"The finer the musician, the smaller the details": NIMEcraft under the microscope

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ABSTRACT

Many digital musical instrument design frameworks have been proposed that are well suited for analysis and comparison. However, not all provide applicable design suggestions, especially where subtle, important details are concerned. Using traditional lutherie as a model, we conducted a series of interviews to explore how violin makers "go beyond the obvious", and how players perceive and describe subtle details of instrumental quality. We find that lutherie frameworks provide clear design methods, but are not enough to make a fine violin. Success comes after acquiring sufficient tacit knowledge, which enables detailed craft through subjective, empirical methods. Testing instruments for subtle qualities was suggested to be a different skill to playing. Whilst players are able to identify some specific details about instrumental quality by comparison, these are often not actionable, and important aspects of "sound and feeling" are much more difficult to describe. In the DMI domain, we introduce the term NIMEcraft to describe subtle differences between otherwise identical instruments and their underlying design processes, and consider how to improve the dissemination of NIMEcraft.

Author Keywords

craft, design, evaluation, lutherie, violin, tacit knowledge, frameworks

ACM Classification

J.5 [Computer Applications] Arts and Humanities – Performing arts (e.g. dance, music); H.5.2 [Information Interfaces and Presentation] User Interfaces – Evaluation/ methodology

1. INTRODUCTION

Many taxonomies of digital musical instruments (DMIs) have been proposed, considering modes of interaction [16], number and types of inputs and outputs, mappings from action to sound [11], and relation to traditional instruments [30]. Like classical orchestration textbooks, these taxonomies can provide structured comparison between the form, function and usage of different instruments.

In this paper, we draw attention to aspects of DMI design which are not captured by taxonomies. This concerns fine aspects of craftsmanship that distinguish great instruments from mediocre ones. We use the neologism *NIMEcraft* to describe these subtle, subjective qualities. A further definition is given in Section 2.3, but consider two violins as an example: a Stradivarius and a factory-made student violin. According to most taxonomies (and indeed, most orchestration textbooks), these instruments are nearly identical in size, interaction mode, controls, mapping, and pitch range. Nonetheless, nuances in sound and tactile response will result in vastly different experiences for professional violinists.

Just as master luthiers possess years of accumulated knowledge in crafting fine violins, many experienced electronic instrument designers in NIME and in industry have developed detailed personal practices to produce highly-refined instruments. Some have shared personal reflections on their design practices in papers [5] or interviews [7]. However, research papers at NIME and similar venues do not provide a full account of craft knowledge. Some aspects of craft are personal, subjective and inherently nonscientific; other aspects, like the tacit knowledge of a master craftsperson, may not be fully communicable in writing at all.

The next section of this paper explores the coverage and potential gaps of NIME frameworks and taxonomies, leading to the introduction of the *NIMEcraft* concept. The paper then presents findings from structured interviews with luthiers and violinists exploring issues of craft in that instrumental domain. The final discussion highlights opportunities and challenges for the NIME community in sharing NIMEcraft knowledge which may not easily fit the parameters of typical publications.

2. BACKGROUND
2.1 NIME frameworks

In his influential 2001 paper, Cook concludes the description of his DMI design principles by stating that "musical interface construction proceeds as more art than science, and possibly this is the only way that it can be done" [5]. Since then, a multitude of NIME frameworks have been published to aid designers, a full review of which is beyond the scope of this paper. An excellent overview is provided by O'Modhrain [23], who states that they "serve to systematize thinking and promote reflection". Mooney's discussion of music-making frameworks [20] casts them in a different light as "mediators":

> The all-important point is that no framework is a transparent, neutral, mediator of artistic expression. All frameworks - because of their design - have a spectrum of affordance whereby certain objectives are easier to achieve than others.

Music-makers can apply frameworks "naively or knowingly, with or without skill", but regardless, "every framework will make its influence known, to some extent, in the creative output. One can 'hear' the affordances of the frameworks used to compose and perform the music" [20]. If DMIs are artistic works, is it possible to see, hear or feel the presence of NIME frameworks in DMIs? Here we suggest some lenses for viewing common categories of interest in existing NIME frameworks, from the perspectives of their applications, elements, scales and combinations (annotated with indicative references).

