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What Is It Like to Create a Bow?
Poiesis as research

Prelude

I had been interested in the cello for many years. I had always loved the sound and admired its physical appearance and the people who are able to make it sing. For about the same time, I shied away from learning a new instrument – especially a bowed one – due to the steep initial learning curve involved. At the beginning of the Coronavirus pandemic, I again began thinking about the cello and the same doubts attempted to push the thought away. This time, I did not give in to my doubts too easily. Since I have a background in playing the guitar, I started looking for options for fretted bowed instruments, which would allow for an easier start into this new territory, as my left hand would be on familiar ground. Almost instantly, the viol popped up on my radar. A viol or viola da gamba is a five- to seven-string bowed instrument that is held between the legs and comes in very different sizes and shapes. It had been rediscovered at the beginning of the 20th century after it sank into oblivion about 100 years before. Just like the instrument itself had been lost in history for a while, I had forgotten about it after the first contact through the movie *Tous les matins du monde* by Alain Corneau many years ago and suddenly remembered the sound and music that had fascinated me as a teenager. There are a few modern incarnations of viols and aesthetically unpleasant home brew experiments, but I fell in love with the looks of the original baroque style instrument and its non-standardized appearance. I started writing

to some luthiers to ask if they had an instrument for rent, since I did not want to spend large amounts of money on a new instrument before having tested whether it even scratched my itch. Unfortunately, there was no instrument to be found for rent and the prices for most used ones I came across could hardly be justified. I therefore kept scanning the online classifieds sections for a more reasonable alternative. At the same time, I organized a few lessons from a viol teacher close by. Shortly after, I found an instrument, that I instantly adored. It was from around 1930, had some wear and tear, and a slightly concerning crack, that probably needed repair. Other than that, it looked just beautiful. As with many instruments of that era, this one does have more resemblance to a cello than a baroque viol.[1] The neck is narrower but thicker, it does have an endpin and top and back plates overhang the ribs, but all that added to its charm and uniqueness. The instrument was located in Magdeburg and the owner had the same last name as me. Her father was a luthier and her grandfather, the original owner and former professional cellist had passed the instrument on to her. Although not related in any known way, I somehow liked the idea of the instrument staying in the family so to say. After picking it up, bow and bag included, I went directly to a viol maker in Cologne to have new frets put on, since those were missing. At home I promptly tried the now fully functional instrument. My left hand felt at home immediately, due to my experience with the guitar, but the bowing proved disastrous at first. It did not sound like expected or hoped for, the bow felt weird in my hand, and I had a difficult time achieving anything even remotely similar to a pleasant experience (and sound). As every self-critical and reflective person trying out something new would do in such a situation, I of course blamed it on the material. The bow must be faulty, almost unplayable even, what else could be the problem. Looking back now, the bow really was nothing to brag about and most certainly did not originally belong to the viol anyways, but to a much greater extent, as I must admit, it might have been my incapacity to properly bow. Nevertheless, I suddenly became very interested in the up until then by me only vaguely aware of universe of bows and wanted to find out more about those unruly objects.

1 It should not go unmentioned, that viols in cello form also existed in the baroque era.

my viol

Three strings to my bow

I wanted a new bow, that I was sure of, one more appropriate to the instrument, one better suited to my lack of skill. Therefore, I started to conduct some research to identify my options. The appearance of bows changed during the centuries with three major forms of construction to be distinguished.[2] The relevant difference for my decision had been the way in which the hair tension can be adjusted, which is necessary because temperature and humidity influence the tension of the hair and accordingly the way, the strings react to bowing.[3] Therefore, while differentiating the three main bow types, I will focus on the area around the frog. A frog, very simply put, is the part of a bow, that sits close to the end of the stick and guides the hair. It can be made of many different materials but in modern bows it is almost exclusively made from ebony.

1. The first type of bow uses a clip-in frog, where part of the stick is carved out for the frog to fit and be clipped into. This way, it cannot move around unintentionally. The hair is attached on both ends to the stick and does not allow for any direct compensation of its tension. This can only be achieved by either exchanging the frog with another one with a slightly different height or placing or removing material underneath the frog to alter its height and the tension.

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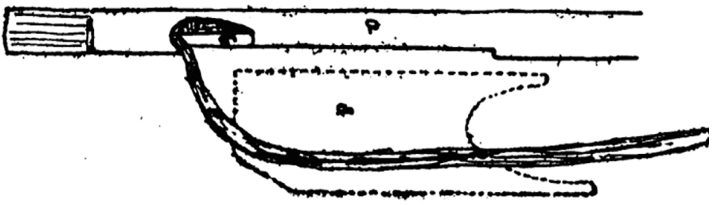

2 Walter Senn, „Streichinstrumentenbau," in *Die Musik in Geschichte und Gegenwart, Band 12*, ed. Friedrich Blume (Kassel: Bärenreiter, 1965), 1551-1556.

