Experimental Musical Instrument Making as a Method of Organology

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The interest in musical instruments dates back to the distant past. Musicology focuses on the study of musical instruments in one of its disciplines which is called organology. The first reports on musical instruments come from the ancient world, but it is Michael Praetorius who can be considered the “father” of organology. His work *Syntagma musicum: De organographia*³⁸ gave this scientific discipline its name. The focus was especially on the division (systematics) of musical instruments, their description as well as didactic and acoustic principles. The technique of musical instrument making has drawn attention quite recently in the second half of the 20th century. We can mention (disregarding university and school textbooks) the publication *The Secrets of Stradivari*³⁹ by Simon Fernandes Sacconi, an American violin-maker of Italian origin, who is considered an expert in musical instruments made by Antonius Stradivari. Sacconi describes Stradivari’s techniques in musical instrument making. The books *The Art of Violin Making*⁴⁰ by Chris Johnson and Roy Courtnall, or *Violin Making. Step by step*⁴¹ by Henry A. Strobel are devoted to the making of contemporary musical instruments. Both works describe thoroughly how violins are made using contemporary techniques.

The methodology of organology contains an inexhaustible number of procedures and aids to understand the subject matter, i.e. musical instruments. In the foreground, there is mostly a historical viewpoint, i.e. a description of the historical development of particular musical instruments, their spread and use in the cultural history of human

³⁸ Wolfenbüttel 1619.

³⁹ Sacconi, Simone Fernando: *The Secrets of Stradivari*, Cremona 1979.

⁴⁰ Johnson, Chris – Courtnall, Roy: *The Art of Violin Making*, London 2010.

⁴¹ Strobel, Henry A.: *Violin Making, Step by Step*, Aumsville (Oregon) 2010.

society. Simultaneously, emphasis is placed on the systematics and the acoustic properties of already made instruments.

When studying musical instrument documentation, we have to rely on several sources of knowledge. First, these include the musical instruments themselves. From them, we can deduce their shape characteristics, tools used, acoustic properties and other important information. Written memorials constitute the secondary source. This group includes, for instance, reports on musical instruments in periodical literature, inventories of church or monastery property, and others. Iconographic depictions offer a special testimony. The analysis of graphic sources is complicated, and it shows the many difficulties to be taken into account (musical instruments common at the time of an artist used in pictures depicting scenes from the distant past is one such difficulty – for instance, biblical scenes showing musical instruments from the Renaissance). Of course, we cannot disregard music notations providing information on the demands made on musical instruments.

Summarizing the aforementioned procedures can result both in quite a detailed picture of particular instruments and in the ensemble of musical instruments used in music culture in a particular place and period.

However, an essential question arises. When documenting the making of musical instruments, we are able to capture contemporary techniques, i.e. the application of contemporary (modern) technologies and tools (e.g. electric machines). This issue is not significant in the case of musical instruments played in classical music. The development of their construction, often lasting over many centuries, is continuous and the techniques are almost identical with those used in the past. Only new knowledge and high-quality tools are used here (in the case of violin neck making the technique has not changed much since the time of Amati, and even the tools used by contemporary violin-makers differ maybe just in machining and motorization – drilling machines, planning machines, milling machines, etc.).

The situation is much more complicated in the case of musical instruments whose traditional making was interrupted. This does not include only ethnic musical instruments, which are the major theme of the research based on which this text has been written; this category includes also the musical instruments used not only in classical music (serpent, shofar, and others). In many cases, today's demand for such non-traditional musical instruments is solved by making copies of "extinct" musical instruments using modern techniques. In this way, instruments are made on the basis of historic models (replicas or copies) which are used for the purpose of exhibitions or for performing music with a historical background (or also as unusually sounding objects for modern music⁴²). Such instruments often display high aesthetic properties, but in principle they are just duplicates of existing musical instruments with no invention and no opportunity to answer the question why some construction details show exactly the design that has survived.

