Design analysis of the Rebab, folk instrument and living ancestor of the violin

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Abstract

This paper examines the design elements of the Rebab, specifically the box shape, concave sides design variants, and its connection to the design of the Violin. Researcher followed the descriptive analytical method and extracting semantics that serves the research objectives. The researchers concludes that this shape of Rebab has widespread role in folk music, especially in desert Bedouin communities in the Arabian Peninsula. There are also physical differences in the designs of the Rebab and the Violin. It is anticipated that the Rebab instrument is one of the predecessors of the Violin in terms of shape and method of playing with the bow. The Rebab has a primitive, rudimentary design that reflects its musical, cultural, and environmental contexts. The researchers conclude also that the box-shaped Rebab designs are acoustically flawed, but that is of negligible consequence given the instrument's folk identity.

Keywords: Rebab, Violin, folk music, instrument design, Arabic Culture

تصميم آلة الربابة الموسيقية الشعبية كسلف لآلة الكمان

علي سالم الشرمان، كلية لومينوس الجامعية
كريس مولينديرز، كلية لومينوس الجامعية

الملخص

تكمن أهداف هذا البحث في دراسة عناصر تصميم آلة الربابة، وتحديداً الصندوقية الشكل مثل الربابة ذات الزوايا القائمة والربابة ذات الجوانب المنحنية الى الداخل، و ارتباط هذا التصميم بتصميم آلة الكمان. وخاصة في المجتمعات البدوية الصحراوية في شبه الجزيرة العربية. اتبع الباحثان المنهج الوصفي التحليلي واستخلاص الدلالات التي تخدم أهداف البحث. اما الفئة المستهدفة في هذا البحث فهي منطقة بلاد الشام. وتوصل الباحثان الى نتائج مفادها انه ورغم التصميم البدائي لهذه الالة والذي يعكس سياقاتها الموسيقية والثقافية والبيئية الا انها مازالت تستخدم وعلى نطاق واسع في الجغرافيا البدوية الطابع وهذا الشكل من الربابة له دور واسع في الموسيقى الشعبية، خاصة في المجتمعات البدوية في الصحراء. كما خلص الباحثان الى ان هناك اختلافات شكلية في تقنية تصميمات آلة الربابة وآلة الكمان، وهذا الشيء البديهي على اعتبار ان الرباب من أسلاف آلة الكمان من حيث الشكل وطريقة العزف بالقوس.

الكلمات المفتاحية: الربابة، الكمان، تصميم الالة الموسيقية، الموسيقى الشعبية،الثقافة العربية.

Introduction

This paper investigates the design of the Rebab, analysing the environmental and cultural factors that influence its design, as well as offering comparisons with the Rebab's younger cousin, the Violin. Rebab is a very ancient musical instrument, so much so that its use goes back to B.C.E., Arabs, Turks, and Persians excelled at playing it (https://www.arab48.com(27/06/2022)). This distinctive musical instrument features a single string century-old bowed string instrument and precursor to the Violin has no standardised design, with examples found across the Arabic world varying according to string count, size, shape, and materials used. This research is focused on the designs that can be categorised as 'box-shaped' and asserts that despite the fact that these variants are not as tonally efficient as their curved siblings, they are still widely used today in the Bedouin cultures such as those in the Arabian Peninsula. The Rebab's design is compared to that of the Violin because of the following: it is a living ancestor of the Violin; the

Violin can be seen as a 'developed', 'perfected' version of the Rebab; and the concave sides of one of the Rebab design variants discussed in this paper echoes that of the Violin.

Problem of the research

The problem of the research is that there are studies that shed light on the Rebab, but they did not address this important aspect in its approach to some instruments whose design evolved from the design of Rebab, with attempts to compare between these two shapes, upright sides and the shape with curved sides.

Objectives of the study

The Objective of the study lies on adding knowledge to the ethnic aspect of music by analyzing the design of the Rebab instrument, studying its design, focusing on the shape with right angles and inward-curved sides, and the extent of its compatibility with the design of the Violin instrument and the performance method of both instruments.