3 Playing a viol allows for an additional way of adjusting the hair's tension with one's finger in direct contact with the bow hair but this is used for articulation and not for permanently compensating for improper hair tension.

4 Henry Saint-George, *The bow, its history, manufacture and use,* London 1896, 30.

2. The second type is called crémaillère bow and could also be seen as a variant of the clip-in version. There, a ratchet and a hoop mechanism allow for the frog to be moved closer to or further away from the end of the stick and therefore to change the tension of the hair. This advantage over the clip-in frog comes at a price. The extra mechanism is a cumbersome device and adds weight to the end of the bow. This can be seen as the least successful type of construction.

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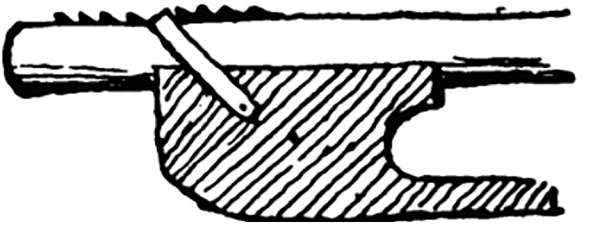

3. The third type is the modern incarnation where the frog is fixed, and the tension of the hair is changed by a screw at the end of the bow. Only one end of the hair is attached to the stick, the other to the screwing mechanism. This form of bow is the most complex of the three and calls for additional materials besides wood and hair, namely leather, metal, and various decorative elements. Nowadays it is the version that is used almost exclusively.

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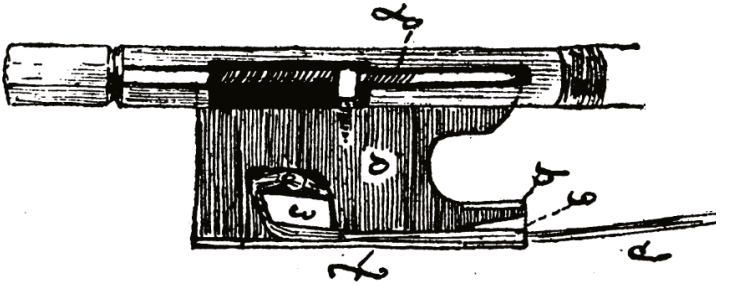


5 Ibid. 32.
6 Ibid. 91.

What kind of bow would I like to use? Which one would best suit the instrument? During my research regarding those questions, I came across a somewhat heated debate in the printed notices of the German Viola da Gamba society.[7] The argument was about the advantages and disadvantages of bows with clip-in frogs and bows with screw mechanisms. The crémaillère was not even mentioned as a third alternative but I had already ruled it out as an option for me before reading the article anyways. In the 1992 February issue[8] of such printed notices, Annette Otterstedt – musicologist, curator, and viol player – described how she came to preferring bows with clip-in frogs through playing copies of original baroque era specimen. Those copies were initiated by herself because at that time she could not find readily available facsimiles but still wanted to test some common opinions regarding bows that she started to doubt. Generally spoken, one question of hers had been, if the modern bow really is better (for her). In this process several of her own beliefs regarding the length and weight of bows and their construction in general began to crumble through experiencing the results of her design experiments. In the following May issue[9] of the printed notices, the bow maker Scott Wallace responded to Otterstedt's article where he criticized or rather just doubted some of her remarks regarding traditional methods of bow making and some advantages and disadvantages she mentioned, while at the same time giving her credit for undertaking those experiments and the reevaluation of clip-in frogs. He finally summed up the differences he saw in both types as follows:[10]

clip-in	**Screw**
elegant	less elegant
sturdy	less sturdy
not directly adjustable	easily and precisely adjustable

In the same issue,[11] violin and bow maker Robert Schär described the process of building copies of historic bows, starting with studying and measuring them in the collections of museums. He also referred

7 Viola da gamba – Gesellschaft, accessed October 3, 2023, https://www.viola-da-gamba.org/.
8 Annette Otterstedt, „Der Steckfroschbogen," *Viola da Gamba Mitteilungen,* February 14, 1992, 4-5.
9 Scott Wallace, „Zum Artikel von Dr. A. Otterstedt im Februarheft," *Viola da Gamba Mitteilungen,* May 13, 1992, 7.
10 Shortened and translated by the author.
11 Robert Schär, „Vom Recherchieren und Rekonstruieren," *Viola da Gamba Mitteilungen,* May 13, 1992, 4-6.

to the article of Otterstedt and praised the benefits of clip-in frogs as well as highlighting the downside of not being able to adjust the hair tension easily. Otterstedt's response to Wallace's critique can be found in the August 1992[12] issue. Besides very convincing arguments against Wallace's claims, she stressed how difficult it had been to even find a bow maker that would really listen to and finally turn her ideas into reality, not blindly sticking to traditional beliefs and prejudices. The final response[13] of Wallace can be found in the same issue, but only focuses on aspects that do not hold any relevance to my article and are therefore left out.

