
MEASURING AFRICAN SCALES

by

HUGH TRACEY

An important aspect of music research in Africa is the measurement of indigenous scales and the ultimate recognition of a number of practical models which will be generally accepted by African musicians in various parts of the continent.

It will be appreciated that the scales we can now observe on the several instruments of fixed pitch, such as the xylophones, and Mbira (plucked reeds), and sometimes on the harps and lyres also, are the direct outcome of free choice in the composition of African music, largely in isolation and without recourse to any mathematical or linear measurement. In this regard African scales are equivalent to those elsewhere of pre-Pythagorean times (6th Century B.C.), and are based on psycho-physical choice rather than established physical norms. Consensus on the tuning of a scale within any one district or community must come from an innate feeling of correctness and general acceptance by musically minded persons within the group. I have often found that less skilled musicians depend upon their more gifted compatriots to decide for them the correct pitch of the notes of their instruments and will defer to them in case of doubt. That there is a "correct" local manner of tuning an instrument is generally acknowledged, and in this way the musicians and instrumentalists of a whole district or language group will be found to strive for an ideal scale or scales which most nearly approximate their common usage and taste, especially when instruments are played together in ensembles.

The first task then of the research student is to measure the incidence and pitches of African scales against modern measuring equipment without attempting prematurely to generalise in terms of present day western scales and intervals which have gradually evolved in Europe over the centuries from the time of Ptolemy (2nd Century A.D.). The danger of writing down African music as interpreted by a foreigner in conventional staff notation with plus and minus or other signs to indicate assumed discrepancies from the tempered scale is obvious, particularly as it tends to represent the local African gamut as an imperfection of a conventional foreign scale, whereas, in reality, the indigenous one, if generally accepted by a contemporary community, has an integrity of its own. Only after a considerable period of empirical research we will be justified in suggesting or establishing a form or forms of notation in respect of pitch which will adequately reflect African norms. This will not necessarily mean avoiding the use of a staff notation but rather the creation of suitable symbols or the use of tablatures which will indicate to the reader a set of note pitches which have oral validity within their specific context of time and place.

How this is to be done is still an open question.

Measuring Pitch

The first necessity will be the acquisition of a satisfactory means of measuring pitch. Highly sophisticated electrical equipment is now available but requires studio conditions for its proper use. Far simpler and more practical for field conditions is a set of tuning forks. Sets of 54 forks are now available* which give the student an accuracy of plus/minus two vibrations throughout the middle register (212-424 vs.). For several reasons this is precise enough. Forks have the added advantage of being portable. They are accurate through a wide range of temperatures and are capable of being sum-

*Quotations for a field research set of 54 tuning forks can be obtained from the African Music Society, P.O. Box 138, Roodepoort, Tvl., S. Africa.

jected to direct test by the African musician or instrumentalist concerned who can help to choose the exact fork to match the pitch he prefers. On numerous occasions I have been astonished at the certainty with which an African musician will unerringly select the right fork to coincide with his desired pitch. This would indicate that the chosen scale follows closely his innate selectivity regardless of secondary mathematical considerations of which he would appear to be quite unaware. There is a high degree of sensory perception in musical pitches on the part of African instrumentalists which cannot be dismissed as arbitrary or "primitive". When more than one musician in a language or tribal group is found when tested independently to demonstrate the same degree of accuracy of choice, then it becomes possible to postulate the existence of valid objective scale values, however subjectively achieved.

If the choice of note pitches in a scale was limited to the simpler mathematical ratios such as the octave (2:1), the fifth (3:2) or the fourth (4:3) one would suspect that the harmonic series was the basis of their selection. But the evidence of many measurements in the field has not so far indicated this to be the case. With instruments of fixed pitch the octave is generally recognised as a true or perfect interval and few African musicians in my experience fail to tune their unisons or octaves correctly. But whereas the true fifth is constantly found in African scales descending from the tonic, thereby giving its inversion a true fourth to the lower tonic, the reverse is hardly ever the case in a rising sequence. This is also true, I am informed, of modern Greek folk music of the mountains of Epiros.

It is significant to note that until the third or fourth century A.D., with the early Greek theorists, the approach to a scale was invariably from the higher pitch to the lower, a phenomenon which I have constantly observed in nearly all African territories south of the equator.

If African scales were founded on the harmonic series of overtones, as some writers have suggested, produced for example by a wind instrument, the fifth would be an ascending and not a descending interval. This theory is therefore unlikely to be proved correct.*

At what point in the history of Western music the descending attitude to modal scales gave way to an ascending one is not clear. It would appear to have been introduced with stringed instruments which have a fingerboard and particularly with the invention of fretted fingerboards with concomitant theories of temperament starting from the open string. As far as I know there are no indigenous African instruments with such fingerboards, the stopping of strings being usually done on the open string (not pressed against a fingerboard) or sometimes against roughly spaced raised wooden stops such as the *Nenjenje* lute of the Medje of northern Congo.