Importance of the study

The importance of this study is for adding knowledge to the Arabic and western libraries by studying the Rebab instrument, in general, in the world, especially the design aspects and approach between the Rebab instrument and the Violin, identifying common frameworks between these two instruments in terms of the development of the shape design and finding some constants to consider the Rebab instrument as a predecessor to the Violin instrument.

Previous study

There is very little literature written in English about the Rebab in a context that is not purely historical, examples being alShurman (2023), Majid et al (2023), and Rai et al (2019). alShurman's research is focused on the socio-cultural context of the instrument, while the work of Majid et al is concerned with the performance context of the Malaysian variant. The research of Rai et al is design-oriented, but of the 3-stringed Malaysian variant and from the perspective of seeking to improve the instrument through the introduction of a new prototype. Other study did by Saleh, Sager (2008), techniques of playing the Rebab

Given this research context, this paper offers new insight into the design of the Arabic Rebab and Violin in the proximization context.

Rebab ancestor Violin

Rebab works to meet the needs of the popular poet in innovative artistic ways, in various shapes and sizes, especially Its raw materials and raw materials are available in the local environment., some of its use was for relief and requesting help and assistance.

Instruments like the Violin that use a bow to produce a sound are called bowed stringed instruments. The Violin shares many parts with the Rebab in terms of design and method of performance (bowed instruments), such as: wood, tuning beg, bow, scroll, bridge, tailpiece, nick, fingerboard, body, curved sides (with curved size Rebab). The Rebab does not contain adjuster, chinrest, f-halls. It is because two reasons:

- The development of the Violin through centuries.
- The kind of music that played by Violin.

Arabian Rebab and the rebec, which came from the orient in the Middle Ages and was played widely in Spain and France in the fifteenth century, are said to be the ancestors of the Violin. (https://www.yamaha.com/en/musical_instrument_guide/Violin/structure/).

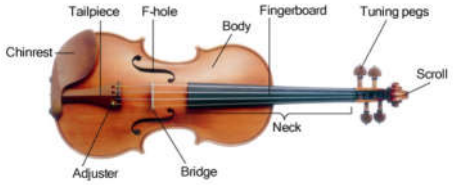
The global art of music uses myriad instruments that are distinguished from each other in terms of pitch range, timbre, shape, material, performance, and method and quality of manufacture. These instruments often have predominant stylistic associations such as classical and folk, determined by their ties to Western art music or folk culture. Maud Karpeles suggests that the "folk" definition "can… be applied to music that has been evolved from rudimentary beginnings by a community uninfluenced by art music" (Karpeles, 1955, p. 6). This definition has implications for instrument design, the inference being that folk instruments are less advanced than their art music cousins. The

design of classical instruments, such as the Violin, has been shaped by the search for perfection in terms of physical shape, tonal versatility, pitch range, timbral beauty and diversity, performance method, and visual aesthetic. However, the design of folk instruments such as the Arabian Rebab are more influenced by external factors such as the availability of materials and tools, and performance contexts that are more limited than mass produced classical instruments. The rudimentary design of the Rebab, and the fact that its design was unaffected by Western art music makes it a prime example of a folk instrument.

The Rebab was identified as a direct ancestor of the Violin by Carl Engel and Kathleen Schlesinger. In his book, *Researches into the Early History of the Violin Family*, Engel states that "the earliest instrument played with a bow known to European nations appears to be the Rebab of the Arabs" (1883, p. 78). Schlesinger cites the Ravanastron and Rebab as precursors to the Violin (1914, p. 15). The fact that the Rebab is the link between the Ravanastron and European precursors to the Violin, as well as the fact that its cultural relevance has been maintained throughout its history[1], invites a comparison to be made between these two leading examples of folk and classical instruments.

The Rebab has desert roots, in rural areas and Bedouin culture. However, its use became popular in cities through 'maddaheen'[2], folk biographers, and folkloric arts groups with audiences at mawlid[3] and Sufi celebrations, and Ramadan nights. (Jaradat,2022).