Weighing all of the advantages and disadvantages and listening to my guts, I took sides for the clip-in frog. This was not due to the historical adequacy of bows with clip-in frogs being more widespread through baroque times, where the viol thrived, but because I thought it to be the better and more elegant concept of a bow. Otterstedt's arguments were more convincing and the whole concept of simplicity resonated with me. Additionally, I am very critical towards traditional beliefs and often prefer alternative underdog solutions or technologies deemed obsolete. Therefore, the somewhat outsider position of the clip-in frog had been another plus.

Research-creation

I could have stopped right there. I was convinced. I preferred the reduced materials and simpler implementation of the clip-in construction. Therefore, I simply would have had to spend a small fortune,[14] buy such a bow and hopefully be happy or find out that my assumptions were incorrect. However, there still would have been unanswered questions then, questions that were relevant to me, the main one for the purpose of this article being:

> What is it like to build such a bow?

This question cannot be answered from a third- but rather only a first-person perspective, through one's own experience instead of reading or listening to descriptions. I also did not want to just study

12 Annette Otterstedt, „Antwort auf den Leserbrief (vgl. Nummer 6)," *Viola da Gamba Mitteilungen,* August 18, 1992, 4.
13 Scott Wallace, "Antwort auf den vorstehenden Brief," Ibid., 4-5.
14 Buying such a handmade bow sets one back 1,000+ €.

finished artifacts of a time long gone. Of course, that is an important part of research. At least, if you were concerned about historical aspects and not just functionality. I leaned more to the historically derived functional aspects which also offered the possibility to build a slightly modified modern interpretation, and not seeing things, in this case tradition, as a given. I hoped for solutions, that tackled the only mentioned and agreed upon downside of the clip-in frog: not being able to easily adjust the hair tension. The answer to the additional open question about how to build such a bow is included in tackling the first one. The final open question about what it would be like to play such a bow, one that I have built myself, comes in third but cannot be tackled in the limited space of this article.

Once again, I opened up my browser to ask the almighty interweb for guidance. I searched for bow makers that had clip-in frogs in their portfolio and had added some means of adjusting the string tension. After quite a while, I came up with three results. This at least felt like an upgrade from the situation mentioned by Otterstedt thirty years earlier, although I am sure I could have found more. And it is very likely, that not every bow maker advertises clip-in frogs on their website. Two of those luthiers I came across used a ratchet between the bow stick and the frog. This reminded me of the crémaillère but here the ratchet was hidden by and underneath the frog. In both cases, the ratchets were made of bone. The third luthier used some kind of wooden pin. From the website itself, I could not figure out much more, other than that it somehow allowed for the frog to slide on the stick. I really liked the website's design and the fact, that the luthier experimented with all kinds of unusual alternative wood species.[15] The exceptionally beautiful appearance of his bows did not hurt my decision and so I opted for his design, since it does not introduce additional materials and the whole concept struck me as elegant and minimalist. I am aware that this has been a purely aesthetic choice at this point but what else should I have based my decision on? I contacted him via E-Mail and after some talk about my intentions and ideas, Michael invited me to visit him in his workshop and stay for a week. This positive response and a feeling that we had very similar opinions reassured me and so I planned a trip to his location in the historical part of Schwäbisch Hall.

15 This seems to be a more sustainable approach since the almost exclusive use of the Brazilian Pernambuco wood in the making of high-quality bows for the last 200 years and therefore its excessive harvesting has led to its status as an endangered species.

overview of one side of the workshop

We instantly clicked and he showed me around his particularly beautiful and organized workshop while we talked some more about his approach and my expectations. Since I specifically came there to build a bow with a clip-in frog, he did not have to convince me of the advantages for my specific project, which he otherwise would have done. For the already mentioned problem of normal clip-in frogs, that tend to be somewhat problematic in changing humidity and climates, he came up with a unique solution. A downside of the alternatives along the lines of crémaillère, including the two concepts of the other two mentioned bow makers is, that if you want to decrease the tension, you first must increase the tension to be able to move the frog at all. This is owed to the principle of the ratchet. Michael instead makes the frog movable without any ratcheting/locking mechanism. He just adds one single tiny pin made of wood to the stick. The frog has a carved-in rail, so the pin only guides the frog. Additionally, the frog is rounded on the bottom with the same curvature as the stick. The frog then is held