By the "application" of a framework, we mean whether it describes an aspect of the activity undertaken by the researcher or practitioner, or whether it describes the resulting artifact or artistic product:

Activity: Design, analysis and evaluation (i.e. a process by which to create or evaluate an instrument). [21, 23]
Artifact: Instruments, performances and installations (i.e. properties of the object itself). [21, 27]

The elements of frameworks come in a variety of thinking styles. Common elements of frameworks can be categorised by whether they describe, guide, prescribe or analyse:

Describe: Epistemologies, taxonomies. [6, 16]
Guide: Principles, guidelines, heuristics. [5, 11]
Prescribe: Processes, methods, protocols. [21, 14, 8]
Analyse: Criteria, evaluation. [24, 23, 1]

Although frameworks are inherently subjective [2], we can still use our lenses to describe a common concern about NIME frameworks. That is, there are a great deal of frameworks to describe, guide towards and analyse instruments and far fewer that prescribe methods to design them [14].

Frameworks can also target different levels of abstraction, from high-level interactive considerations to subtle nuances:

Macro: Interactive or performative paradigms (e.g. symbolic vs. embodied interation) [6, 16]
Meso: Instrument families or musical cultures and their structures (e.g. comparing sensor or mapping strategies) [19, 17]
Micro: Subtle differences between otherwise identical instruments or performances. [12]

In the last case, though Jordà proposes *micro-diversity* to describe the ability of a single instrument to support subtly different performances [12], less has been written comparing the micro-scale differences between two otherwise identical instruments.

In conclusion, using the lenses we have introduced, we can say that NIME frameworks enable the combination and recombination of different thinking styles, at different scales, for different applications. However, it is important to consider what existing NIME frameworks might be missing, and what the consequences might be.

2.2 Tacit knowledge, craft practice and evaluation

Designer Bret Victor writes: "One's ability to articulate an idea always lags behind the understanding of the idea, and the understanding of an idea often lags behind the embodiment in which it is first given life." [28]

To discuss tacit knowledge - which encompasses what we "know but can not tell" [25, 4] - and craft practice, we can borrow from Kettley's *suggested protocol for introducing craft to other disciplines* [15] the three of their seven principles which are most related to tacit knowledge:

1. **Internalization of material:** Internalization of both source material and the material being worked is essential for the development of original language [14].
2. **Processes of internalization:** Internalization of materials is achieved through action - techniques include

drawing, direct manipulation of material and repeated exposure to the material [16].
3. **Embodied process:** Control over formal expressive elements at diverse effective ranges is dependent on an embodied understanding of the processes of production [22].

Combining these additional lenses with our existing ones might explain why there are no thinking styles for micro scale differences between instruments. Since craft practice is at least partially tacit, it is not possible to fully describe or analyse the internalised processes of design. For DMI designers, what can be articulated in research literature are macro scale DMI design principles such as Cook's [5] and performer-centred processes such as Morreale's [21]. For DMI performers, their ability to give feedback via evaluation methods such as [8] is potentially limited, since players are not necessarily sensitive to "hypothetical future capabilities" [18]. As Magnusson points out, neither virtuoso designers, players or anyone else should be expected to be able to describe material epistemologies in words, since they so often precede scientific discovery [16].

However, if as Green suggests we expand the "evaluative horizon" of NIME research to include practice-led approaches [10], such as those described by Kettley, then we can start to recognise and study the ways in which detailed design methods *are* naturally transferred, such as from practitioner to practitioner [14]. It is obvious that experienced designers do use feedback and do not fall into the traps described, so there must be *something else happening* in the design process that is not accounted for by current frameworks, goals or specifications. How does Cook *know* his design principles to be true, and why do we not doubt him?

2.3 NIMEcraft: plenty of room at the bottom

Feynman's famous talk, *There's plenty of room at the bottom* [9], kickstarted a revolution in nanoscale physics and engineering. Inspired by this turn of attention to the small, we introduce the term *NIMEcraft* to mean the following:

The micro scale differences between otherwise identical instruments and their underlying design processes.

Returning to the example of the two violins; they are both violins, possessing the same "mapping", embodying the same musical language, the same people can perform the same music on them, and yet one is good and one is bad. NIMEcraft is the difference between two or more *reacTables* [13], two pairs of *The Hands* [29] or two *Birls* [26].

