

Early Lurs

from the Nordic Bronze Age and Living Indian Metal Horns

Abstract

From the Nordic Bronze Age periods II-IV we have findings of early forerunners of the first European brass instruments, the first smaller bronze lurs. None of these instruments is in such a state of preservation that musical capabilities or sounding could be investigated. In this work we have made brass-replicas of four different lur findings from Rørlykke Mose, Pääarp, Gullåkra Mose and Hindby and investigated their musical properties. It was found that these instruments are limited to very discrete types of playing techniques by physical laws of wave mechanics and that they must have been purposefully designed for specific musical applications each. A search for similar still existing instruments which fulfil similar physical boundaries has revealed an extremely high similarity for a variety metal horns from the traditional India. Comparative studies have been performed by blowing experiments and sonographic measurements to give a plausible reconstruction how the earlier Bronze Age lurs must have been used and how they have sounded.

Introduction

The Bronze Age cultures of northern Europe are well known for their variety of bronze objects of extraordinary quality in craftsmanship and unique design. In particular the famous bronze lurs of South Scandinavia are noteworthy examples of high quality bronze castings which is almost impossible to reproduce with modern techniques of craftsmanship or experimental archaeology. Altogether, 39 lurs of the Danish Late Bronze Age are recorded, including some examples, which have disappeared. As late as in 1988, the pair of lurs from Ulvkær, Vendsyssel, Denmark, came to light. In Sweden, Norway, North Germany and Estonia, 24 lurs have been found^[1]. Many of these instruments are well enough preserved and restored such that their musical capacities could be investigated by blowing experiments which are published in the 1947 years^[2]. Amongst these lurs are mainly the highly developed examples from

the spectacular finding from Brudevaelte, Maltbaek or Tellerup. These lurs are providing large ranges of natural overtones up to 40 notes which have been played or measured^[2]. However the music which these instruments have been designed for is lost and the high flexibility of these metal horns allows for almost any style of music based on natural overtones.

Beside the highly developed bronze lurs from the later periods V-VI there are rare findings of earlier bronze lurs from the periods III-IV which have been discussed as technical precursors to the later lurs. These metal horns have shorter sounding lengths in general and most diameters of the tubings are broader. In contrast to the later lurs which are all S-shaped with more less 90° torsion, the elder lurs are featuring a variety of shapes. The pair of lurs found in Rørlykke, Denmark are S-shaped with very broad tubes, as the lur from Pääarp,

Sweden in C-shaped with smaller diameter for instance. The lur from Gullåkra, Sweden is C-shaped as well with a bold sounding tube however. Unfortunately none of these earlier lurs is well enough preserved to perform blowing experiments, such that the specific overtones are not accessible.

In general the relatively short sounding lengths of the earlier lurs will physically limit these instruments to much fewer notes accessible for the musician. Furthermore the specific design of each instrument implies very different styles of music which must have been played.

The main motivations of this study are now to make these instruments hearable again and to find out how they have sounded and to assess what are the musical capabilities these instruments provide to produce music.

The first objective was accomplished by reconstruction of five early lur types with modern techniques of metal working. Blowing experiments did then yield the accessible overtones and characteristic sounding.

The second objective was tackled by a comparative study with technically identical instruments. Fortunately, it deemed to be feasible to find almost exact counterparts of each early Bronze Age lur-type which is today part of a living culture. It has been discussed by O' Foghlú^[3] and O' Dwyer^[4] that European metal horns from Bronze Age and Iron Age of Ireland can be found in the living cultures of India. Given the fact that the earlier bronze lurs from northern Europe are limited to strict physical boundaries, it was sufficient to find instruments which are technically comparable enough to delimit the musical capacities and accessible blowing techniques for each of the investigated instruments. Thank the very rich cultures of India it was possible to find a technical counterpart to each of the five investigated lur-types which could explain how these instruments must have been used.

Reconstruction of the Lurs

As mentioned before the original lurs from the Nordic Bronze Age are cast from bronze in *cire perdue* technique. The very

thin bronze layers of ca 0.8 mm are hard to reproduce with modern casting techniques. Therefore it is better feasible to reach such filigree material strengths with sheet metal. However the Danish bronze caster, Peter Jensen made two precise copies of the two *Brudevælte* lurs in 2013. These cast lur-replicas are owned by the Archaeological Museum in Stavanger, Norway. The Indian instruments used for comparison which are still alive today are either worked from sheet metal or cast from bronze.

In the very beginning of the now discussed work all physically relevant data on the instruments was collected. The sounding length which is the most important parameter for these valveless horns was just implicitly reported in some cases and lots of measurements had to be interpolated from various photographs. The condensed data was then used to build replicas of the lur findings from Rørlykke Mose, Gullåkra Mose, Påarp, Hindby and the Wismar-Horn. From each instrument two replicas were produced each from recent MS-63-brass alloy which contains 63% copper. All pipes were made from metal sheets of 1.0 mm strength for sounding tubes and 1.0-3.0 mm strength for other construction parts such as end plates, mouthpieces or bushings. Broader conical tube bends were worked in two halves which were brazed together with silver brazing length- and section wise. Tube sections thinner than 40 mm were made from sheet metal and tube bending was performed. In the special case of the Wismar-horn organic cow horn had to be purchased that fits into the reproduced metal sections. Therefore Watussi-cow horn from African breeds had to be used since adequate European cow has died out.

