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A KWAIKÈR INDIAN XYLOPHONE

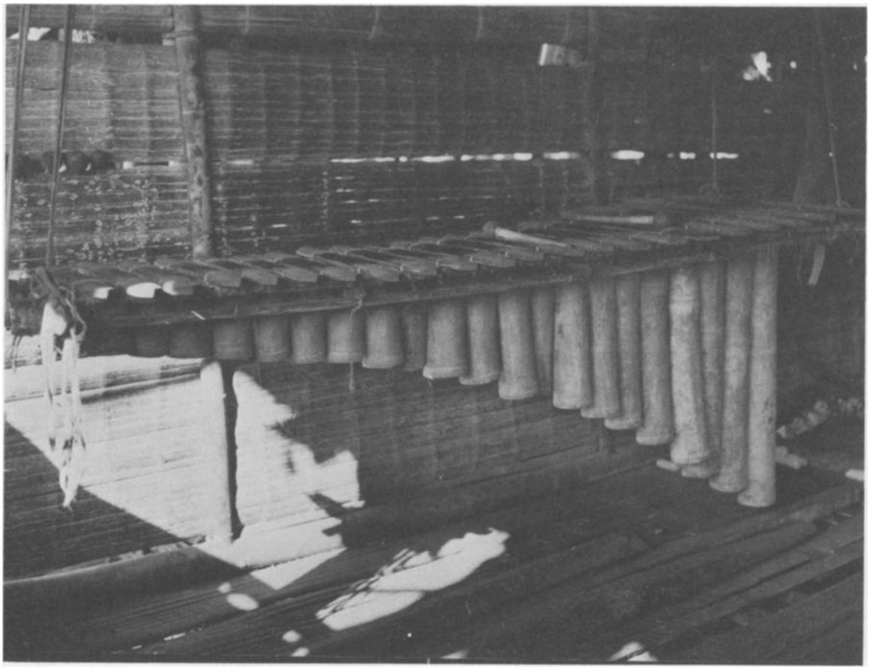
A. M. Jones

The American Indian xylophone occurs mainly in Mexico, Guatemala, Honduras, Colombia, and Ecuador. At first blush it strikes one as a very sophisticated instrument built of planed timber, with elaborately constructed thin wooden resonators (Lee 1926:607; Long 1936:453), and tuned to the chromatic Western scale. Closer investigation shows, however, the existence of a much simpler and more bucolic type which is found up-country in some places. Vida Chenoweth (1964) and Lee (1926:612) have described or pictured such instruments for Guatemala. But no one, it seems, has critically examined the _tuning_ of these up-country xylophones: one has the impression from the literature, that they may be tuned to a non-Western scale. If so, this is of prime interest to the ethnomusicologist. Recently an opportunity has presented itself to the writer to test the tuning of one of these xylophones, and it is this tuning which is the subject of this essay: at the same time the opportunity is taken to discuss some of the factors attending an exercise of this sort.

For some ten months last year, Miss Ann Osborn, during an anthropological field study, was staying with an Indian family of the Kwaikèr[1] tribe. This small group, part of the Chibchan language family (Steward 1947:967), lives in Colombia near the boundary with Ecuador, in the southern department called Nariñio, in the western foothills of the Andes, their territory lying roughly halfway between the capital, Pasto, and the seaport Tumaco. Both the father of the family, Benancio, and his son Luis are xylophone players, and Miss Osborn on numerous occasions made tape recordings of their playing. She did not, however, make a specifically analytical recording of the separate notes of the instrument such as would enable an ethnomusicologist to obtain clear-cut figures for the scale used. Nevertheless here was the first chance we have had of trying to determine this tuning. To take readings on a _Stroboconn_ from an actual performance of music is very difficult indeed: but _faute de mieux_ the attempt was worth making.

The xylophone, which is slung from the roof of the owner's house, contains twenty-two keys made from the _Chontadura_ palm, resting on two transverse beams wrapped in _bejuco_ leaves which serve as an isolating cushion. The keys are held in place by two thongs wrapped round them at the nodes. Each note has a bamboo resonator, plugged at the bottom by the natural node, and open at the top, and held in position by a horizontal stick which pierces through it near the top. Either one or two players perform on it: in the latter case, one player operates the lower notes and the other, standing opposite him on the other side of the xylophone, plays the treble ones. They each have two playing sticks which have a head made by winding on the stick a length of latex rubber.

The music played by these Indians is quite distinct from that of obviously Spanish provenance: in fact, Miss Osborn says that her Indians would not be able to play the latter at all: this Spanish-style music is played by _mestizos_. She has some recordings of the latter, and the difference between the two styles is unmistakable. However, in this essay, we are solely concerned with the _tuning_ of the xylophone.



A Kwaikèr Marimba. (Photo: Ann Osborn).

At the outset one was faced with three difficulties. Firstly, Miss Osborn had not recorded a tuning fork so as to enable us to correct any variation in pitch caused by dubbing and replaying on a different machine. Secondly, as she used a small battery model, there is no guarantee that each time she switched on, the machine ran at exactly the same speed. We know by experience how greatly even a mains-operated recorder can vary in this respect. Thirdly, as we have already mentioned, it is not possible to obtain unequivocally accurate readings on a Stroboconn from a recording of a musical performance because the notes have too short a duration of time for the stroboscopes to register properly.

Under these circumstances, what scheme could be adopted which would yield the most trustworthy results? There are, of course, two ways of computing a scale: one is to measure the pitch of each note (vib. per sec.): the other is to measure in cents the intervals between successive notes. The latter, in this case, is much to be preferred as the results will be independent of the vagaries of the recorder. The v.p.s. method can then be used as a secondary check. This is the basic procedure we adopted.