We deliberately position NIMEcraft as a subset of craft that focuses on these details, because we believe this is where important knowledge about DMI design is hiding in plain sight, assumed but unspoken. Additionally, we argue that the details encompassed by NIMEcraft accumulate to the extent that NIMEcraft defines player experience as much as, if not more than macro and meso scale specifications do. As NIME advances, focus and attention is required for the experiential details that distinguish fine instruments from crude ones, and correspondingly the ways that this knowledge can be shared in the community.

3. STUDY METHODOLOGY

There are models and precedents of practice-led craft culture that NIME can turn to explore ideas of craft. In these studies we turned to traditional lutherie. Although lutherie is not equivalent to *digital lutherie* [12], the relevant parallels are the existence of scientific knowledge in the community, and the practical application of guidelines and frameworks through tacit knowledge. Therefore, we want to understand how luthiers create and evaluate new instruments, how they use scientific tools, and how players understand

the difference between two instruments that are similar in all but crafting details.

3.1 Participants

In the first of two studies, luthiers were interviewed by a DMI design researcher about a range of topics in violin making, which included their use of guidelines, comparison, measurement and analysis at various stages of the instrument creation process. In the second study, players were interviewed by a DMI researcher after playing two different violins, where one was known to be of lesser quality. The luthier study involved six luthiers who exhibited a range of experience. Half were either undergoing or had recently completed vocational training in lutherie (*L1, L5, L6*), and the other half had >25 years of experience as professional luthiers (*L2, L3, L4*). The player study involved seven professional violinists. In this instance, professional was taken to mean someone who had developed their playing over greater than ten years, and had significant experience participating in orchestras and ensembles.

3.2 Interview and analysis method

In the luthier study, the luthiers were interviewed in their workshop (2/6), at the author's laboratory (1/6) and remotely (3/6). In each case they were asked to bring or have available an instrument in progress, or an instrument they had made already. The interviews were based on but not constrained to a script, and covered their development as luthiers, an instrument they were working on, and their methods in the context of realising the fine details of violins.

The violin players were invited to the author's laboratory for interview, and brought with them their personal violin and bow. A week prior to visiting, they were given a short piece of music to learn. Before the interview, they were filmed playing three pieces on their personal violin and a provided factory-made violin. The first piece was from their repertoire, the second was the piece they had learned recently, and a new piece of music was also presented to them on the day. After playing, they were asked about their musical background, their relationship with their personal violin and bow, and to compare their playing experiences.

Both studies were thematically analysed deductively [3]. The luthier interviews were coded for references to the quality of violin function, behaviour and structure, descriptive clarity and valence (positive or negative), formalised knowledge (theoretical knowledge, explicit knowledge and analytical thinking) and practice-based knowledge (craft, implicit knowledge and design thinking). The player interviews were coded for which violin was being referred to, along with the same quality and description codes as the luthier study.

4. RESULTS
4.1 Frameworks and goals as foundations

An example of a lutherie framework is the architecture and geometry of violin body templating, which along with other foundations distill centuries of accumulated experience and set the overall constraints of making. The luthiers describe these guides and prescriptions as offering safety from failure:

L4: *"This craft, in planning, in design, in making, it's all very safe. You cannot fail if you have a good guide. That's why the apprenticeship works so well, because you cannot fail if you do what you are told."*

L1: *"You're working in the knowledge that whatever you do, within boundaries, it's going to sound good."*

Devising frameworks this specific is a difficult task that requires years of experience, especially in the numerical or parametric domain, due to the complexity of the violin:

L1: *"Let's say I made these two violins and the elevation of this [pointing to violin 1] came up to 27mm on this and 25mm on this [violin 2]. Let's say this one sounded way better, or I preferred the sound of this one, then you could think 'Ok well, 25mm is obviously the thing to do. I'm going to make all instruments 25mm from now on.' But then you'll make another one identical, or what you think is identical, and have it 25mm and it wont sound as good."*

While frameworks insure luthiers against failure, goals are also necessary to drive them towards fine quality. The luthiers appear to deliberately set non-specific goals, due to the difficulty of setting out to fulfill criteria:

L3: *"The goal is always the same, it's always a great instrument. Of course we could say we want something a bit brighter, a bit darker, a bit deeper, a bit rounder, but that is secondary."*

L1: *"It's quite hard to start making an instrument with that goal, to say 'I'm going to make an instrument that's really easy to play'."*

Once the foundation and goal are in place and an appropriate plan has been made, the formal decision making process comes to an end and the making begins.