in place by the tension of the bow hair.[16] Therefore, if I wanted to lower the tension of the hair of the bow, I did not have to put additional stress on the hair to do so. I can simply slide the frog along the stick. Due to the style, a viol bow is held, and the viol is bowed, adjusting the hair tension and therefore changing the frog's position, is not a problem (for me). Shortly after our initial talk, we went straight to work by discussing what kind of wood to use. A bow stick calls for very specific characteristics in the wood and most species simply cannot be used. Although Michael still could offer several options, we settled for snakewood, a beautifully textured wood of reddish/black color that had been used extensively for baroque era bows due to its density and weight. The frog can be made from many more wood species or bone since the function is not quite as limiting to the attributes of the material. Michael got hold of a very rare and difficult to come by wood called Tubi. It can only be found on the Solomon Islands east of Australia, is dark in color and very heavy but at the same time easy to work with. I was totally amazed by all of the different kinds of wood and their specific qualities. This offered a completely new perspective on wood in general as the colors and textures I have seen ins Michael's workshop were nothing I had ever seen before.

choosing the wood for the frog, unfinished stick as color reference

After the initial choices had been made, it was time to start the more difficult work. The first thing we did was a very rough cut of the piece that would later become the stick and head of the bow. It seemed as if we had made a good choice. As soon as the wood had been cut and released its tension, it showed a slight bend just like it should have been in the finished bow. This allowed us to later

16 A bit of rosin can be added to the stick where the frog is sitting to further increase the friction.

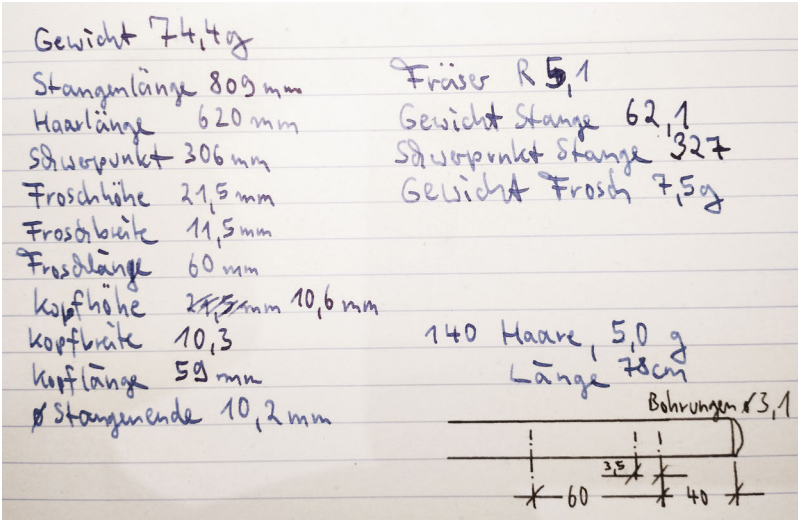
skip the step of bending it with heat. I then started using a plane to bring the piece into a shape closer to the expected end result with a mixture of measuring and eyeballing the thickness and using chalk to mark the parts, that had to be taken off. Initially this was done very roughly and gradually more refined while changing plane sizes. As the planes became smaller, other tools were introduced for further work on the stick and the head like rasps/files, chisel, carving knife, scrapers and so forth, while always checking the consequences of my doing and adjusting the next step and gesture. A frame of reference and experience in the field were substituted by trust in Michael's supervision and a very close observation of my actions and the piece at hand. Already during those few days, I became increasingly familiar with the tools and materials, what to expect from them, how to handle and how not to handle them, how to store and how to place them on the workbench, how to clean them and what to look out for. I slowly developed a feeling for the processes, the movements, a sense for the response of the material and especially gained more confidence. There had not been a blueprint for the bow. Its form evolved during its making. There were of course a few attributes it had to show, a few things, that needed to be a perfect fit, but other than that, there had been quite some freedom in the execution. While getting closer to an intended result or working on something that had to fulfill specific criteria, the intervals of checking with Michael grew shorter again and the material taken off became increasingly fewer. "Can I still keep going? It already feels very thin." His probing eye and bending the stick to check for its reaction made my heart skip a few beats, but he absolutely knew the material and assured me that I was quite far away from any danger. For him, it was not always necessary to measure, but more important to feel the reaction of the material, knowing exactly what it needed to do in response to his probes. Every piece of wood is different, so perhaps with one piece you can or have to take off some more relative to a measured value and with others you simply cannot, or it will break. Therefore, the non-existent blueprint could have only been a rough estimate anyways. When, as in my case, the head and frog are designed on the go and I did not have an exact shape in mind, just eyeballing from other bows which's shapes I liked most, the stick itself then must be adjusted to place the center of gravity in

the perfect position for bowing. This is very important for the bow to be held comfortably without using force to keep it in a horizontal position. The center ideally has to be exactly where the hand grips the bow. When moving the frog, this does slightly alter that center, but the moving of the hand accordingly automatically adjusts for that change.