In any one tune only certain notes will be used: so, in order to register as many of the xylophone notes as possible, we took samples from a wide selection of pieces. All told we took about twenty-two sections of the tapes and calculated the cents values of the intervals for the notes on each separate section.

What now is to be done with this large array of figures? Two important factors are involved. Firstly, consider the case of any one particular interval.

We have now got a lot of varying values for this interval. If we merely take the average of these as our final result, we shall give too much weight to the extreme deviations in our readings—what one might term our "worst efforts." A method more likely to give the true figure and one which gives little weight to these extreme deviations is to calculate the median figure, that is, the "middlemost of a group of figures arranged in order," the formula for which is $\frac{n+1}{2}$, where n is the total number of readings we have taken for this interval.

Secondly, to find out the nature of the scale, it is wrong merely to look at the intervals expressed in cents. We have dealt with this elsewhere (Jones 1964:26ff.), but the point needs emphasizing. If one is certain that the maker tuned the instrument solely by listening to the intervals of adjacent notes, such a list of intervals would be acceptable. But if it is possible that he might have paid attention to other relationships in the scale, then a list of intervals may be most misleading, for it will tend to double in size any error he makes. Take a simple example: suppose a man is tuning by ear the notes $D^{\#}$, E, and F in the modern Western scale: the intervals in cents should be $D^{\#}$ - 100 - E - 100 - F. Suppose he tunes E badly, making it 20 cents flat. The figures will now be $D^{\#}$ - 80 - E - 120 - F. The difference between the intervals E - F (120 cents) and $D^{\#}$ - E (80 cents) is 40 cents, whereas in point of fact his error was only 20 cents. By doubling his error the cents intervals give a totally false picture of the actual situation. To avoid this, one should use Cumulative Cents figures. Starting with one note to which we assign the number "0", we successively add the interval numbers together: the resulting table gives a far better indication of the scale the maker was aiming at.

In reviewing our tuning figures it was noticeable that no less than eighteen out of the twenty-two samples contained a note at approximately 309.5 v.p.s. Accepting this figure as a point of departure, one could ascertain from the median intervals, the vibration number of all the other notes. The following Table shows the final result. The third column—the Median Interval in cents—is the important one, for it is from this column that the others were calculated.

TABLE I

V.p.s.	Cent no.	MEDIAN INTERVAL in cents
186.2	157	163
204.5	320	149
223	469	248
257	717	127
277	844	193
309.5	1037	176
342.6	(12)13	197
384	210	149
418.5	359	189
467	548	130
503	678	205
566	883	154
619	1037	133
669	1170	

To anyone accustomed to non-Western xylophone tunings, this Table at once suggests that the scale is probably an equiheptatonic one. This can better be seen by setting out the Cumulative Cents. The theoretical equiheptatonic scale has a constant interval of 171.4 cents between each note. The left-hand column in the following Table shows this scale in Cumulative Cents: the right-hand column is obtained by successively adding the intervals given in Table I.

TABLE II: Cumulative Cents

Theoretical Equiheptatonic in Cents	Xylophone
0	0
171	163
343	312
514	560
685	687
857	880
1028	1056
1200	1257
1371	1406
1543	1595
1714	1725
1885	1930
2057	2084
2228	2217

TABLE III: Thirds in Cents

287
312
319
320
335
338
346
359
369
373
375
397

Let us look closer. In an equiheptatonic scale the interval of a third is a very discriminating one. It contains 2 x 171.4 = 343 cents as against the equal-tempered 300 cents for a minor third, and 400 cents for a major third. If a scale consistently registers about 343 cents for its thirds-intervals, that scale is an equiheptatonic one. The Kwaiker xylophone gives the following thirds (Table III) intervals in cents—arranged in order of size.

The Median Value for these figures is 342 cents—almost exactly the theoretical value. Were the maker aiming at a scale containing semitones, there would be one set of thirds hovering above and below 300 cents and another set above and below 400 cents. There are no figures at all above 400 cents, and our figures can be seen not to fall into two groups but to provide a continuous spectrum of values from the lowest to the highest.

Further, looking at Table II, we can compare the relative sizes of the respective thirds in their lower and higher octaves and we see there is no selectivity in the use of either small or big intervals, for if there were, these would appear also in the octave above (unless one is to postulate each octave being tuned to a different scale!). For instance, the first third in the low octave is 312 cents: in the octave above it is 338 cents. The second third of the low octave is 397 cents and its octave is only 319 cents—and so on. The variation in size of the thirds may be due either to defective readings on the Stroboconn (which were to be expected) or to inaccuracies in the tuning by the maker, or to a combination of both.

We suggest that one can reasonably conclude that the maker was aiming at the Median Value and this constitutes a strong indication that the scale he is using is the Equiheptatonic Scale. When we compare his Cumulative Cents figures (Table II) with the theoretical values we see that he has made quite a fair attempt, though these Median figures are not accurate enough for us to make a final judgment.

We make no claim that the figures we have given are perfect. They are the best we could produce under the circumstances and are, as far as we know, the first quantitative evaluation of an American Indian up-country xylophone scale. They are put forward in order to set the ball rolling. Many more tuning lists must be collected and they should, if possible, be compiled by taking a Stroboconn out to the field so as to get an indisputable set of figures: or, at the very least, careful tape-recordings should be made for measuring purposes—tapping each note slowly at least three times and recording an A-440 tuning fork on the tape as a permanent pitch-reference.

There is an urgent need for expeditions to up-country Guatemala, Honduras, Ecuador, and Colombia. Cannot universities help us musicians here? Any field expedition—not necessarily a musical one—should be able to take a tape recorder and bring home valuable material. We suspect there may be more in these up-country Indian xylophones than meets the eye.

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FOOTNOTE

1. Given in Steward as Coaiquer: we follow Lehmann's spelling.