Filtering partials with a friction bow – the unusal playing technique of the *Serankure* in Southern Africa[1]

Jürgen K. Schöpf, 13.11.2017

Summary

Bowed monochords in Southern Africa are not confined to a single ethnic community or language. They are therefore known by a number of names[2]. For this article I will only use the Setswana proper name *Serankure*[3]. This instrument type is played in a way that is most likely unique: the comparatively short bow (ca. 20cm) has no built-in permanent tension. By deliberate changes in the bow hair tension while playing, this bow is rubbed against the metal string in an elliptical motion (variable contact point). Through such changes in bow hair tension certain partials of the string can be emphasised and used musically. This playing technique has been wrongly described by early authors using observation and interviewing only. A new explanation takes the vibration of the bow hair bundle into account and models it as a filter. The frictioning of the bow hair against the string is furthermore modelled as a double string system, forcing a resulting vibration that both members can perform. Thus the bow hair tension can be used to directly influence the vibration mode of the string. The length of the bow and elliptical movement are preconditions for this system to work.

The instrument – construction

The monochord trough zither *Serankure* can be described – in terms of the Hornbostel-Sachs classification of musical instruments – as a true stick zither with attached resonator, code 311.221 (HORNBOSTEL 1914:576 and MIMO 2011).[4] It consists of a partly hollowed out wooden rod usually a little under a metre in length (83-114cm), the diameter being 3.5-5cm (SCHÖPF 2008, NORBORG 1987, Phuthego 1999 and 2006). A metal wire string is wrapped several times around the upper end, and then pulled from behind through a cut and over the wrapping (that serves as bridge). A the lower end a tuning peg keeps the string under tension. A flattened tin can is used as resonator.

The bow called *Kopana* is approx. 20cm long. In its making, the wooden stave is asymmetrically curved under heat to an angle of about 60°-70°, and dried in this position. Two cuts at either end receive the bow hair, preferably of a *Kukama* tail (*Oryx gazella*). The bow hair bundle is at one end knotted to a plastic thread and thus extended. A thick knot is applied to the hairy end, which in turn is inserted into a small cut at the thinner end of the bow stave. The plastic threaded end is tied to the thicker end of the bow. The bow hair tension is kept with a slight slack.

1 This text is an updated and translated version of SCHÖPF 2011.
2 For a more extensive discussion on these names see SCHÖPF 2010.
3 See Figure 2 at the end for a photograph of a specimen.
4 For a more detailed discussion on the classification of the *Serankure* see SCHÖPF 2010.

History, distribution, application

Historic reports mention resonators made from calabash, ostrich egg shells and dried leather bags. Therefore the technological preconditions to build this instrument in the south-central-African high plateau are fulfilled at least from the 14th or 15th century on and thus pre-colonial. From this time archaeological evidence of metal wire production is available in Zimbabwe (PHILLIPSON 1977). The exploitation of higher partials of a string for melodic purposes as well as the physical appearance of the instrument point to a relative chronology and descent from the musical bow. This allows to place the *Serankure* in an ancient and unbroken tradition from pre-historic times (in either written and oral history). The area of distribution of the *Serankure* suggests its core in Tswana settled regions. The independent development of the friction bow appears likely (SCHÖPF 2008).

The *Serankure* has been an instrument of herders in Botswana. While lacking earlier accounts this is evident for the first third of the 20th century. Boys between 10 and 20 years of age were usually sent out herding cattle for weeks or even months. In this setting the instrument served the herders for their personal entertainment as well as for guiding the cattle. Its principal use has been the accompaniment of one's own voice, ensemble usage being rather an exception (for more details see SCHÖPF 2008). Until the 1990s, no women were reported to have played the *Serankure*. An innovation that is likely to be attributed to the annual Botswana Music Camp where playing the *Segaba* -- another common name for the *Serankure* – can be learned.[5]

Playing technique – previous explanations

The player holds the instrument while sitting, usually with the 3rd to 5th fingers of one hand grasping the tuning peg. This hand rests on the horizontal thigh close to the knee. The upper end of the instrument with the resonator rests against the shoulder. All combinations of using the left or right hand, or left or right shoulder have been documented, but a player is usually consistent in using one of the four options. The thumb is used to brace the string at one spot close to the tuning peg. For some rare pieces of music up to three bracing spots are used. Predominantly two fundamentals in an interval of about a second are produced. Transcriptions show e.g. a scale of d', g', a', c'' and d''.