The other possible approach to the making of musical instruments, which is more complicated and technologically demanding, is to try to find and apply the techniques used by

⁴² For instance, the ensemble of musical instruments of the Draga Banda band includes also *skipky* from Jihlava.

makers at the time when the musical instrument was a vital part of the particular music culture. Not only can we produce musical instruments almost identical in appearance, but – based on reconstruction – we are able to understand the construction rules of the survived musical instruments and to gain a better insight into the maker's mistakes and into the compromise needed for the functioning and appearance of the instrument. This knowledge is important when working with surviving historic musical instruments, and it can be used to distinguish in an easier way the maker's manual faults from technological difficulties caused by the availability of materials and tools of the time.

The principle of experimental musical instrument making is identical with the approach of experimental archaeology, where this research direction is used most frequently.⁴³ The major struggle is to comprehend technological procedures, to keep them for the following generations and to understand or explain the human society phenomena that cannot be found by different historical or social methods; if possible, to confirm / disprove the theses gained from the sources of a particular discipline.

The project on the documentation of making string musical instruments with a chiselled body has been based on the above principles. It has been implemented with the institutional support of the Ministry of Culture of the Czech Republic for the long-term conceptual development of the National Institute of Folk Culture, a research organization, between 2012 and 2014. Within the above project, the making of three selected musical instruments from the aforementioned group has been documented. *Korábek* has been chosen as the principle representative. In this case, the musical instrument was reconstructed according to the description and depiction published in Ludvík Kunz's work: *Die Volksmusikinstrumente der Tschechoslowakei*⁴⁴ and *Nástroje lidové hudby v Čechách, na Moravě a ve Slezsku*.⁴⁵ The reconstruction was made by Miroslav Černý from Provodov (District of Zlín).

Skřipky from Jihlava has been chosen as the second musical instrument. It was reconstructed by Pavel Hušek from Hradec Králové according to surviving instruments as well as the maker's own research connected with his experience relating to musical instrument making.

Ochlebký was the third chosen instrument. It was made by Vít Kašpařík from Velké Karlovice (District of Vsetín). This musical instrument making most approximated the conditions of the experimental procedure. This musical instrument was made based on the maker's rich experience with the making of folk musical instruments.

The research results have been summarized in the publication entitled *Hudební nástroje IX. 1. Vol.: Dlabané smyčcové nástroje*,⁴⁶ a part of which is also a video-documentary

⁴³ The Department of Archaeology, Faculty of Arts, Hradec Králové University, is one of the institutes dealing with experimental archaeology in the Czech Republic. The Prehistory Archaeological Park in Věstary is one of the outputs.

⁴⁴ Kunz, Ludvík: *Die Volksmusikinstrumente der Tschechoslowakei*, Leipzig 1974, pp. 65–68.

⁴⁵ Kunz, Ludvík: *Nástroje lidové hudby v Čechách, na Moravě a ve Slezsku. Sv. 2 C–H [Folk Music Instruments in Bohemia, Moravia and Silesia, Vol. 2 C–H]*, Rožnov pod Radhoštěm 2009, pp. 425–426.

⁴⁶ Höhn, Jiří: *Hudební nástroje IX. 1. část: Dlabané smyčcové nástroje [Musical Instruments IX, I Vol.: Chiselled String Instruments]*, Strážnice 2014.

capturing the making of the aforementioned musical instruments. In the following text, we will attempt to summarize and assess the experimental making of *ochlebky* and to outline further possibilities to continue the project.

Ochlebky – experimental making

When preparing the making of this musical instrument, an assessment was performed on the conditions under which it was made, on the tools available for the original makers and on the technological properties they used. As to the material, the only possible solution was to use the material that grew in the maker's neighbourhood. Therefore, it was possible to use basic woody plants, such as spruce, willows and oaks. Fruit tree wood (pear trees, apple trees) might have not been used so frequently because fruit trees were important for their fruits and it was not desirable to cut a healthy tree gratuitously. In principle, we can exclude all exotic woody species (ebony, mahogany etc.) and such woody plants that are unsuitable because of their properties (for example, pine trees contain a high percentage of resin, often in the form of resin pockets).