The obtained instruments were not tuned to modern musical note scales afterwards to retain the closest accordance with the originals. In this regard it is not clear if the Bronze Age instruments had undergone a post-tuning to desired frequencies. Therefore it has to be mentioned that the accuracy of the obtained replicas scales with the deviations in measuring and interpolating rather than tuning.

The playable eigenfrequencies of each lur replica were measured with the *spectroid-software application and Audio Spectrum Analyzer from Fountain Computer Products* on blowing experiments and video sequences. The results are gathered in Table 1)



Overtone	Rørlykke (Hz)	Gullåkra (Hz)	Påarp (Hz)	Hindby (Hz)
1	95	146	182	135
2	220	264	270	744
3	404	434	398	1020
4	521	586	(492)	–
5	621	763	(598)	–
6	727	926	–	–
7	832	–	–	–
8	938	–	–	–

Table 1: Measured eigenfrequencies of the lur-replicas (Image: Matthias Leven)

For the Wismar-Horn a measurement of the particular eigenfrequencies makes no sense since the organic cow horn is not preserved and thus the sounding length of the original is lost.

Generally the most important parameter which determines which eigenfrequencies are accessible on a valve less horn is the sounding length. But the shape and functionality of the mouthpiece section has an influence what eigenfrequencies of the chromatic overtone series is producible as well.

Comparison

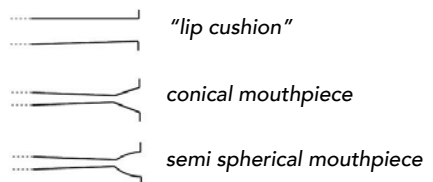
Lurs are valve less natural horns. Thus they can only produce the series natural overtones. The accessibility of the notes is due to physical limitation by the characteristic sounding length of each horn. Thus the musical options of a horn is strictly limited by laws of physics and can be summarised by the relation *the shorter the horn, the less*

notes are playable. Thus it is very convenient to compare these instruments by means of wave mechanics:

$$\text{Equation (1)} \quad L = \frac{c}{2U}$$

In case of the earlier Bronze Age lurs these limitations are so constraining that it is indeed fair to say that these instruments are designed for very specialised and discrete styles of music which are definitely distinct from the later lur types from periods V-VI.

Figure1: Different types of mouthpieces of bronze lurs [2] (Image: Matthias Leven).



Beside the most characteristic sounding length the design of the mouthpieces has another impact on the accessible notes and blowing techniques^[5].

In the experimental phase of the lur study it was found that the type of "lip cushion" which is the characteristic mouthpiece for the Gullåkra lur and most likely for the Påarp lur serves good to play high frequencies in rhythms by a tonguing technique. The conical type of mouthpiece was most likely used for the Rørlykke lurs and deemed to support the use of a broader variety of notes in a series in the experiment. Even Glissando-techniques of playing were achieved on the replicas of the Rørlykke lurs.

Effective sounding lengths of the Indian metal horns where taken from reports, supplier information or calculated from the notes which are played Eq (1) respectively.

Rørlykke lurs

The first type of lurs which was investigated in the comparative part of this study is the Rørlykke lurs. These instruments are S-shaped bronze lurs with wide openings at the end plates of ca 72 mm. The sounding lengths reconstructed from photographs were 150 cm and the tubes are decorated

with bushings and small endplates. The lacking mouthpiece sections were reconstructed in analogy to the conical mouthpieces of the Folvisdam-lurs which are similar in size^[2]. Interestingly there exists a nearly identical instrument in northern India. The *Ransingha*-horn is an S-shaped horn from copper alloys which is mostly found in the region of Uttarakhand federal state of India. These horns consist of two semi-circular sections which are mostly put together with a 90° or 180° torsion. The tubing's are decorated with bushings similar to the Bronze Age lurs and the end of the broad tubing has a narrow endplate. These metal horns are produced in mainly two sizes where the larger one has an effective sounding length of 152 cm^[6]. This means that instruments can be found which are technically identical to the bronze lurs from Rørlykke. Both types of instruments feature integral mouthpieces and even the pairwise appearance of both instruments is frequently observed in the living tradition of India. The cultural background indicates that both types of Indian and European horns are played within ceremonial contexts.

When the Indian *Ransingha* horns are played there are mainly two styles of playing practiced. Long drawn high pitched



Figure 2: Comparison of the lurs from Rørlykke (Denmark, left, Image: Matthias Leven) and the Ransingha-horns from Uttarakhand and Himachal Pradesh (Bengal, India, right, picture Ransingha: Metropolitan Museum of Art). Even at first glance these instruments reveal their high similarity. The equal effective sounding lengths, integral mouthpieces, endplates decorative bushings and pairwise usage makes them technically equivalent. The picture next page left column shows a scene where Indian Ransingha horns are played pairwise accompanied with drums and dancing (picture from rare video material, Tara music films, Phadee culture, Shanti bhatt).





or rhythmically blown sounds are played which end in a final *Glissando*. The latter is a rhythmic blowing of randomly arranged sequences of notes on two horns which can be repeated in infinite cycles. Fig. 2 shows a scene from rare video material from northern India where these instruments are played pairwise in a traditional setting, accompanied with several drums and dancing. In contrast to modern brass horns these traditional instruments are specifically designed for these rhythmic styles of music. Due to the extraordinary high similarity with the bronze lurs from Rørlykke it can be safely assumed that these instruments were designed for a very similar types of music. It is necessary again to consider the high physical restrictions of these horns such that typical horn signal music is not accessible.