The first published report on this instrument is provided by KIRBY (1934). Regarding the playing technique he writes:

> *"… the variation in tensioning is deliberate, and, together with the choice of spot, on which the string is bowed, serves to isolate certain harmonics of the string."*

The first part of this explanation most likely is based on KIRBY interviewing players because the variation in tensioning the bow hair can hardly be observed externally while it is being played. The second part rather relies on KIRBY's knowledge – and inference – of *flageolet*-technique of European violin family instruments. KIRBY's explanation becomes more pointed in Nicholas ENGLAND's dissertation of 1968, published in 1995, on the music of Khoisan people in the border area of Botswana and Namibia. ENGLAND repeats KIRBY's explanation and adds to it an elaborate drawing (see Figure 1 below).

He starts at the bottom of the figure with a transcription of the two fundamentals (open string and one braced position) in a two-line notation. He then calculates for every sounding tone its respective vibration node on the string. He then connects these vibration nodes on the string for the *flageolet*-tones with the transcription of the resulting music. From this he deduces the seemingly required

5 See PHUTHEGO 2006: 192.

vertical motional pattern of the bow as the central statement of his drawing. This motion pattern is derived from the "*flageolet*" explanatory model in a deductive manner, not from empirical data, and it has not been tested empirically. In fact, it cannot be tested. KIRBY, ENGLAND, and BREARLEY have not played the instrument themselves. Otherwise they would have had to reject this model immediately.