When Amati, Stainer, and Stradivarius were developing their Violin designs, providing the blueprint for the instrument's modern form, they carefully examined previous manifestations of the instrument, basing their innovations upon them. As established by Tai et al, "the complex geometry and structure of Amati Violins were rather different from those of preexisting string instruments, setting new standards for both visual and acoustic appeal" (Tai et al 2018, p. 5296). This is an example of the process of reaching the end of a design stage and then returning to experimentation and innovation to advance the design of the instrument, in terms of both sonic and visual aesthetics.



Shape (1): (https://www.yamaha.com/en/musical_instrument_guide/Violin/mechanism/)

The creation of the final design of a musical instrument depends on the contribution of people skilled in instrument construction as well as those skilled in performance. Experienced musicians and teachers are consulted in the design process because they understand that form and perfection in design plays a pivotal role in the sonic and visual aesthetic of the instrument.

The quality of instruments handmade by master craftsmen is superior to those mass-produced in a factory. The reason for this is that in addition to the creative talent of the craftsmen, they are committed to the specific design and aesthetic requirements of the musician requesting the instrument.

The Rebab's design, on the other hand, has not undergone similar stages of development and perfection. This is because the instrument's manufacture is restricted to regional populations, without a standardised approach to design. In fact, some details of the Rebab's design, such as size, cavity depth, and shape, differ depending on materials and tools available to each instrument maker.

Historical and design background of the Rebab

The diversity of musical instrument design is particularly broad in the Arab world, with many similarly shaped instruments with common pitch ranges, timbres, and playing styles. Often made of wood, percussion and woodwind instruments are the most popular.

Regardless of the shape, the structure of the instruments is based around a resonating chamber in the form of a box or tube, the particular design details of which determine the tone, dynamics, and pitch range of the instrument. For example, a Rebab with a larger body and longer string length will have a lower pitch range and richer timbre than a Rebab with smaller dimensions. However, both are considered to be the same instrument: the design differentials are a result of the varying environmental conditions across the Arabian Peninsula.

"The process of practising rituals since ancient times has constituted itself a synthetic event in which all kinds of arts are involved, and the succession of musical cultures to this day has bequeathed to us musical instruments with a design character that is intimately linked to the materials of the outside world and the craftsmanship of the human in it" (AlShurman 2019, p. 215). The basic design of the Rebab is found in folk musical instruments throughout the world with a variety of incarnations of form and function. It is an ancient design that is considered to be the origin of bowed string instruments. As established by Kathleen Schlesinger, the earliest form of bowed string instrument is the Ravanastron, which inspired the Rebab and subsequently the Violin. It is widely recognized that the spread of bowed string instruments in Europe can be attributed to Arabic culture. Further to Schlesinger's tracing of the Violin's history on this path, Farmer states that the fact that the rebec was introduced to Europe from the Arabs is "generally admitted" (1930, p.767). Stowell provides a more recent confirmation of this, describing the medieval rebec as being related to the Violin, and notes that its design "reflects its Byzantine and Arab origins" (Stowell 2001 p. 174).

The Rebab's shape varies across the Arab world, with variants including square or rectangular, round, boat or pear shaped, or hemispherical bodies. It dates back many centuries and has been mentioned by Arab writers and scholars such as Al-Jahiz from the Al-Saila group, the books of Ibn Khaldun, as well as a detailed chapter in The Great Book of Music by Al-Farabi. An image of the Rebab was also found on a piece of silk found in Iran that is now kept in the Boston Museum of Art. "The poet's Rebab is a musical instrument far from complex that the poet himself creates, and it takes the colour of Bedouin, and perhaps the ease of obtaining materials and the simplicity of this design made it adapt to the life of the nomads" (Gawanmeh 2002, p. 70). The Islamic conquests helped the Rebab to become widely spread across the Arab world, and similar instruments are also found in Europe under various names including Rapla, Rebec, and Rabel.