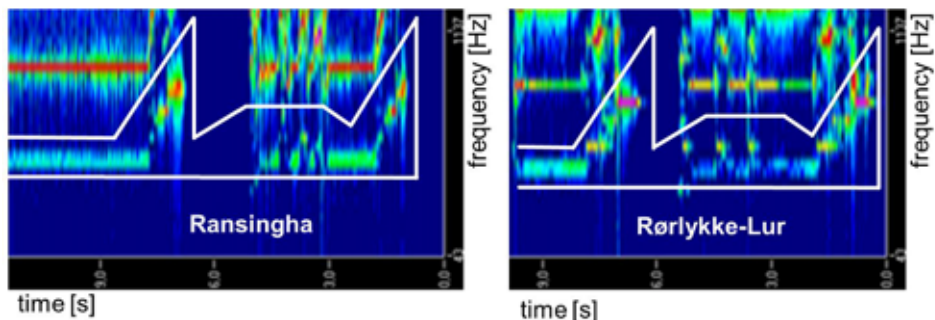
To investigate the technical similarity of the compared instruments by practical per-

formance soundtracks of traditional Indian *Ransingha* music were extracted from the video material that is published by the local people in the partially remote areas where these cultures are alive. The basic playing techniques were then reproduced on the replicas of the Nordic Bronze Age lurs to assess in how far these instruments can be used for the same musical techniques.

Performed blowing experiments on the replicas had successfully reproduced the blowing techniques found in the *Ransingha* music. Figure 3 shows a two dimensional spectrogram comparing a sequence of typical *Ransingha* music featuring glissando playing-techniques with a reproduced sequence on a replica of a Rørlykke-lur. The spectrum reveals that this playing technique is accessible and even the tuning of both instruments is almost the same. Other techniques were successfully reproduced as well which indicates that both instruments were designed for very similar musical uses. (Fig 4)

Other playing techniques described for these specific Indian *Ransingha* horns were found to be accessible on the replicas of the Rørlykke-lurs as well. Fig 4 demonstrates that characteristic rhythmic playing styles and polyphonic playing techniques can basically be reproduced.

Figure 3: Sonographic 2D-spectrogram comparing *Ransingha* music with an imitation on a replica of a Rørlykke-lur. The pattern of the sequence of *Ransingha* music (highlighted left) can be almost perfectly reproduced on the Rørlykke-lur (right) with frequencies from 521-950 Hz. In particular *Glissando* techniques are accessible on both instruments (source of music sequence: Video credits 1).



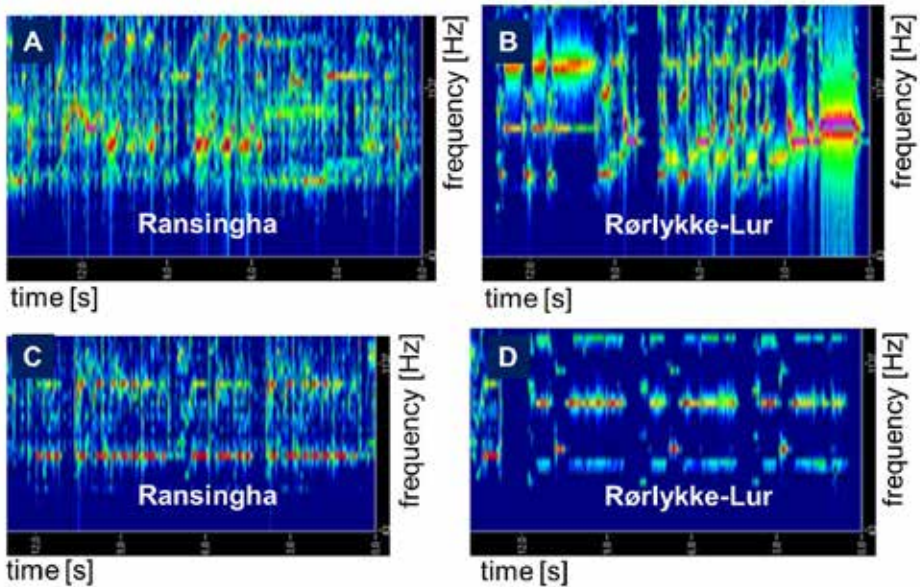


Figure 4: Various 2D spectrograms of Ransingha music imitated on the Rørlykke-lur-replica. Section **A** shows a sequence of randomized notes being played by two Ransingha players. **B** shows the same technique on the Rørlykke-lur. **C** is a wide spread rhythmic Ransingha music and **D** the imitation on the Rørlykke-lur (source of music sequence: Video credits 2).