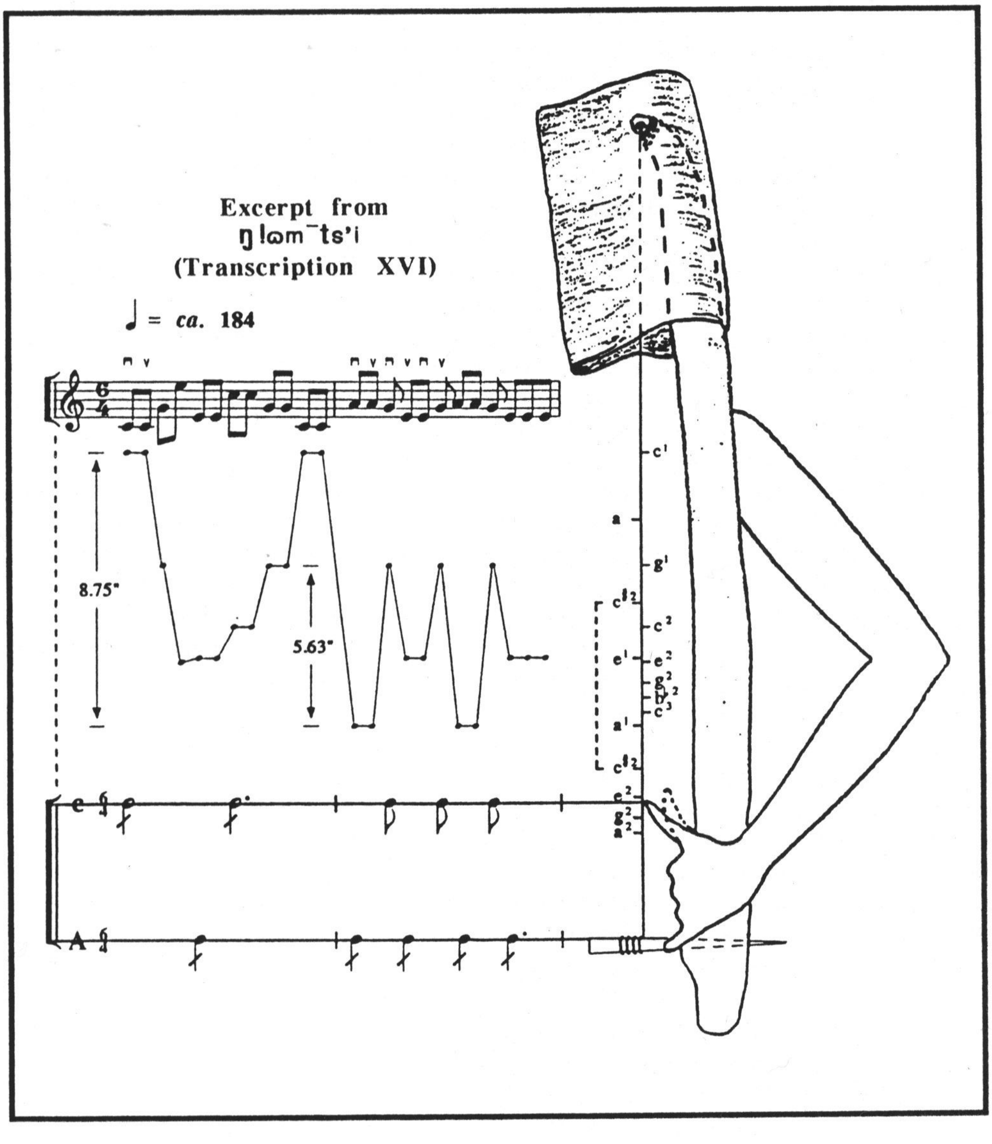

Figure 1. This explanation of the playing technique of the *Serankure* is clearly wrong, as is obvious to all players (taken from ENGLAND 1995, Figure 11).

Falsification of previous explanations

The model of KIRBY and ENGLAND, also taken over by BREARLEY, contains two mistakes: first, by consequence of the *flageolet* explanation, the vertical bow movement along the string depends of the played melody and *vice versa*. Therefore a certain motional pattern results in a specific melody. Hence, for any *other* melody a *different* motional pattern is required. This, however, does not match the observable facts: the player moves the bow in a continuous and elliptical motion on the string regardless which piece of music he actually plays.

Second, after Young's Law, it is impossible to provide energy to a string at its vibrational node. A *flageolet* is produced when the respective vibrational node is held still, while energy is provided to the string at a different spot. However, the thumb of the *Serankure* player braces the string always at the same position in the interval of a second, thus shortening the effective length of the string. Therefore a second point to put energy into a *flageolet* is not given in playing the *Serankure*.

A new explanation

Inspired by acoustician Jobst FRICKE (oral communications 2002-2005), the key to a valid explanation is the bow hair. It is known that friction bow hair can itself vibrate, theoretically both in transversal as well as longitudinal modes. Its vibrational mode depends on the same parameters as those governing the fundamental frequency of any string: length, mass, and tension.

Therefore we model the *Serankure* with its bow as a coupled system of string and bow hair that are rubbed at each other while the contact point is constantly changing. Such a coupled system can only vibrate in a frequency that both parts of the system are able to perform. This can be achieved in the present case because the bow hair is short enough to overlap with its transversal vibrational properties with those of the much longer, yet thinner metal string and higher tension. In order to control the resulting vibration it is sufficient to control just one of the parameters of only one part of the system, in this case the bow hair tension.

In other words: the player sets the bow hair with his hand under a certain tension, and thus, a certain fundamental frequency of the bow hair bundle. In rubbing the string with this tensed bow hair he provides energy to the string and causes it to vibrate transversally, while at the same time forcing the string to comply with this fundamental frequency of the bow hair bundle. The bow hair thus acts not only as the provider of energy to the string, as in all other bowed instruments, but at the same time also as a mechanical filter, forcing the string to comply to its own vibration. Since the playing hand is in direct contact with the bow hair, this transversal vibration can easily be sensed by the player.

Increasing the tension of the bow hair results in a rise of the fundamental frequency of the bow hair, forcing the string to comply. But while the string cannot perform any frequency (due to its constant parameters of length, mass and tension during playing), it will jump, just as energy levels in quantum physics, to the next possible higher stable vibration, that is, the next higher partial of the series of overtones.