4.2 Tacit knowledge enables detailed craft

Before luthiers can make fine instruments, they must spend substantial time acquiring the necessary tacit knowledge and crafting expertise:

L4: *"Forget about knowing how to make a violin when you get out of school. You have to spend ten years before you can make a violin without asking for help."*

L3: *"For five years at school, you learn to control your hands and you learn to see. You're given some tools and materials and you have to learn to see what's a bump, what's a curve, what's a bump within a curve. If I tell you remove this 1/10mm here that's what you need to do... Once you've done that, your eye starts to perceive things, and that's very difficult to define."*

There were similarities in the luthiers' descriptions of this process to practising a musical instrument, where repetition and flow are important factors for internalising the making process. As the luthier currently studying described:

L1: *"For me it's like practising music. There's a lot of it that's quite like scales where you just have to put the work in. It's a weird sensation where you're switching off while being so concentrated and focused. Your brain starts to wander elsewhere but you're still focusing. It's similar to practising the same passage again and again."*

Frameworks are important for luthiers in training during this acquisition stage, since they are yet to gather the empirical experience necessary to feel their way through the process:

L1: *"I have no idea if [a given violin will] sound better. I'm judging it purely on the fact that I was given a set of measurements to follow."*

Whereas the practical aspect of craft is transferable through tools and frameworks, the tacit knowledge required to apply them appropriately is not. This impacts their ability to progress throughout their careers:

L3: *"I was in a school recently and looking at the students' work and trying to comment and help them to see, and they just can't see and they wont be able to unless they learn. There's no way to transmit this knowledge, to convey, to give, to communicate this knowledge. Even at my level when I've got a colleague that sees something on my work and tells me to look at something, if I can't see it they can't help me. They will never see anything until their brain is ready to get this knowledge."*

When asked to describe what it feels like to be in the

moment of making, one luthier noted the limited capacity of deliberate, logical thinking versus embodied thinking:

L3: *"Your hands are guided by your brain, but your brain is not clever enough to guide you through all those parameters, so it has to be subconscious. Your attention is fully in this automatic system, which is kind of the opposite of attention. To concentrate on something semi-automatic doesn't make sense. Somehow you need to get into the right frame of mind that allows your body to act."*

The same luthier was then asked whether they use any formal analysis techniques during the making process, answering that this approach cannot adequately guide their decision making process:

L3: *"I can't stand in front of thousands of doors knowing that if I open a door it might be the wrong one. That might stop me from going ahead. So I have to assume that I know something, or decide that I know something, decide that I might be wrong but I'm going in this direction. I'm relying on my feeling, what I feel when I make."*

4.3 Tacit knowledge needs open comparative tools

When asked about the influence of scientific forms of knowledge on their work, the luthiers described attempts to internalise them with varying results. The experienced luthiers had a desire to learn more, but described a lack of specific language that could be related to their making experiences:

L3: *"I am still looking for a few keys that will help me understand how the box is vibrating."*

L2: *"For people in my situation who had been studying making from a traditional point of view, there was no dialogue that people could use to explain certain phenomena about the behaviour of vibrating instruments."*

For example, all of the experienced luthiers mentioned that visualisation had an impact on their understanding of their work, but that it was difficult to turn this knowledge into practical applications:

L3: *"That's been very useful for me as a maker, to understand that every bit of the instrument is moving differently according to the frequency that is being played, and to understand the connection between the front and the ribs and the back. Being able to visualise it, having a slow movement, that was very useful for me."*