The Påarp-lur

Another distinct type of Bronze Age lur is the Påarp-lur from Sweden. This lur is a C-shaped horn with a measured sounding length of 164 cm ^[2]. The overall diameter is much lower as the previously discussed Rørlykke-lur, but the broad mouthpiece section indicates that the lost mouthpiece was a sort of "lip cushion" (Fig. 1). Blowing experiments showed that the longest of the three early lurs from Scandinavia could merely produce three notes which can be safely played for musical use. This surprising finding is due to the diameter of the mouthpiece section which does not allow to reach the fundamental tone. Many of the higher overtones need to be forced out and sounding flat so that just three frequencies remain in the spectrum which is playable. It may sound confusing that the craftsmen had made high efforts to build an Instrument of cast bronze like this which can just

produce three notes. But the reason for this may become clearer when the Påarp-lur is compared to the famous Indian Kombu-horn and it's established playing techniques. (Fig. 5)

Figure 5: The Påarp-lur (left, picture: Historiska Museet) and the Indian Kombu-horn from Kerala (right, picture: Wikiwand.com, Fotokannan)



Påarp-lur [Hz]	Relative proportion Påarp	Kombu [Hz]	Relative proportion Kombu
182	0.67	262 (Sa)	0.67
270	1.00	392 (Pa')	1.00
398	1.47	523 (Sa')	1.50

Table 2: Comparison of the playable eigenfrequencies of the Påarp-lur-replica with the notes Sa, Pa' and Sa' played on the Indian Kombu-horn reveals the characteristic tuning to a quint in harmony to the fundamental tone for both instruments.

The Indian *Kombu* horn is a C-shaped conical tube of skinny diameter which has a sounding length of ca 132 cm. In place of the cast bronze chain the *Kombu* has a rope of textile for stabilization ^[7]. This instrument is designed for a style of horn music which is strictly limited to the use of three notes (Sa, Pa' and Sa') which are forming a quint in harmony with the fundamental tone. Interestingly the Påarp-lur is not just optically designed in the same C-shape, but the characteristic tuning to three notes forming a quint in harmony with the fundamental (lowest accessible tone respectively) is found again. (Table 2).

Considering the limitation of both instruments to three playable notes it makes sense that the Påarp-lur was designed for the same style of music as the *Kombu* from India. When these instruments are played groups of two, three, five, seven, nine or more players are playing rhythmic sequences on the upper two notes of the instruments. In India the *Kombu*-horn is therefore literally called a percussion instrument rather a melodic instrument. It becomes apparent that for this rhythmic style of horn blowing accessible overtones beside Sa' and Pa' would be hindering to play the music accurately.

Figure 6: Staging of the C-shaped Påarp-lur may be reconstructed from Swedish rock carvings (Kalleby). (Right). The same staging in rows can be found for *Kombu* players in Kerala, South India, (Left). (picture Kalleby: Tanum Rock Art Museum Underslös. Documentation Project, Tanum World Heritage, picture *Kombu* Pattu: Mohkum.Aminus3.com/image/2020-D1-02.html).



The techniques of *Kombu* blowing were experimentally performed on the Päärp-lur replica and it was found that the *Kombu* music is well playable on the Bronze Age instrument.

Apart from the technical similarities there is also an analogy which can be found in the rock carvings of West Sweden. There are depictions of lur blowers who are blowing large C-shaped lurs. The best examples are the rock panels of Kalleby and Långemyr (Bohuslän, Sweden) where lur blowers are standing in rows of three lur blowers very similar to the staging of *Kombu* blowers in Kerala. In *Kombu Pattu* usually uneven numbers of players are standing in rows directed by a lead player. This is another hint that indicates that the Päärp-lur has been used in a very similar way to the *Kombu*. (Fig 6 left + right).

This relation is not necessarily a direct cultural relation, but it substantiates once more the very strong technical and musical similarities of these instruments.

The bronze lur from Gullåkra

Another type of C-shaped metal horns amongst the earlier Nordic Bronze Age lurs is the lur finding from Gullåkra Mose. This lur has a measured tube length of ca 110 cm^[2] and a wide diameter of ca 70mm at the bell opening. Compared to the Päärp-lur this horn is stockier and the curve is

much tighter. Despite the similar C-shape this is fairly classified as another type of instrument which has been played in a different way with some confidence. In this case the mouth piece section is preserved and can be classified as the "lip cushion"-type. The tight mouthpiece diameter and the short sounding length does not allow for deeper notes and melodic playing appears very difficult. Therefore the overall design indicates that this lur was designed for high sounds and rhythmic ways of playing.

Interestingly there exists a traditional brass horn in India which features all these properties described for the Gullåkra lur from Sweden. The Indian counterpart of this lur is called *Tutari* and is still played at ceremonial occasions in central India. This C-shaped horn features a sounding length of ca 100 cm and is designed with a flat and skinny mouthpiece to play high rhythmic sounds and Glissando-techniques. Both, the Nordic and the Indian instrument are decorated with ornate bushings and a bronze chain versus a textile line connects both ends of the C-shaped horns to make these instruments portable. *Tutari*, *Turi* or *Turahi* is derived from *Turya* word in Sanskrit language. It is made with thin sheet of copper or brass, in different sizes for example; in Rajasthan 109 cm and also in 69 cm, in Bihar 95 cm and also 127cm, in Orissa 85 cm and in Uttar Pradesh 182 cm. *Turhi* - Made with copper and Brass, in Bihar its 127cm long. In Rajasthan it is 109 cm also in 69 cm. In



Figure 7: Comparison of the Gullåkra-lur and the *Tutari*-Horn from central India. Both C-shaped instruments are featuring similar sounding lengths, mouthpieces for rhythmically played high sounds, decorative bushings and similar bell ends (picture Gullåkra-lur: Reallexikon der Germanischen Altertumskunde, Band 15, Heinrich Beck, Dieter Geuenich, Heiko Steuer, De Gryter, 2000, Picture *Tutari*-horn: Musicianmatters.com).