finishing touches on the bow stick, frog in the box on the right

For me it sometimes had been stressful, especially when thinking about what would have happened, if I were to break the stick or did ruin it beyond repair and would have had to start all over again. This would have meant the end of the bow project, due to the limited time I had planned in. Luckily nothing of that sort happened. I had worked on the stick and frog in parallel for quite a while. When I felt tired from the at times somewhat repetitive removal of material from the stick, I moved to the frog and continued the detailed work on shaping it. Those were two completely different processes for me, albeit using similar tools. Both lines of work complemented each other nicely and I could use one to take a break from the other. I took a close look at the frog and liked its appearance. The dark wood's rounded shapes felt very comfortable against my hand. The

stick appeared to be smooth and had a very nice shine to it. It took a while before the words came out of my mouth. In disbelief I stared into Michael's direction, back to the two pieces of wood and back to Michael again. "I think I am finished." I expected him to answer with an "almost, you just have to …," as has been the case several times before. This time, after checking everything very carefully, he agreed with a nod, "Let's put everything together then." We turned the frog's guiding pin on a lathe, drilled the hole for it and tried moving the frog along the stick. It worked perfectly. However, a bow is nothing without its hair. I chose black over white hair due to the looks as well as the slightly rougher structure being an advantage for lower string instruments – like my viol – whose thicker strings then are more easily set into motion and compensate for my lack of skill. There are two ways to calculate the amount of hair for a bow, either counting or weighing. Since every single hair has to be checked for its quality anyways, we counted them. They were cleaned, brushed to make sure they run in parallel and cut to the proper length. For my bow, finding hair long enough was a challenge, which resulted in only having to trim the tips. Small wedges are used to attach the hair to the bow. I already made the necessary complementing recesses in the head and stick before, and then almost like a surprise it really became a bow. I held the completed artifact in hand after having doubted several times whether I could succeed on time.



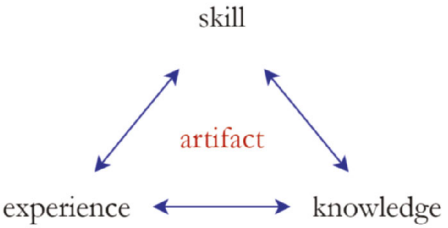
measurements of the finished bow

It took me one whole week to finish the bow and I did not expect it to be such a tedious and labor-intensive process. Judging from the appearance of a finished bow, on first glance it seems to be an artifact of very low complexity, minimal parts, and materials. Getting it to that point – to those exact features from the raw materials and only using hand tools – is another story. Having had no prior experience in building instruments or woodworking, there was so much to learn and new impressions to be had, it totally amazed and still amazes me, getting to know the tools and materials, working with my hands, creating something that did not exist before, shaping the frog and the head of the bow completely to my liking, counting hairs, weighing the materials, localizing the center of gravity, being proud of my own hand's work. Am I happy with the result? I am more than happy and sometimes, especially in retrospect I have a difficult time believing and imagining, that it was really me who created it. It not only looks but also plays so much better than the old bow that I have not touched since. How does the outcome of this adventurous week connect to my research work and where does it lead to next?

Evaluations and speculations

In the following analysis, I aimed for breadth instead of depth, showing possible paths, options and (possibly) relevant positions, to roughly stake out the theoretical field in which I am operating. Therefore, it can only scratch the surface of what must then be further evaluated. This whole project outlined above tried to answer a research question through the creation of an artifact, a poietic action, historically informed and with practical value for today. The term poiesis here is meant as a combination of the traditional Aristotelian interpretation of using purposeful actions to bring something into existence and the usage by Pickering as a "doing without knowledge/science."[17] On the other hand, it is used beyond creation or action but towards an epistemic purpose. Therefore, the goal was not solely the physical object nor the actions that lead to such an artifact. The outcome beyond the bow itself will be elaborated upon through the following epistemic triad composed of gaining knowledge, acquiring skills and having experiences.

17 Andrew Pickering, "Acting with the world: Doing without science," *e-cadernos CES* [Online], 38, 2022, http://journals.openedition.org/eces/7894

