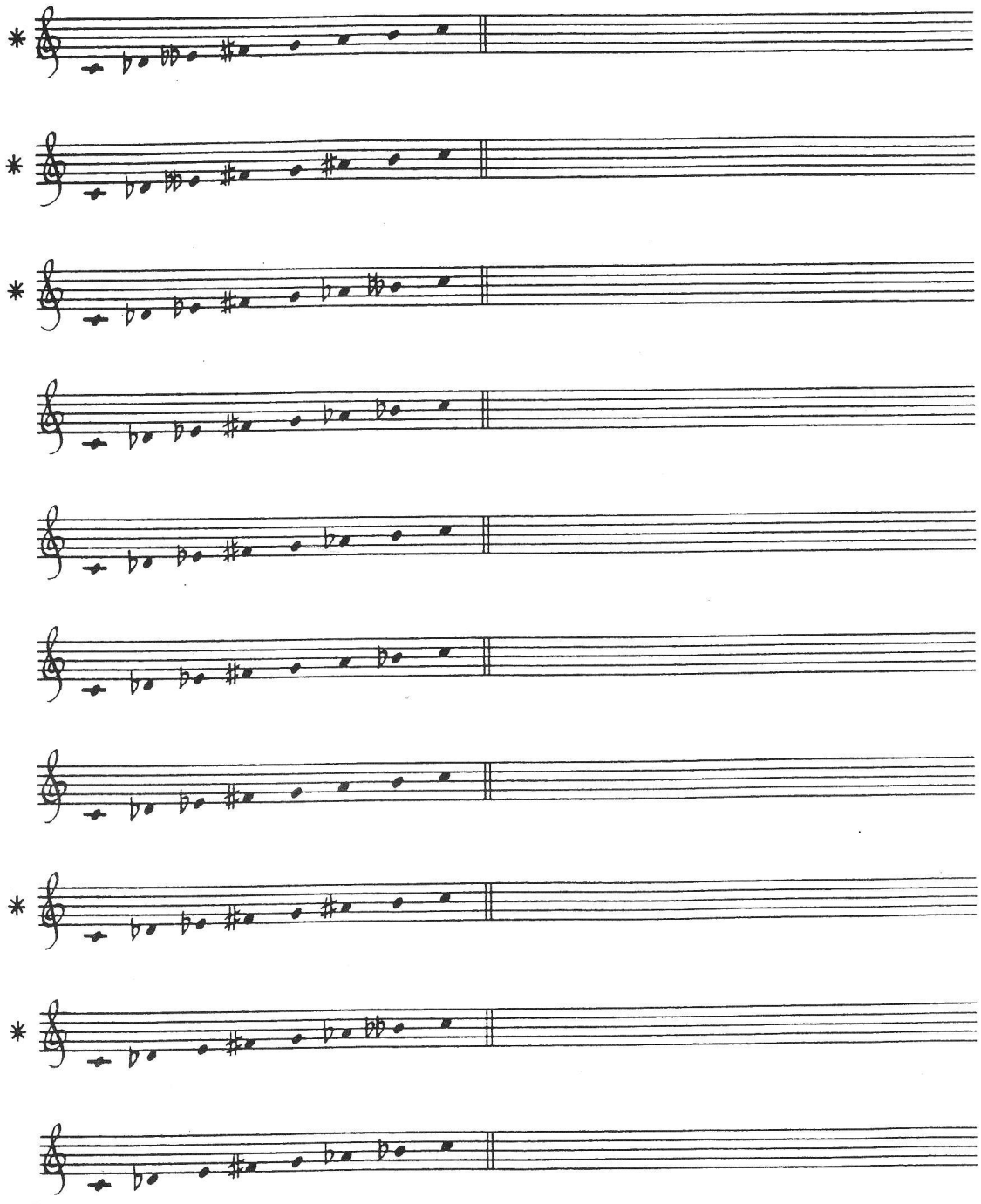
Figure 1: 72 South Indian Mēlas.