It is more complicated to define the tools used. Here we can proceed on several groups of information sources. The first one includes the surviving musical instruments. When researching them thoroughly, we can find some traces of the craftsmen's tools used. In criminalistics, this method is commonly called mechanoscopy.⁴⁷ The procedure is based on a thorough investigation of traces left by craft tools when shaping the material. During a visual investigation, major attention is paid to characteristic phenomena which followed different ways of material treatment. We can find differences between the traces left by a jack plane or a chisel. In the case of smoothed wood, attention is paid to passing lines, edges and difficult-to-access areas (it is necessary to use small mirrors to examine the space inside the musical instrument). It is exactly in these places that we can find some traces of techniques preceding the final trimming. Not all traces are visible to the unaided eye; therefore, it is suitable to follow up a visual investigation with an optical one. To study particular musical instruments, optical appliances and devices (magnifying glass, microscope) are used to better differentiate between traces left behind; at the same time, this method reveals possible new data (for example, Sacconi in his book *The Secrets of Stradivari* proves the final grinding of a violin plate with horsetail based on small residuals that got stuck in wood pores⁴⁸). The above investigation results in an approximate list of craft tools used for the making of a particular musical instrument, as well as in the direction in which the musical instrument was led when the material was worked.

Because of the limited scope of the aforementioned visual method, it is necessary to add another source of research that is based on common knowledge about musical

⁴⁷ Compare Havlíček, Ladislav: *Mechanoskopie: Stopy a znaky řemeslných nástrojů* [*Mechanoscopy: Traces after and Signs of Craft Tools*], Prague 1940.

⁴⁸ Compare Sacconi, Simone Fernando: *The Secrets of Stradivari*, Cremona 1979.

instruments and techniques at a particular time. In the case of *ochlebký*, it is necessary to research into communities living predominantly the shepherd's way of life in the region of the Carpathian arc. This period corresponds to the 19th century. Based on the information obtained in the above way, it is possible to get a resulting picture of the tools and procedures employed thanks to the techniques which are still being used. Alongside the techniques, the tooling is also passed on. Taking into account what has been mentioned above, we can deduce a certain parallel between making the body of the musical instrument and the producing chiselled-out bowls. The resulting shapes are similar, and the traces left by the tools show similar features. Therefore, we can apply identical techniques and tools when making the body of the *ochlebký* (the production of a chiselled bowl was demonstrated for example within the project *Lidová řemesla a lidová umělecká výroba v České republice*).⁴⁹ Similarly, the making of the top plate can be compared with the production of shingles (by splitting a coniferous tree trunk, a quite thin plate is made; then it is worked by a drawshave to get the necessary thickness). The blank made by splitting the tree trunk, which is thinned to the required measurements, is an input material for the plate as well.

The surviving tools constitute a specific input source of information about the making of a musical instrument. However, this source can rarely be found in the folk setting. Even though a lot of tools have survived, we often lack information about their origin, age and, in some cases, even about the way they were used. It is very difficult to reproduce the complete workshop of an instrument maker. The workshop of Jan Veverka from Lipov can be mentioned as a successful example – the large collection from this smithy includes 462 objects; the collection from the workshop of carpenter Jan Šťavěl from Javorník with 103 objects is another example.⁵⁰ However, the author does not know about more or less complete equipment from a workshop of a folk musical instrument maker.

Iconographies (photos, drawings....) represent the last source for the research into musical instrument making. In this case, however, we have to rely only on the 20th century – that means a period where the researched musical instruments were no more commonly made.

Procedures in the experimental making

The reproduced musical instrument was made on the basis of the above analyses. A longitudinally split tree trunk drying under natural conditions for many days was the basis for the *ochlebký* body making.

First, the body was hewed using an axe and converted into a rough shape similar to a bottle (Fig. 1). This rough shape was trimmed using a drawshave, a knife and an axe (when trimming the surface, the axe was used as a cutting tool – the cutting edge was

⁴⁹ Pavlišťik, Karel: *Práce ze dřeva I. část [Objects Made from Wood, 1st Part]*, Strážnice 1998.