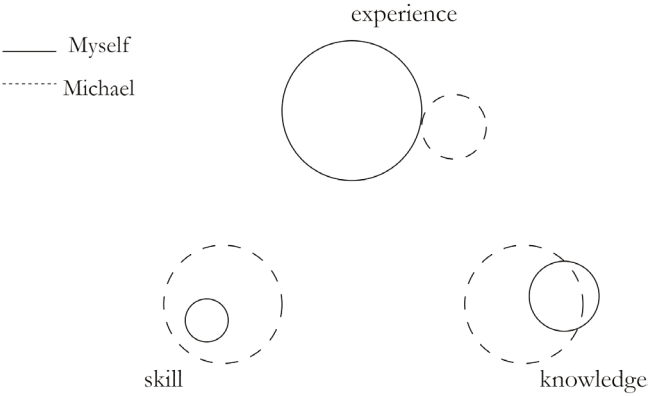


Although one aspect is shown on top, they are not meant to be generally ranked in a specific order or one being always more important than the others. The triangle only shows a momentary state and can be turned to indicate, what aspect is in focus and therefore on top, comparable to a microscope revolver with three lenses for focusing on certain aspects of a subject. I consider them as interdependent equals and am interested in the specific qualities and interconnections between all three, hence the bidirectional arrows from one element to all others. While I created the bow, I gained knowledge, had experiences and to a lesser extent acquired skills along the way. I gained knowledge – for example – about the existence of certain species of wood, where they come from or what they can be used for. I had the experience of using certain tools and ultimately building a bow. I acquired some skill in using the necessary tools. This restriction regarding skill is important. Doing something only once normally does not result in acquiring a skill. Achieving this takes time and practice. However, an experience can be had instantaneously, whereas having experience in a certain field is derived from having had several such experiences. In this aspect it is equal to skill. Regarding knowledge, there have been and still are different and in parts opposing concepts of what it actually is and how it can be achieved. The scope of this article cannot even begin to cope with the subject. I personally tend towards an interpretation as language based with an added truth value and negotiated in specific socio-historical contexts and discourses.[18] A clearer definition is not necessary at this point as long as the differentiation between the three components of the epistemic triad is apparent. The more interesting aspect for my explication is the triad's application on the bow experiment.

While analyzing the role that Michael had played in the creation of the bow, I also mapped my thoughts to the epistemic triad from above. This time, the most relevant aspect for my experiment and

18 Based on Richard Rorty's concept of knowledge and truth as explicated for example in *Philosophy and the Mirror of Nature*.

research question is on top. It is important to differentiate between a mere construction, building or making something, produce a physical result or intentionally create something as an epistemic object, creation as a method of research. This is the reason why I consider the term creation as appropriate, because you create something new regarding the epistemic triad, something that did not exist before.[19]



The dashed circles represent Michael, the solid ones resemble me. We do have overlapping knowledge in some parts, like the general frog principles, whereas Michael has vastly more knowledge regarding materials, tools and techniques and I might have some specific knowledge in the history of bow making and viols. When it comes to the experience of the project, I would suppose that I gained a lot more new experiences, but Michael might have also made some experiences in teaching and helping with bow making. However, the fields or kinds of experiences we had during our collaboration, were very different from another. Therefore, the two circles are separated, only touching in one point, which can be seen as the project of building the bow itself. In the skill department, Michael already possessed all of the skills I very crudely – if at all – acquired, and in a way, he had been an externalized set of skills and experience for myself by answering my questions and being the reference that I myself was lacking. This is why I incorporated my skill circle into his. I could not estimate from the current state of the bow if I were doing the right thing, for how long I should do a certain task, what the specific forms, shapes and measurements were, that I was working

19 It could be valuable to try and incorporate Hans-Jörg Rheinberger's concept of experimental systems and epistemic things into this approach.

towards. In a way I did do without knowledge/science. Of course, I knew about the different modes of frog construction, but I did not have any experience or skill in this field. There had not been a blueprint before, and the head and frog were shaped on the go. Measurements were taken after the construction. Claiming it as an example of a "Doing without knowledge" still could be considered a false attribution, because Michael did possess the role of skill and experience in an externalized form. I would not have been able to finish the experiment in one week without such a form of externalized help, in whatever way this help might have been delivered. The alternative would have been to acquire the necessary skills and experience through many experiments and failures myself, something that would have taken a substantially longer time.

Taking such a closer look to the role of Michael led to important insights. There are different possible combinations or rather separations of the elements in the epistemic triad. However, it is a matter of where one draws the borders of the bow producing system. If it incorporates Michael, then the system of course does have skill and experience. If the border was drawn around me, then the system is lacking in both aspects. Such a seemingly paradoxical doing without skill, which would result from the second version of the system, also directly points to modern production methods, where one set of skills is externalized to the execution by a machine. It should be interesting to compare in-depth traditional crafting to a digital production setup, where you not only can skip the process of making by hand and delegate it to a machine, but you also interact with the tools symbolically and have to at least have a vague idea of the result you want to achieve. You need to have some kind of blueprint or sketch beforehand, and there has to be a description before the production. This directly contrasts taking measurements after the bow had been finished, as I had witnessed. Consequently, you cannot work in correspondence with the material or design on the go, you evaluate on finished objects or prototypes, accept the outcome or trash it and go back to the drawing board. Therefore, there is always an additional layer of abstraction between the "maker" and the made. The concept of "thinking through making"[20] falls apart and