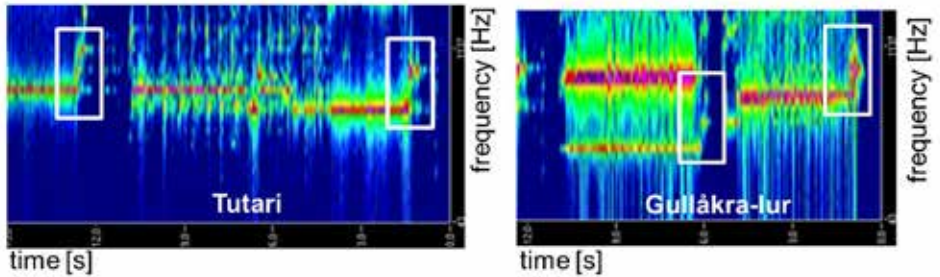


Figure 8: Sonographic 2D-spectrogram comparing a sequence of *Tutari*-music imitated with the *Gullākra-lur*-replica. The basic playing technique, in particular the glissando can be reproduced (highlighted areas). The frequencies are showing an offset since the *Gullākra-lur* is about 10 cm longer compared to the *Tutari* (source of music sequence: Video credits 3).

South it is known as *Kona kombu*. *Vakri*/twisted *Ransing*, originates from *Ransinga*, made with brass or copper, three hands long (4.5 feet). (Jaiswal, 2013, pg.97-99) [8]. Also in Nepal, *Funga* is like *Turya* shape, made out of copper in three parts, maximum length is 3 feet. People from *Newar* community used it for religious functions. *Singa* or *Narsinga* is four feet long in a cow horn shape, made with copper, divided in to four parts. Sound of the instrument is very sharp but not so musical. Popular among the people from the mountains. Jaiswal, 2013, pg.219) [8]. (Fig 7 left + right)

Blowing experiments on the replica of the *Gullākra-lur* confirmed that the playing techniques from the *Tutari* horn can be successfully transferred to the bronze lur. Particularly the rhythmic playing of high notes with a tonging technique were perfectly adopted by the special mouthpiece and the sounding length of the *Gullākra-lur*. (Fig 8).

Simon O' Dwyer has described the rhythmic playing for the Bronze Age horns from the prehistory of Ireland as well [4]. The related music was reproducible on the *Gullākra-lur*'s replicas as well.

And again there is a very interesting hint how the small *Gullokra lur* may have been staged in the Bronze Age. The rock panel of *Fossum* shows a posture of two *lur*-blowers who are standing face to face and playing small curved horns. Almost the same posture is often taken by *Tutari*-players on ceremonial occasions. (Fig 9 left + right).

Again this is not definitely an evidence for a direct cultural relation, but a similar set up for the *Gullākra* horn makes sense due to the very specific design musical application.

Another staging of this short C-shaped horn can be frequently found on rock carvings from Sweden. These horns are often found pairwise on boat depictions amongst other stylized crew figures like axe bearers



Figure 9: *Lur* blowers in the Nordic Bronze Age (rock carving *Fossum*, Sweden, picture: Gerhard Milstreu) are playing small curved horns in similar postures like the *Tutari*-players in India (picture: Hinglai Events and Wedding Organizers, Mumbai).





Figure 10: A panel from Vitlycke, Sweden shows a C-shaped horn being played on a boat. The frequent motif along with axe bearers and rowers is sometimes interpreted as a ritualistic scene where lurs have played an important role (Image: Matthias Leven). A boat with C-shaped horn and kneeling crew, Tanum. (Tanum Rock Art Museum Underslös). One of the 8 stones in the Kivik grave with a human with C-shaped horn. (Gerhard Milstreu)



or rowing crew. Here is a ritual context assumed where boats and lurs have played an important role. (Fig 10).

The Lur fragment from Hindby

The bronze lur found in Hindby, Sweden is a more difficult case. There have been discussions how this lur has actually looked like before it was fragmented. The heavy damage allows just to estimate whether this lur-fragment was just part of a larger lur or if the tubing is essentially complete. It is safe to say that this lur had an endplate and a chain or belt. The slight bending of the tube makes it unlikely that it has been a part of a typical semi circular sounding tube of a larger lur. The given length of the preserved part and the slight curvature finds at least a counterpart amongst the metal horns of India again. There is a horn of very similar size and curvature which makes it possible to derive a reasonable reconstruction of shape and usage for the Hindby-lur.

The remaining part of the Hindby-lur has a length of 77 cm tubing which is decorated with three bushings ^[9]. An Indian metal horn with a sounding length of 72 cm is the so called *small Kombu* or *Kombu-Kahale*. It is decorated with three bushings as well and is played still today on ceremonial occasions. The so obtained replica of the Hindby-lur was blown and could produce three notes as eigenfrequencies. It is obvious that such a short Instrument is physically limited to a very special style

of music which can be transferred from the preserved Indian tradition. In blowing experiments on the replicas it was possible to reproduce *Kombu-Kahale* styles of horn music. (Fig 11 left + right).