⁵⁰ Both collections are parts of the ethnographic collections at the National Institute of Folk Culture in Strážnice.

pressed against the worked material as shown in Fig. 2 – not as a hewing tool). The inner cavity was made by a round adze. The excess material was removed by hewing first, and then the surface was trimmed using an adze as a knife – by pulling and pressing (Fig. 3). The resulting (outer and inner) surface of the body features a lot of sharp edges and quite smooth faces (Fig. 4). Fine notches can be seen inside the musical instrument. The surface is pleasant to the touch and it can be held easily. Possible smoothing (not done during the reconstruction) could be finished with a piece of broken glass or a shard of knife (sabre, axe...) used like a carpenter's scraper.⁵¹ The neck shaping trimmed by a knife is noticeably smoother than the body and does not block the thumb movement when playing the instrument. The head was finished using a knife. This activity is in accordance with the woodcarver's art and corresponds to the maker's capabilities. Based on the maker's long-time experience, the flat shape of the head (Fig. 5) was modelled on a musical instrument called *rebec*.

Fig. 1

⁵¹ The experiment supposes the musical instrument's surface was smoothed even after the musical instrument was finished, while it was used. This technique is not determined by other production process and it could be used as to the needs.

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Making peg holes in the flat head was a more demanding as a procedure than as a technique. There were two possible ways. The first and easier one was to make a hole using an auger (or a gimlet). In the course of the reconstruction, the more difficult way of

burning holes with a red-hot piece of iron was used. For this procedure, a special tool from a carpenter's cramp was made. The cramp was converted into an L-shape, its sharp tip on the longer side was stripped and provided with cut-out teeth (Fig. 6). The high temperature (the cramp was heated up in the fire) and the rough surface removed the wood material and created the holes. The resulting round holes through the approx. 1,5-mm-thick head featured very smooth walls that were slightly conical thanks to the cramp shape. The tapering shape was preferred for locking-up the peg in the hole; as a consequence, the tuned sound of the musical instrument lasted longer.

Fig. 6

The production of the top plate was based on the procedures used for shingle working. The blank made by chopping up the trunk (spruce) was thinned to the necessary thickness (3–6 mm) using an axe and a drawshave. The surface area was trimmed with an axe by pulling and pressing; this procedure substituted the jack plane which was seldom available at the shepherd's hut. The plate contour was made with a knife. Musical instruments of this type were provided with soundholes. For the reconstruction, the maker chose an easier form consisting of two eyelets connected to a C-hole (Fig. 7). The soundhole was made by burning the eyelets using the same procedure as in the case of the peg holes; the body of the hole was cut out using a knife. The same technology was used to make a hole for the bridge foot (see below).

Fig. 7

The top plate and the instrument case were joined together using several methods. The use of nails (metal or wooden ones) without any glue seemed to be the most common method. Apart from resin, glue was not as available as nails, which were also used in other activities as documented in records found in folk settings. Therefore, there is no reason to question the use of nails even in the construction of musical instruments.

For the transmission of oscillations between the string and the body, a high flag-shaped bridge was usually chosen. The foot under the bass string stood on the top plate and the other, which passed through the plate, leant against the bottom of the body (Fig. 8). The technique for this type of joint between the bridge and the soundpost would be feasible under the given conditions.

It is not necessary to pay much attention to the production of pegs, bridges, and nuts because this concerns the basic skill of knife work.
The musical instrument was given gut strings.

Fig. 8

Results of the experimental making

To avoid any possible misunderstandings, it is necessary to point out that the researched information comes from only one experimental attempt, and it is to serve as a basis for the following theoretical and practical work that can verify, disprove or modify the data. On no account the information can be understood as a dogma; it can rather be interpreted as one of many possible procedures. The project was to discover whether the chosen methods can also be applied in organology, and how they can enrich our knowledge of musical instruments.