20 As evaluated upon by Tim Ingold for example in *Making: Anthropology, Archaeology, Art and Architecture* (London: Routledge, 2013).

putting actions first is rendered impossible. Making itself converts into an abstraction, a black box. You can only evaluate the input by its output without direct influence on the process beyond formulating the recipe. In such a context, the valuable result is not the artifact, but the recipe to produce it. The generation of such a recipe of course still does need a very specific set of skills, knowledge, and experience, but a very different one from those of the craftman. On the other hand, this delegation allows for agency beyond one's own manual skills. Suddenly the difference between knowing how to make something, being able to make something and making something spans another interesting triangle worth looking into. You can know how to do something, but not be able to. And even if you know how to do something and are able to do it, does not mean, that you will do it. The same delegation of skill and experience to Michael allowed me to work way beyond my personal skill and experience at the time.

Neither in the traditional definition of poiesis nor in the version of Pickering, the epistemic aspects of poietic actions are the center of attention. The explications stop with the end of the poietic action, but what comes next? In my interpretation, Pickering's approach is not just a getting along with a world full of surprise, constant change and emergent behavior, where everything is connected with everything. It can also be read as a way to learn about this world through interacting with it. Perhaps you start without knowledge or without science, because the analytical approaches sometimes fail or simply are not applicable in a specific situation. Nonetheless, you the gain experience, skill and knowledge through actions or in the case above, through the creation of a bow. You might come across systems, that you cannot control, but can interact with.[21] Still, not every reaction of such a system towards your actions is unexpected, and you can cope with unexpected behavior through experience, here in the second form of its definition as a gaining of experience instead of having experiences. Not knowing how a piece of wood will react to your use of a carving knife on it still allows simply having a go and feeling along the material's reactions. However, after several such experiences, I gain experience and skill in the handling of the carving knife and the wood's reactions. In the same way, the

21 And there are also systems that you have complete control over, but whose future states we cannot predict.

Fukuoka[22] method Pickering uses as an example to illustrate[23] the "doing without science" is not just a dealing with the unknowns in certain systems, it is also a form of research. Doing nothing is doing something, it is a decision based on something. You have to at least very closely observe the surroundings, your own actions, and their consequences and then decide to do nothing out of certain knowledges, conclusions and assumptions or experience. Otherwise, it would not be possible to adjust actions accordingly. Actions may come first, but then you have to interpret the consequences thereof or tap into your experience and base the next actions upon those consequences. Even if a system is a Blackbox to the user, as long as it delivers reproduceable or at least comprehensible outputs, the user can meaningfully interact in such a way. It is comparable to improvising. Improvisation as a tool to deal with situations that you cannot fully control does not rain down from the heavens, it is an experience-based set of skills and knowledges. If creating something or acting in that way is executed as a reflected upon practice and not just a practice, if the poietic movement does not end with the finished artifact or the fulfilled action, it then can be used as a method of research. Creation as a research tool seems to be a straightforward endeavor and one would expect it to be an already well-established and researched part of the scientific study of musical instruments. Or as design researcher Bruce Archer puts it to stress the importance of such a method: "There are circumstances where the best or only way to shed light on a proposition, a principle, a material, a process or a function is to attempt to construct something, or to enact something, calculated to explore, embody or test it."[24] Yet, creating something rarely occurs in (traditional) organology beyond building functional copies or restoring originals, whereas the latter is on the decline.[25] An in-depth theoretical discussion and classification still is missing. In the discourse of NIME[26] (New Interfaces for Musical Expression) many experimental approaches

22 Based on the concept of wu-wei, that is sometimes falsely interpreted as doing nothing, the farmer only does the absolutely necessary and in accordance with nature. In Pickering's theory this translates to acting with instead of acting on.
23 Pickering, "Acting with the world: Doing without science."
24 Bruce Archer, "The Nature of Research," (transcribed from a photocopy of the original in January 2009 by), *CoDesign*, January 1995, 11.
25 One example of going above and beyond, is the research of Christina Dörfling, albeit she methodologically seems to be recognized more at home in the field of experimental media archaeology than in organology.
26 https://www.nime.org/.

can be found, and the development of "new" instruments and interfaces mostly based on digital technologies is the main focus. At the same time, past inventions do not receive the necessary attention, whereby the "new" at least becomes debatable or things sold as new actually have been done already a hundred years before.[27] There are of course many other fields dealing with artifacts and their creation, some of which have already bled into organological research. One with an increasing impact worth mentioning is (experimental) media archaeology.[28] As the term archaeology implies, it does have an historical perspective, but analyzing the past to find uses for the present does not seem to be rated very high on their agenda. Further discourses dealing with the study of artifacts and already influencing organology like material culture studies, anthropology of technology and science and technology studies are as far as I can tell from a first overview, seldom concerned with the actual creation of artifacts as a method of research. Design research in the form of research through design, depending on the definition of design and if it involves the actual creation of an object, most of the time neglect what has been done before. The Canadian version of artistic research named research-creation[29] has similar blind spots.[30] All of the positions mentioned above have to be further evaluated to see if those first impressions prove to be true, as well as what can be drawn from them for my own argumentation.