Box-shaped design variants

The Rebab's design is subject to variations in terms of shape, size, materials, and bow. However, regardless of the bow's design variants, its size remains proportionate to that of the instrument. The constituent parts are as follows:

1. the frame: straight or concave sides (see shape-2).
2. al- Sabib: the string, made of animal intestines or metal.
3. al-Karrab: tuning peg
4. al-Qaws: the bow, made of horse/camel hair.
5. al- gazal or al-Faras: the wooden bridge, through which sound is transmitted from the string to the vellum.
6. Vellum: resonating top plate, made of leather or fish skin.
7. al-Makhaddah: the pillow, which is a small piece of cloth that is placed under the string from the opposite side from the top, whose function to fix the string to the base of the instrument.

Shape (2): This image shows a Rebab with the constituent parts (listed above) typical of those played by Bedouin musicians. (https://musicaparaver.org/irudi/prods/img464_0.jpg)

Shape (3): This image shows a Rebab with design variants including straight sides and larger size. (https://www.wam.ae/en/details/1395302794390)

The structural design of the Rebab depends on the region of origin, such as the square and rectangular shape (shape-3), that is found in the Arabian Peninsula. Other forms include the smaller, hemispherical Egyptian Rebab. This design variant is not covered in detail within this study, as this paper's focus is the box-shaped design, but an image is provided for context.

The Arabian Rabab's design is subject to variations in terms of shape, size, materials, and bow. However, regardless of the bow's design variants, its size remains proportionate to that of the instrument. The following table to shows some examples of these differences:

Medium size	Larger size
Straight sides	Curved sides
Slightly curved bow	Semicircular bow
String made from animal intestines	String made of metal
Vellum made of sheep's leather	Vellum made from fish skin
Bow hair made from camel / horse tail	Bow hair made of synthetic yarn

In conclusion, the Rabab instrument is designed from rudimentary materials that are determined by the environmental context of the particular instrument maker. Its simplicity of form is shown by its single string and very limited pitch range, which in turn reflects the simple vocal melodies that it accompanies. It is not possible to perform musical styles other than those for which it was designed, showing its deep connection to the music, culture, and environment of the Arabian Peninsula.

Shape (4): This image shows a Rebab with design variants (https://www.arab48.com)

The Rebab has a nasal tone, moderate volume, and low dynamic range, due to its single-string design, acoustically inefficiently shaped body, and primitive materials.

The colour of the wood used in Rebabs varies greatly, including white, yellow, brown, becoming blacker when exposed to weather conditions (Gawanmeh, 2007- 45). The lustre of the wood, which indicates the presence of wax, oils, or added dyes, is not desirable to be present as it affects the resonant properties of the instrument. Therefore, the less noticeable an instrument's lustre, the higher its quality. An instrument that is made of dry, aged wood will have a full-bodied and complex tone, the grain of the wood adding to its visual aesthetic appeal.

Design flaws of the box-shaped Rebab and their sonic consequences

Like other bowed string instruments, the Rebab's sound is created by vibrations caused by the friction of the bow on the string, resonating the vellum via the bridge and amplified by the cavity. However, these vibrations are much weaker than those of an instrument with a more advanced design, such as the Violin. This makes it impossible to match such an instrument's tonal complexity and dynamic range, because the sound waves are not controlled by the Rebab's body effectively. The 90 degree angles and parallel sides of the instrument's body cause phase interferences at lower frequencies, resulting in non-linear resonance characteristics. If the sides of the body were curved, creating a more oval shape, the frequency response of the instrument would be more even, due to the lack or reduced amount of phase interference. This would result in a 'warmer' and less nasal tone because the lower frequencies created by the instrument would not be lost to phase cancellation.

The depth of the cavity is similar to that of a Violin, but the fact that the top is leather rather than wood restricts the instrument's dynamic range. The top is one of the most important elements in the amplification of the sound created by the string, as it conducts the vibrations from the bridge into the resonance chamber. The lack of rigidity of leather compared to wood of a similar thickness restricts its ability to resonate. The reason that leather is used instead of wood is the accessibility of this material and lack of access to tools required to create wood plates thin enough to be effective resonators.

Rivets are used to attach the leather top to the body of the instrument, which is less acoustically efficient than a wooden plate fixed to the body with glue. The spaces between the rivets cause a reduction of air pressure in the body cavity, resulting in a reduced dynamic range.