The experimental making of *ochlebky* could confirm that a musical instrument with high-quality sound and appearance can be made using basic tools that were available to shepherds (Fig. 9). The set of tools required to make a simple instrument consisted of a knife (a basic tool for humans since the prehistoric times until now), an axe (necessary for surviving not only in the country), an adze and a drawshave (basic tools for the production of most utilities used in households – bowls, troughs) and several simple

aids (a cramp, a pencil or coal). The techniques applied to musical instrument making are common also to other activities of a human being especially those connected to his survival in society and nature.

Fig. 9

It was also found out that a skilful worker was able to make *ochlebky* in two and half days, even if he only had a moderately-equipped workshop. If we use the time measurement known in applied archaeology where an activity is converted into man-hours (the amount of time needed to fulfil a task: one man-hour equals the work of one person in one hour), the final value equals approximately 15 hours. Therefore, it may be feasible to make one musical instrument a week providing the maker devotes himself to the construction only in his leisure time (for example, in the evening).

Carving a more complicated head or even chiselled pegbox, presented by e.g. *ochlebky* depictions in the publication *Nástroje lidové hudby v Čechách, na Moravě a ve Slezsku*⁵² by Ludvík Kunz, with the use of simple tools seems to be unrealistic.

⁵² Kunz, Ludvík: *Nástroje lidové hudby v Čechách, na Moravě a ve Slezsku. Sv. 2 C-H* [Folk Music Instruments in Bohemia, Moravia and Silesia, Vol. 2 C-H], Rožnov pod Radhoštěm 2009, p. 423.

It is significant for organology that the applicability of the chosen method has been confirmed. It can also extend possible approaches to musical instruments because it introduces new information about the main subject matter which cannot be obtained in another way. Even though the result must always be understood as one of many possible interpretations with almost no possibility to generalize, it is suitable to include this method as a possible direction for future researches in the field of musicology.

Experimental Musical Instrument Making as a Method of Organology

Abstract

Experimental musical instrument making with the use of period tools and techniques seems to be one of many possible methods for researching the development of musical instruments. This is especially important for the study of those instruments where the customary use and transfer of techniques in traditional forms, i.e. from the maker – teacher to the learner, were interrupted. This is not only useful when researching folk music instruments, but also when documenting musical instruments in extinct cultures or musical instruments vanished in previous eras. The output resulting from experimental making extends our knowledge of the development of particular musical instruments and explains their functional, aesthetical and structural features by elucidating the course of their making. In this way, it is possible to discover the inputs (cost, time, knowledge and material) required to make musical instruments. It is always necessary to be aware of the fact that experimental making is an interpretation based on the experience of those who participated in the project, and the documents that have survived from the time when the researched musical instrument was a vivid part of the music culture; more general results can be reached only if the procedure is repeated many times.

Experimentální stavba hudebních nástrojů jako metoda organologie

Abstrakt

Experimentální stavba hudebních nástrojů za použití dobového vybavení a technologie se jeví jako jedna z možných metod pro zkoumání vývoje hudebních nástrojů. Jako obzvláště důležitá se jeví při studiu těch nástrojů, u nichž došlo k přerušení tradičního užití a předávání technologických postupů tradiční formou, tedy z výrobce a učitele na žáka. Není to jen případ instrumentáře lidové kultury, ale zároveň i východisko při dokumentaci nástrojů zaniklých kultur nebo vymizelých v dřívějších obdobích. Výstup vzniklý na podkladě experimentální stavby podstatně rozšiřuje znalosti nejen o vývoji jednotlivých nástrojů, ale hlavně osvětluje jeho funkční, estetické a tvarové charakteristiky tím, že se snaží pochopit průběh celé stavby. Lze tak zjistit vstupy (ekonomické, časové, vědomostní

i materiální) potřebné ke stavbě hudebních nástrojů. Vždy si je ale potřeba uvědomovat, že experimentální stavba je výkladem postaveným na zkušenostech aktérů a dokladech, jež se dochovaly z doby, kdy zkoumaný hudební nástroj byl živou součástí hudební kultury a pouze jeho několikerým opakováním je možné dosáhnout obecnějších výsledků.

Key words

Musical instrument; folk culture; experiment; chordophone; making.

Klíčová slova

Hudební nástroj; lidová kultura; experiment; chordofon; výroba.