Within the range of certainty of this attempt to reconstruct the Hindby-lur this instrument deserves a distinct classification by shape and functionality as well.

The Wismar horn

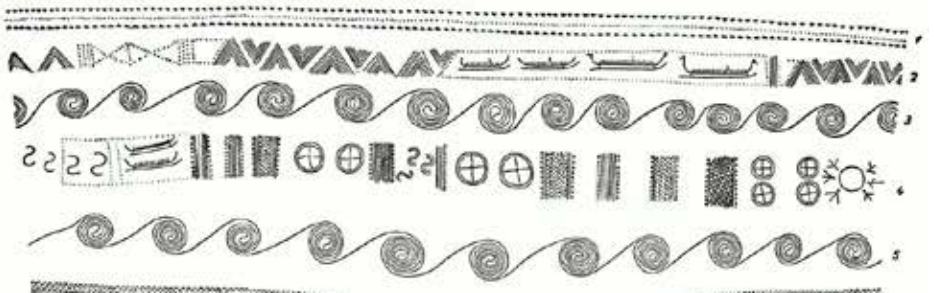
Finally, there is a last type of horn instruments from the Nordic Bronze Age which can be revived by the means of physical reconstruction and a comparison with traditional Indian instruments which are still in use. The Wismar horn, or perhaps more accurately the three bronze mounts from a horn (including a mouth piece), found in 1836 in a peat bog near the town of Wismar, in North-West Mecklenburg, North Germany, differs from the other horn instruments, as it is richly decorated with a full scale Bronze Age imagery. The large rim mount is covered with rows of ships, some with horse headed stems, wheel crosses, human figures carrying spears, and spirals. This iconographic repertoire is well known from Scandinavian rock carvings. In accordance with the Bronze Age ship chronology, the ships – and the horn can be dated to a late part of the Early Bronze Age, around 1300 BC. Considering this date, the Wismar horn could be determined as a 'proto-lur' ^[10]. (Fig 12).

Figure 11: It is possible to reconstruct the Hindby-lur with it's unusual shape and size thank the still existing Indian *small Kombu* or *Kombu Kahale*-instrument (picture Hindby-lur: <https://travelslinskane.blogspot.com/2016/12/pa-historiska-museet-i-lund.html>, picture *small Kombu*: [IconsPng.com](https://icons.png.com)).





Fig. 12. The Wismar horn, northernmost Germany, c. 1300 BC. The Wismar horn consists of richly decorated bronze mounts, originally placed on a large horn, probably of an aurochs. Overall photo: Philip Schreiber. Detail photos: Flemming Kaul, the National Museum of Denmark. Drawing: After Sprockhoff 1956.



Since The Wismar Horn is a composite of cow horn enhanced with bronze sections a direct comparison of effective sounding lengths is not possible in this case because the organic horn is gone. At any rate, bearing in mind the size of mounts, the horn of an aurochs bull is worth considering. The Indian counterpart to this kind of composite horn is called *Pepa* and is used on ceremonial occasions. Both types of blow horns consist of a large cow horn which has a decorated extension of metal at the opening which is attached with rivets. This section enlarges the sounding length and adopts the diameter of the organic horn. Both types of metal extensions are showing decorations with religious content or ornaments. Both horns feature a mouthpiece-section from metal with integral mouth-pieces

The eigenfrequencies of the organic horns have no basis for comparison. However, the reported styles of horn blowing were reproduced on the replicas of the Wismar-Horn from the Nordic Bronze Age.

Susira Vadya or Wind instruments in Indian cultures

An early evidence for various Indian musical instruments is already given in the literature of the Vedic period. Amongst various flutes from different materials, string instruments, drums and different horns have been reported in the *Natyashastra* by Bharata Muni (300 BC). These early references are describing particular instruments, their orchestrated use and a classification into four categories such as string instruments, blowing instruments, percussion instruments and solid body instruments. Many of these instruments can be seen in paintings Ajanta caves and sculpturing at Ellora. During this period a rapid development of a rich variety of musical instruments becomes visible in the works of Bharata Muni. In the context of this study it is in particular noteworthy to mention the *Turya*, a war trumpet similar to the *Tutari*, *Susira Vadya* horns of many shapes and sizes and the *Sringa* horns. The term *Sringa* or *Shringa* originates from the Sanskrit and means "horn" ^[8, 11]. (Fig 13).



Figure 13: Rock art sites in Madhya Pradesh with depictions of horn players; **A** horn player at Jambu dweep, Pachmarhi; **B** worrier playing horn. Maradeo, Pachmarhi; **C** two long pipe players. Nimbu Bhoj, Pachmarhi; **Music and dance at Tapka Pani**, Pachmarhi (pictures: Dubey-Pathak, Meenakshi).



In India, tribal culture is still alive and playful. The tribes from Central and North East India are still using the most ancient instrument, buffalo horn to communicate message and also music for the religious ceremonies. It was originally made from horn of buffalo or cow, but later on the term was applied for any kind of horn and trumpet. We found sixteen rock art sites in Madhya Pradesh with horn players: Bhimbetka, Jhiri, Jawara, Chiklod, Kathotiya, Budni, Panna, Sagar, Chhaterpur, Rewa, and in Pachmarhi (Jambu dweep) (Fig. 13 A), Maradeo (Fig. 13 B), (Nimbu Bhoj) (Fig 13 C) (two long pipe players), Sambhar Jhil (Fig. 14), Kanji Ghat 2, Churna and Tapka Pani (Fig. 13 D) ^[12].