The elliptical movement of the bow on the string, i.e. with a constantly moving contact point, is required because both sub-systems, bow and string, need energy to vibrate, and both need this energy in a *transversal* mode to develop their respective *transversal* vibration. If the contact point were stable, only one sub-system could derive energy from the movement and the coupling of the system would immediately break down.

Conclusion

Careful observation and playing of the *Serankure* have led us to clearly falsify the earlier explanations of KIRBY and ENGLAND, echoed by BREARLEY. Instead, we are able to present a valid model of the physical process involved. Since the *Serankure* playing technique superficially resembles that of other bowed instruments it is mistaken as such by the naive observer. But both theoretical and empirical analysis presented here clearly support that the *Serankure* bowing technique is unique in the fact that it allows to elicit specific partials with the bowing technique itself.

Figure 2. A Serankure of Pae Moeketsane, photo by the author, 1997.

References

Brearley, John (1996) "The Segankuru – a 'Bush Fiddle' or a Bowed Bow?: Some of its Exponents and their Songs" *Botswana Notes & Records* 28, 1996, pp. 121-144.

ENGLAND, Nicholas M. (1995): "*Music among the Žũ'|'wã-si and related peoples of Namibia, Botswana, and Angola*" New York, London: Garland.

FRICKE, Jobst P. (retired Professor of musical acoustics at the University of Cologne, Germany): Personal communications in 2002 and 2003.

KIRBY, Percival Robson (1934): "*The musical instruments of the native races of south Africa*" Oxford University Press, London: Humphrey Milford.

MIMO (8.7.2011): "Revision of the Hornbostel-Sachs Classification of Musical Instruments by the MIMO Consortium". http://www.mimo-international.com/documents/Hornbostel%20Sachs.pdf

Norborg, Åke (1987): *"A Handbook of Musical and Other Sound-Producing Instruments from Namibia and Botswana"*, Musikmuseets skrifter vol. 13, Stockholm.

PHILLIPSON, David W. (1977): "*The later prehistory of eastern and southern Africa"*, London: Heinemann.

PHUTHEGO, Mothusi (1999): "Segaba: An African zither and its potential for music education" in: *Botswana Notes & Records* 31, pp. 119-128.

PHUTHEGO, Mothusi (2006): "The *segaba*: An indigenous form of music education" in: Minette Mans (ed.): *Centering on African Practice in Musical Arts Education*, Cape Town: African Minds, pp. 181-194. http://www.oozebap.org/biblio/pdf/2011/Centering%20on%20African%20Practice%20in%20Musical%20Arts%20Education.pdf

RYCROFT, David (1966): "Friction chordophones in south-eastern Africa", in: *The Galpin Society Journal*, vol. XIX, April 1966, pp. 84-100.

SCHÖPF, Jürgen (2006): "A unique Zulu stick zither in the National Museum in Copenhagen, Denmark" in: Christ, Heidi (ed.): *Musik verbindet uns. Festschrift für Marianne Bröcker*, Uffenheim (Germany), Forschungsstelle für Fränkische Volksmusik, pp. 135-147

SCHÖPF, Jürgen (2008): "*The* Serankure *and Music in Tlôkweng, Botswana*" Berlin: VWB-Verlag

SCHÖPF, Jürgen (2010): "The *Serankure* and music in Tlôkweng, Botswana. Interdisciplinary restudy of an indigenous bowed instrument" in: Faculty of Arts, Charles University in Prague (ed.): "*Ročenka Textů Zahraničních Profesorů" (= "The annual of texts by foreign guest professors")* vol. 3 (2009), Prague: Ff Uk Praha / Togga, pp. 507-517. https://www.ff.cuni.cz/FF-8338-version1-rocenka_zp_3_2009.pdf

SCHÖPF, Jürgen (2011): "Teiltöne filtern mit einem Streichbogen – die ungewöhnliche Spieltechnik der *Serankure* im südlichen Afrika" in: *Fortschritte der Akustik* 37, 2011, pp.563-564 http://pub.dega-akustik.de/DAGA_2011/data/index.html