The construction of the bow used to play the Rebab also contributes to the instrument's restricted tone and dynamic range. There is less tension than bows of instruments made by master luthiers or factories, due to the lack of a bow screw mechanism. An interesting difference in the Rebab's bow design compared to other string instruments is that the hairs are wound together in a spiral form, rather than the straight alignment found in the bows of the Violin family. The advantage of this spiral formation is that friction is generated without the need for rosin, which is not available to desert-residing Bedouins.

Aesthetics and function

The concepts of aesthetic form and function are two interrelated nodes in instrument design, so it is important to consider their manifestation and balance in the construction of the Rebab. Its design constitutes several integral parts, each of which plays a vital role in the production and amplification of the instrument's sound.

The curved sides of some Rebabs serve the function of improved frequency response compared to simpler box-shaped designs, due to the more even diffusion of sound waves inside the instrument's body. As previously mentioned, 90 degree angles and parallel sides are not efficient properties for sound production, creating a weaker and less rich tone.

Some Rebab designs include holes in the vellum that let the sound waves escape the acoustic chamber, resulting in improved amplification compared to closed body designs. The small size of these holes and their position at the corners (and sometimes edges) of

the vellum maintains the structural integrity of the vellum's centre, therefore maximising its resonance capabilities due to the proximity of the bridge to the centre of the instrument's body.

The influence of environment and culture on the Rebab's design

Where musical instruments are mass produced, factories acquire raw materials and tools from international sources and can specify and control all aspects of the instrument's design. However, in the absence of these facilities, environmental conditions determine the availability of materials and tools, ultimately influencing the design of the instrument. This is particularly true of the Arabian Rebab, as it originates in desert regions far from urban areas that can support the infrastructure required to produce musical instruments on a large scale. The raw materials that are available to Bedouin Rebab designers are: a small number of tree species, such as Acacia and Juniper, used for the instrument's body, neck, headstock, and bridge; pomegranate wood and horse hair for the bow; sheep, goat, or camel skin for the vellum; and animal intestines for the string. This limited access to resources results in the Rebab's primitive design and subsequent tonal and dynamic limitations.

The cultural context of the Rebab also affects its design. The main role of the instrument is to accompany a poet's musical recitations. The melodies that the poets use are very limited in terms of pitch range, which is reflected in the Rebab's design, only being capable of playing four or five notes (depending on the virtuosity of the performer).

In the maddaheen performance context, the Rebab accompanies the poet's recitations that are limited in terms of pitch range and timbre. This is reflected in the Rebab's simple design, which is influenced by the available materials from the surrounding environment in which the poet lives. From here we notice that many of the design elements of the Rebab are a result of the environment whose resources are exploited to design a folk instrument far from complexity, with acoustic properties commensurate with this simplicity.

Conclusion

In conclusion, there are a multitude of design variants of the Rebab, some of which are less refined than others. The basic and acoustically flawed design of the box-shaped variants of the Bedouin Rebab reflect their role as folk instruments whose designs need not attain the same level of tonal complexity or aesthetic beauty as their younger cousin, the Violin. The rudimentary raw materials are determined by the environmental context of the particular instrument maker, and their simplicity of form is shown by its single string and very limited pitch range, which in turn reflects the simple vocal melodies that they accompany. It is not possible to perform musical styles other than those for which it was designed, showing its deep connection to the music, culture, and environment of Bedouin societies.

This research contributes to the understanding of the design of instruments that form part of the Violin's ancestry, and explains why, even though some of these ancestors are still widely played today, they have not undergone levels of development and refinement similar to the Violin. Further research could include design analyses of other Rebab variants within their context as precursors to the Violin.

الهوامش:

[1] On the other hand, the Ravanastron, according to Willey Gates, had fallen out of use before the development of the modern Violin (Gates 1895:10)

[2] Arabic cultural tradition of a poet praising an important person, such as a tribal leader, royalty etc, accompanied by the Rabab.

[3] The celebration of the birthday of the Prophet Muhammad

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