Figure 14: Enjoying music at Sambhar Jhil. Pachmarhi (picture: Dubey-Pathak, Meenakshi).

At Tapka Pani, there is also a drummer and dancers, one of whom could be wielding a big horn. In early times, pipes and drums were also used to announce conflicts and to warn other groups. They would be made of easily available hollow tubes such as horns, bones, bamboos or metal. In early times, horns and drums were also used to announce conflicts and to warn other groups. Two straight long horn/pipe players, painted in red and white in the Nimbu Bhoj shelters, in a running posture and holding weapons, are probably indicating a conflict. Another depiction of pipe in the Kanji Ghat shelter II, shows a male figure who appears to be a warrior, holding weapon and playing a long and slightly conical shaped pipe. The broad end of the bore is joined with another piece and suggests that possibly they were aware of using an extra device for the

control of tone quality of the instruments. (M.Dubey-1993, 2000) (MDP. & JC.2019) ^[12].

The simplest and earliest known form of trumpet was made from organic material like animal horn or shell with bored mouth holes. These instruments were either end blown or side blown in some cases with detachable mouthpieces of separate material. Some instruments of this archaic type are still found today as blow horns for lip vibrating techniques. Gonds tribes from Baster, have two types of horns *Kohuk / Akum* original buffalo horn and *todi* made with bronze and brass. They play horns only for the religious purpose; *Devpuja, Jatra, Madai* and other ritual ceremonies. *Kohuk/Akum*, announces the joyful festivals. These gonds are also known as bison horn maria and muria tribes. While performing bison horn dance during the harvest festival, men are supposed to put on headgear, it is traditionally made with the horns of Bison. It is passed down from father to son. The head-dress of Bison Horn Maria men is decorated with feathers and cowrie shells. Women of the Bison Horn Maria tribe wear headbands made of cowrie shells and dress up with silver jewellery. *Shringa* is an end blown instrument. The tip has been removed to create a mouth hole. It has various names in different parts of India; *Kohuk* a horn of maria gonds in Bastar, (Fig 15).





Figure 15: The Todi-horn in various settings; **A** Todi/ Akum. (Metallic horn); **B** Todi being played during Dusshera festival. Jagadalpur, Chhattisgarh; **C** Instruments have been deposited at the Devgadhi / Sanctuary, Bastar (pictures: Dubey-Pathak, Meenakshi).



Bastar area of Chhattisgarh state is known for bronze casting of *cire perdue* ^[13, 14]. Local tribal craftsmen prepare (Fig.15 D, E) solid and hollow both types casting of varieties of artifacts including *Todi/ Akum* (Fig. 15 A) (metallic horn) and *Mohari* (Fig. 16) a

Figure 16: *Mohari* a flute like instrument (picture: Dubey-Pathak, Meenakshi).



flute like instrument. *Todi* and *Mohari* is also blown during *Madai*, *Jagar*, *Jatra* ceremonies (Fig. 15 B).

Mohari player has to play different tunes for different rituals. After the rituals these sacred instruments supposed to place in the *Devgadhi / sanctuary* (Fig 15 C). From *Kahal* in Himachal Pradesh ^[15] another brass horn is known which consists of a brass tube with straight bore and double bents, a flat end bell and integrated mouth piece. This instrument is used in folk music and on processions in festivals. *Karnal* is a long brass trumpet in two sections from Himachal Pradesh which is played in folk music and on ceremonial occasions such as processions and temple service.

Another type of metal horn from the northern states of India is the *Ransingha* (Fig. 2). These conical horns are made from copper or brass sheets in two curved sections and being used in Laddkh, Himachal Pradesh, Uttarakhand, Sikkim and Nepal on various religious occasions, weddings and folklore ^[6, 16]. The overall shape of these horns which are referred as *Ransingha*,

Narsinga or *Sringa* is an S-curve in several variations. The related types of music and dancing are part of each cultural identity of the local states. Several annual festivals with shrine worship are popular events being celebrated still in modern times. In extensive religious ceremonies including parades with shrines, divinities are entertained by dancing and singing choir wise in groups of people which are accompanied by flutes, drums and the *Ransingha* horns. The horn music often uses just a few high notes which are often blown with much pressure to give shrill and loud voices.

The *Pepa* horn is a traditional instrument used in Assam, north east India. This instrument is made from buffalo horn. The tip of the hollowed animal horn is removed to give a blow hole and finger holes are drilled to access several notes. *Pepa* horns are sometimes equipped with a metal rim at the opening to reinforce the natural material and to create a bell end. Other types of *Pepa* horns are containing sections of bamboo and double horns with adjusted arrangements of the finger holes are used as well. *Pepa* horns are used is frequently used in traditional music and dancing in the region of Assam. A similar instrument from buffalo horn with bamboo sections is called *Singa*, used in Orissa^[16].