The first written mention of temperament as a phenomenon did not occur until the end of the 15th century, though no doubt the practice of temperament had been evolving over several centuries. There are a few places in Africa where consideration of the possibility of temperament has already started, but these are the exception.

Order of Tuning a Modal Scale

It seems likely that considerable light will be thrown upon African scales in instruments of fixed pitch if the observer is present when the instrument maker or player tunes his instrument for the first time during manufacture. There is little evidence as yet published on this aspect. On several occasions I have seen musicians tuning their instruments of the *mbira* family not in sequence of adjacent notes but in irregular order through some system of their own, though I do not yet have sufficient evidence to

*Intervals, Scales and Temperaments, by L. S. Lloyd & Hugh Boyle, Page 9: "Yet the fifth, or the fourth as an interval approached downwards, is perhaps the one interval, other than the octave, which we may count on finding in widely different musical scales, evolved by different peoples, in different countries, and in different times."

draw any firm conclusions. The Chopi xylophonists from Mozambique almost invariably tune their slats in regular ascending order, attempting, they say, to achieve even intervals throughout the central octave starting from *Hombe*, the tone centre. The remaining notes are then tuned in true octaves from the already established heptatonic scale. What is here remarkable is that several Chopi instrumentalists are able to tune their xylophones entirely by ear without reference to another instrument or musician and find their sense of "perfect pitch" for this instrument coincides exactly with that of their fellow musicians. Here again is an indication of the integrity of local modalities which cannot be lightly dismissed, or attributed solely to memory.

The tuning of wind instruments, with the exception of the single note end-blown flutes or pipes, is more arbitrary, as the complex physical theory of flute tuning does not appear to have been discovered. Indeed wind instruments were the last to have been added to western instrumental ensembles on this account. In consequence, African flutes are usually played solo employing the intervals dictated by the physical properties of each individual instrument. In only one instance have I found V-notched flutes being played together in unison, and truly in tune with each other. They were three *Abalere* flutes of the Ganda played on Mengo Hill, Kampala. The musicians described broadly how they made them but I was not able to watch one being constructed, or to learn how they managed to bring them into exact pitch with each other.

The tuning of single note pipes is subject to free adjustment through the alteration of the length of each pipe, reducing the length to raise the pitch or, with open-ended pipes, by the use of plugs and ramrods. The Zaramu of Tanzania, among many others, use the former method and the Tswana of Botswana the latter. It is interesting to note that the modes employed for an ensemble of pipes is not necessarily identical with the scale of the xylophones or mbira used in the same village, though there is no reason which would prevent their being tuned in unison with each other if they cared to do so. The familiar modes of the two kinds of instruments (flutes and xylophones) are not necessarily associated with each other in the mind of the players and in consequence such instruments are not usually, if ever, found in the same ensemble. In most African ensembles in my experience, one kind of melodic instrument only is featured at a time, together with percussive accompaniment such as drums and rattles. The introduction of more than one type of melodic instrument may yet develop from contact with western instrumental practice. In Uganda different kinds of stringed instruments are played together such as the *Ndingidi* lute with the *Endongo* lyre, accompanied by a drum, the eight string lyre being tuned to the accepted scale and the single string lute taking its pitch from it.

Diatonic or Chromatic Scales

From all the evidence at present available there does not seem to be any sign of the use of chromatic scales in Africa but only of diatonic. By this is meant that the instrumental scales so far observed and measured represent only the notes used in a single mode without including others which apply specifically to another mode. Admittedly several instrumental and vocal modes may be found to exist in practice within one community, but the totality of pitches used in those modes as far as we know are never assembled and combined on a single instrument in one chromatic sequence. Thus in present day usage African musicians may vary the pitch of their tonic or starting note, but when tuning their scale from this pitch they do not appear to change the modal relationships of the consecutive untempered intervals. This being so, it can be claimed with justification that there is no change of key in most African music but only a change of mode using a different note pitch as a starting point or tonic within essentially the

same scale, as with the early Greek modes. Again the Chopi have shown this to be possible*.