Such a poietical research is highly relevant in certain forms of reverse engineering and experimental archaeology, as I became aware of just recently at the Greifenberg Institute of Musical Instruments.[31] It is important to stress – and the research results at the Greifenberg Institute underline this claim – that the possible questions that can be answered by this method are not limited to "What is it like to…?" They not only build facsimiles of historical instruments but focus on finding out exactly how a specific instrument could have been built to replicate the process itself. Therefore, not just the tool itself

27 Some institutions in this realm are for example the Intelligent Instruments Lab in Iceland (https://iil.is/), the Tangible Music Lab in Austria (https://tamlab.kunstuni-linz.at/), the Augmented Instruments Laboratory in England (https://instrumentslab.org/) or iii in the Netherlands (https://instrumentinventors.org/).

28 This is a still young and very diverse field with different interpretations of what Media Archaeology is or should be, some of which can be far away from actual physical objects. The concept of "Thinkering" might be something worth looking into (https://www.c2dh.uni.lu/thinkering).

29 I prefer this expression because it has the actual creation as a form of research in its name and because it is not charged with the more discussions about university politics surrounding artistic research.

30 Two examples of intriguing exceptions being the works of Ioana Vreme Moser (https://www.ioanavrememoser.com/) and Derek Holzer (https://macumbista.net) that have been done without direct institutional affiliation.

31 https://www.greifenberger-institut.de/.

is important, but also the way in which it had been used. If you want to know how something had been done, you must dig deep into the process itself, try it out, compare the tracks the luthier left and see if you can figure out what left them. You have to create tools and experimentally explore what traces those leave and if something similar could have been used to achieve the result in the past. It is historically informed research into processes. A lot of information about those processes and tools had been lost or needs to be dug out from different and sometimes unconnected historical sources. There is no handbook or a "how to" YouTube video revealing how it had been done. I witnessed the research into how a certain rivet connection in a piano hammer had been achieved. Visually analyzing it microscopically, measuring and documenting every detail, building possible tools, endless trial and error, comparing not only the results with the original parts but also the tiniest scratches the tools left on both, discussing, developing new hypothesis and starting all over. Just for one such tiny part of an instrument the research can take weeks. Of course, it would be easier to just produce a functional equivalent. However, that would not have answered the question of how it had been done 200 or more years ago.

As was shown above, the method of creation allows questions to be tackled and epistemes to be revealed, that strictly analytical or as Pickering would put it "scientific" methods cannot reveal. Therefore, it should be part of the toolbox of every researcher into musical instruments or any artifact if one does not want to unnecessarily limit the breadths and widths of questions to be answered. It is not intended as an opposition but as an extension of other research methods. Additionally, it can not only be used to tackle historical research questions but also ones about the applicability to the needs and wishes of the future, opening organology up to the possibility of not just studying the present and the past, but actively creating and researching for tomorrow. I do not see any reason why organology should "just" be a historical science. Yet, at the moment this almost exclusively seems to be the case. Viewed in that way, the bow is not a replica of a certain historic specimen, but the application of traditional principles in the form of the clip-in frog, combined with a solution for its drawbacks. In the example of creating a bow in the baroque style, it had been a looking into the past to dig out

interesting concepts, that might be useful for today.[32] Organology therefore could be branched out into a historically informed speculation of musical instruments. In this way, it would lead beyond making something to see if it works, beyond the artifactual result and its application. It then could additionally answer questions, that deal with "What if…?", not just bringing artifacts into the realm of experience, but shaping the realm itself and expanding upon it, moving it away from a thought experiment in confined spaces right into the wild to explore its possibilities.

The next step will be to evaluate the scientific approaches already dealing with artifacts in research contexts and reference valuable concepts for my own argumentation, incorporate them to develop a poietic framework of research and elaborate, applicate and test it in the field of organology to finally assess their value as an additional method. The goal will be a theoretical poietic framework that allows historically informed research through the creation of artifacts and at the same time produces valuable results for contemporary practices. Otterstedt's experiments and the experiments with different wood species in the construction of bows by Michael can already be seen as practical examples of a such a form of poietical research.

head of the bow with attached hair

32 This is very close to the reading of history in Nitzsche's „On the use and abuse of history for life" and Foucault's methods as explicated in *The archaeology of knowledge*.

bow with attached hair, frog moved in direction of the head to make the tiny black pin visible