A well-known and widely used metal horn is the *Kombu* from south India. It's name descends from the Malayalam language and means "horn". And indeed the *Kombu* finds it's origin in archaic horns which were made from sections of animal horn from cow or buffalo which were linked together to build the full length of the instruments. Later the instruments of the *Kombu* family were crafted from cast bronze, copper or brass (Fig 5) with a conical bore. "These instruments are already mentioned in the Tamil classic *Silappadhikaram* believed to be written about 2000 years ago in Kerala." (Rajagopalan, 1974, pg.40)^[16]. Usually the *Kombu* is designed in a C-shape or S-shape in fewer cases and two basic types of these instruments are reported. The smaller instrument is called *Timri* and the larger *Bari*. It is mentioned that the C-shape of the *Kombu* covers 210

degrees of a circle with ca 60 cm in diameter resulting in a length of the tube which measures ca 4 feet^[7, 16]. Most *Kombu* horns are separated in three sections of curved tube which are fitted together and stabilized with a cord or a rod which is stretched over the diameter of the C. In the traditional use of the *Kombu* three notes are playable (Sa, Pa' and Sa'). Therefore *Kombu* is seen and used as a percussion instrument for rhythmic blowing instead of melodic playing. Musicians are holding the *Kombu* in an upright standing position such that the bell end is on top over the musician's head with the opening pointing backwards. The playing takes usually place in ensembles of *Kombu* where several musicians are aligned with a lead player who improvises rhythmic patterns, which a chorus then repeats (*Kombu Pattu*). In ancient times *Kombu* was played in war along with drums. Nowadays *Kombu* music is widely found in festivals and religious ceremonies in the southern parts of India, in particular in the Kerala federal state. There are several large festivals like *Cenda melam* or *Pancavadyam* where *Kombu Pattu* is performed but temple service and weddings are mentioned as occasions for *Kombu* performance in general. *Kombu Pattu* is mostly organized in groups (Fig. 6, left) of odd numbers like three, five, seven, nine or multiple *Kombu* players which are often accompanied by other instruments such as *Shehnai*, drums and cymbals. *Kombu* music in it's rhythmic composition is organized in cycles of beats called *Thalam* which can consist of a defined number of beats such as *chempata* (8), *atanta* (14), *dhruvam* (14), *chempha* (10), *anchatantha* (16), and *thripata* (7). Each *Thalam* can be accented with accompanying cymbals and often *Kombu Pattu* is increased in tempo of the rhythms with decreasing rhythm sequences (Killius, Rolf. 2006)^[7d].

Beside the mainly discussed metal horns from the Indian subcontinent there is a variety of similar instruments which are more less falling into related categories or unique in their use and design. The *Narsingha* is a large C-curved copper horn from Nepal. Turahi is a long trumpet from

Rajasthan used in temple service. *Bhungal* is a straight bronze trumpet from the same region used in religious contexts and weddings^[16]. From Tamil Nadu-state another S-shaped instrument *Konkombu* is known for being used in temple music and martial arts. *Gowri Kalam* is a straight conical metal trumpet from Tamil Nadu which is used in temple processions.

Conclusions

Regarding the results of this experimental study on five different types of Bronze Age lurs it can be concluded that it is possible to reconstruct the earlier Bronze Age lurs physically and to closely assess their musical capabilities. Considering the discovered physical limitations of these instruments allows to recognize a specific and purposeful design of each investigated instrument for a distinct type of horn music. The playable notes were measured experimentally and the musical capabilities of these metal horns can be delimited by blowing experiments in terms of accessible blowing techniques respectively. Fortunately, the various Indian cultures of today are providing very similar metal horns so that an educated guess becomes possible for which types of music these instruments may have been used in the Nordic Bronze Age. At least the Indian types of horn music could be successfully reproduced on the replicas of the bronze lurs in all cases. The investigated lurs can be assigned distinct types of metal horns and the frequent depiction of the specific types of lurs in contemporary rock carvings suggests that these instruments were not produced as randomly designed unique pieces of craftsmanship. Beside the fact that most of the lurs were found in pairs, rock art suggests that specifically the Päärp-lur may have been played in larger groups. This finding is supported by the *Kombu Pattu* from India where very similar Horns are played in larger groups as well, due to the playing techniques rooted in the instrument itself.

In general it appears very likely that there have been, similar to the Indian cultures, larger localized cultural contexts around these early lurs. The high specificity

on which these early lurs are optimized for special styles of horn blowing suggests that these instruments were developed over time and produced on larger quantities than the rarity of findings may indicate. To each type of lurs a special style of music may have existed as well. In India we can see that most of these instruments are played within different religious festivals and important social events. These occasions are varying between different regions in their contents and cultural expressions. The same could be assumed for the earlier Bronze Age lurs of northern Europe as well.

It becomes an obvious question after all whether there might be a direct historic or cultural relation between the European and Indian metal horns. There are indeed details in decoration of the horns which may go beyond a coincidental analogy. But the very basis for such a conclusion would require more archaeological data and safe dating of the Indian instruments. For now this research on the discovered analogies stays just a technical study which helps to understand the discussed Nordic Bronze Age findings.

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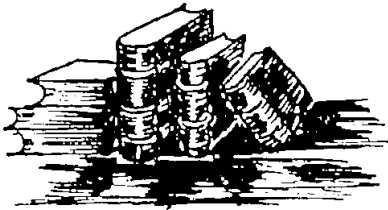
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