Far more evidence must be gathered, and intervals measured in the field in the presence of the musicians before general rules can be deduced for African tuning practices. It is particularly important that research students should not infer that African scales contain common western intervals merely because, to their undisciplined ear, they seem to do so. Accurate measurement is essential. For example, it may be found that African musicians use four or more varieties of tone in the ratios of 8:7, 9:8, 10:9 and 11:10 (maximum tone, 234 cents; major tone, 204 cents; minor tone, 182 cents; and minimum tone, 165 cents), which makes nonsense of generalisations about their striving for conventional intervals found on our keyboard instruments. The visual corrective of a diagram on graph paper setting out the exact position of each note in an African scale in relationship to the tempered scale, together with a diagram of intervals employed, is a prerequisite to any statement about an African scale, or for that matter, to an acceptable system or systems of notation for various African musics. It may be found necessary to avoid the use of the alphabetical system of naming notes with the western rising sequence of pitches in letters from A to G, and substitute for heptatonic scales other letters such as J to P or a numerical one (1—7) in *descending* order. This may prove to be a trial to conventionally trained western musicians but the discipline involved might well “rid their minds of cant” and the jargon which would tend to hide the realities of African musical sense behind a screen of familiar western catchwords.

The increasing use of the guitar throughout central Africa will require special attention, as it is a fretted instrument which involves an involuntary use of temperament. Anyone who has recorded an individual repertoire of several songs by a single performer to the accompaniment of a guitar is likely to have noticed the tendency with few exceptions to play every item in the same mode or “key”. Close examination of such a guitar will generally reveal, from the finger marks, the very limited use of the keyboard, confined in most cases to the production of the three common chords, and also the fact that the strings themselves are not necessarily tuned to the western conventional sequence (E, A, D, G, B, E).

The voice is notoriously adaptable and singers will usually (though in Africa not always) modify their performance to the scale of an accompanying instrument and revert to type when unaccompanied. I found a notable example of this several years ago with the Namirembe Cathedral choir at Kampala when the performance was relatively commonplace when accompanied by the organ but filled with delightful modal subtleties when freed from its restrictions.

The very adaptability of the voice will pose certain problems to research students when studying the music of those communities which do not use instruments of fixed pitch from which their modal equipment may be determined. Since far greater latitude is allowed to singers than to instrumentalists, (particularly western singers who use excessive tremolo), the pitch of each note in a vocal scale may be ascertained only as a nucleus and not as a mathematical exactitude. In this case it may be necessary to determine a new kind of “mean-tone system” or “just intonation” for each musically homogeneous community. The fact that such a system might be accurate for use in one mode or “key” only would be no disadvantage in the immediate future as it would give way to more elaborate systems without difficulty as African musicians became consciously aware of the position. So long as the need does not arise, there is little point in setting out a system more complicated than the situation warrants. We would

*i.e. “Sound of Africa” Series, TR.207 — (B. 5 & 6). “Lawanani Michanga Sika timbila tomakono”, — where this composition of Komukomu is played by him and his *timbila* orchestra in two modes, the one pitched one note (approximately a minor tone) lower than the other. He had recorded this item for me on a previous occasion, and when I asked him to record it again, it was immediately clear to me that it was not in the same mode. He admitted he could play it in either, and so without hesitation recorded both versions.

thus avoid confusion in minds which are as yet unprepared for the next step, and at the same time retain the undoubted charm and distinctiveness of the many African intonations.

The primary function of the research student, I maintain, is to accumulate data by detailing the incidence of musical scales, however subjective, as they exist in practice in each part of Africa and not prematurely to introduce an "ideal" system of tuning of his own choice such as the western tempered scale which may have no artistic support in the present day within the limited musical cosmos of African peoples. The mathematical complications of the artistic and scientific objectives of temperament, and the setting out of scales with fixed intervals as with the western keyboard instruments, however useful in other circumstances, need not be contemplated at this stage. Indigenous instruments of fixed pitch do not lend themselves to temperament and there are unlikely to be African musicians who would be capable of maintaining such standards unaided even if it were theoretically possible. As far as is known there are few if any African professional piano tuners in the whole continent and, even if there were, the services of such men would not be available to village musicians who must continue to tune their instruments by ear against their own psycho-physical norms.

A clear picture of the reality of innate tunings throughout Africa will be the best foundation for logical development in future rather than the illogical acceptance of any foreign theory and especially of notations based upon temperament.

Where there is still no need for freedom of modulation in African instruments of fixed pitch (to enable the musician to change key), there is no call for the mistuning of established, if subjective, African intervals, either (*a*) prematurely to attempt to achieve equal temperament, or (*b*) to insist upon the immediate use of such expensive instruments as the piano or organ in educational work. Far better to understand, analyse and employ the undoubted African musical sensibilities as they exist, untrammelled by mathematical theories, and so prepare the way for real progress to keep pace with actual and not imagined musical ability.

This I consider to be one of the major contributions of any musicologist to the study and encouragement of music in Africa.