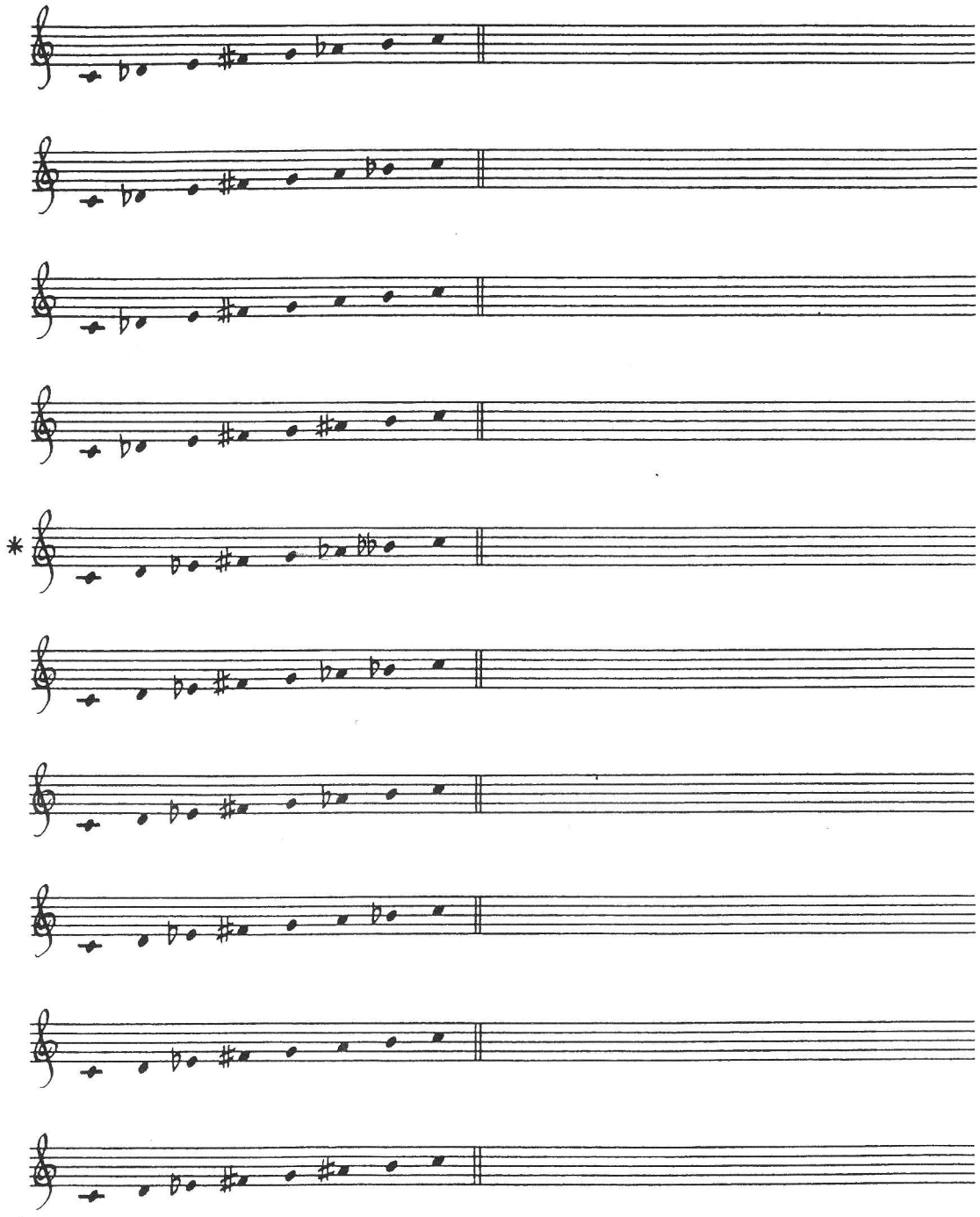


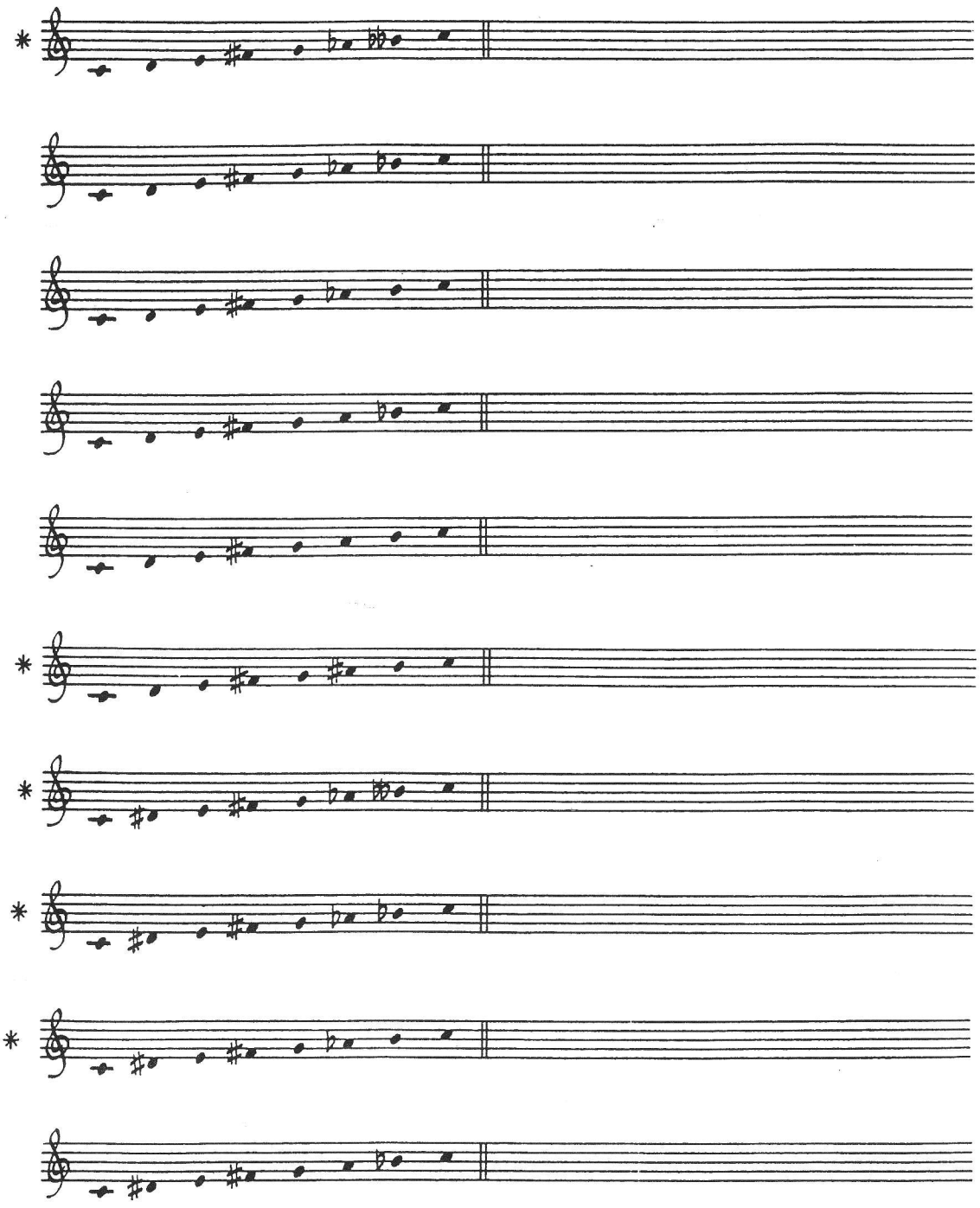


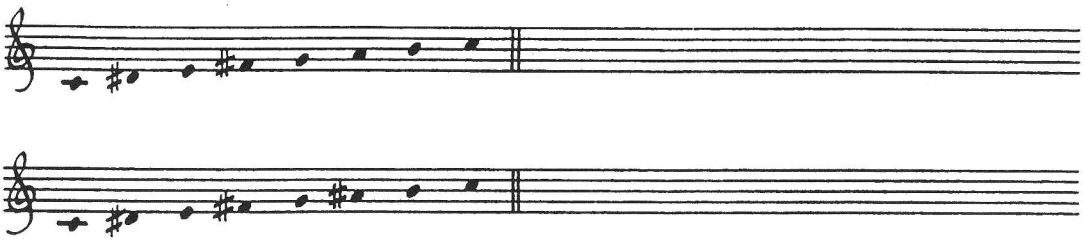












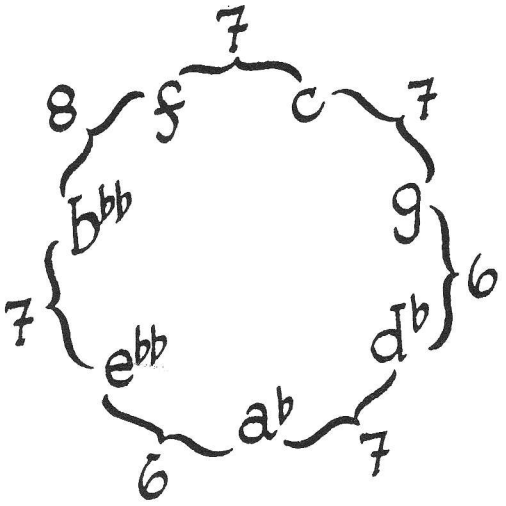


Figure 2: Mēla Kanakāṅgī expressed as a cycle of half octaves.

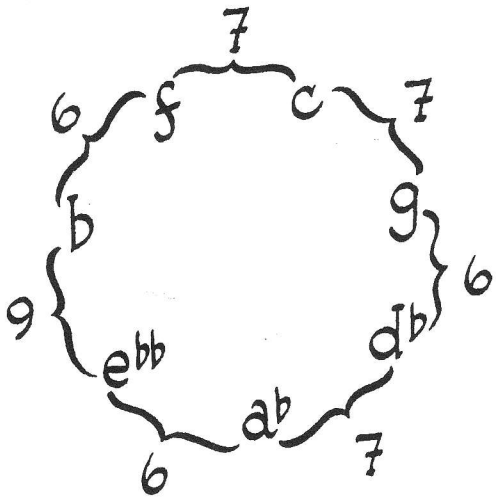


Figure 3: Mēla Gānamūrti

	No. of mēlas	No. of janyas	Average no. of janyas per mēla	maximum no. of janyas/mēla	minimum no of janyas/ mēla
Regular	45	1434	32	132	12
Irregular	27	497	18	28	13

	Standard Deviation	Z	
Regular	30.00	- 2.95	(less than - 2.88)
Irregular	3.47	19.10	(greater than 2.88)

Figure 4: Distribution of janyas among regular and irregular mēlas.

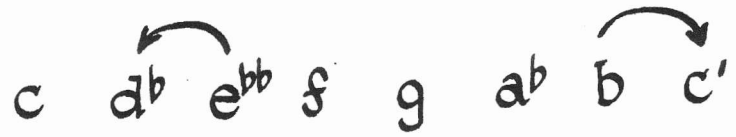


Figure 5: Mēla Gānamūrti arranged from low to high.