L4: *"I like those graphs, they're full of colours! I just love it. It just doesn't basically say where to cut! They don't supply any instructions. That's my problem. I know many people in this branch of violin making; I ask them direct questions and they never answer, because they don't know. They speculate 'Why does this violin sound bad and this one good?' and they compare those two graphs and they are almost identical. But how to move this [acoustic] peak here, and this peak here [indicating two points on a violin plate]? I guarantee you they have no idea, because they're doing it the wrong way - measuring with computers. The computer is as clever as the guy who programmed it, unfortunately. We rely on our hands."*

The theme of frameworks as reassuring influences reemerged, but again in this context with limited actionable consequences:

L3: *"I have colleagues that are quite into scientific approaches, which I think is a good way to reassure them. I'm afraid I haven't seen anything convincing in the serious research that's been going for 20 years apart from the visualising tool. The rest hasn't been very useful."*

One luthier had sustained an interest in using acoustic theory in their making. They reflected that familiarisation with it had integrated with their tacit knowledge, suggesting there are traceable links between them:

L2: *"Some of us are struggling with just understanding the theory behind it, but actually coming to a point now where, for an instrument maker, it might not be necessary to understand totally the theory.*

It kind of remains tacit empirical ways of working. What seems to happen is that when your understanding of the physical behaviour of the thing increases, it doesn't necessarily mean for example that I am capable of describing very very accurately what is going on. But it's changing my total view of the way an instrument behaves, sort of through the back door, in a way."

However, they found this relationship difficult to describe when asked to elaborate, despite their confidence of its impact on their work:

L2: *"What I'm trying to say is that the knowledge gained through this kind of acoustic work, is not necessarily something I would be able to write very eloquently about. But it influences me a lot, and I know for a fact that is has improved the sound of my instruments."*

4.4 Playing and testing as separate skills

The luthiers were adamant that players were sensitive to violin quality in a completely different way to them, which made players mostly unsuited to the task of evaluating a violin. Despite undergoing far less training in instrumental practice than players, luthiers are able to test their instruments with simple but precise gestures:

L3: *"Playing the cello for me means pulling the bow. I can still test, I have learned to hear. I have learned to define what works and what doesn't work, even with a shitty bow technique. If it works with my bow technique, it will work for the potential customers."*

At the core of this issue seemed to be a distinction between playing and testing instruments:

L4: *"Musicians can differentiate. They cannot tell a good instrument if they don't have a good and a bad instrument. Give musicians three instruments, and after twenty minutes they would have no idea which one they played. It's so confusing, it's so demanding, you have to be trained. You have to have big stamina to do this."*

Stamina in the previous quote was referring to the luthiers' ability to test for long periods, and in doing so retaining the feeling of a comparison long after the sensory impression had faded. This was cited as a critical testing skill that was as hard won as any other in their work. There appeared to be a link between their desire to test in detail and their overall goal of fine quality:

L3: *"I think you really have to go beyond the obvious 'yeah it's working, it's fine, it's a great cello'. It's never just great; you have to understand what is good and what could be better."*

Luthiers tested their instruments against idealised behaviour, which was claimed to be more particular than what a violinist would look for:

L3: *"Some musicians are actually quite good at testing instruments, but they are quite rare because most of them haven't tried enough to know what we need to look for. They need to aim for this absolute, perfect sound."*

Feedback from different players can be ambiguous and fluctuates based on their level of experience:

L1: *"'Projection' and 'ease to play' are meaningless words. I could find something easy to play that you would find horrible... The threshold [of quality] changes for everyone as well, based on your playing ability."*

As a result, one of the more experienced luthiers claimed to have gradually become less dependent on musician's feedback:

L3: *"I don't rely on the musicians' opinion anymore to*

adjust my instrument, because most of them are not used to trying instruments. They are used to their own instruments and making them work for their needs. They are not used to playing for an ideal mechanism, an amplifier. They don't know what works with their instrument, they know they love it and they will never use anything else. The point is, when I demonstrate my instrument they have have to be impressed, shocked by the amplifying capacity, the link between string vibration and bow action."

4.5 Verbal player feedback misses details

To investigate the limitations of player feedback as described by the luthiers, seven violinists were asked to compare their experience of playing a factory-made violin and bow with their own in quick succession. As expected, all participants preferred their personal violin, citing lower quality aspects of function, behaviour and structure in the factory-made violin. 6/7 players mentioned the factory-made violin's strings as being poorly spaced due to the proportions of the bridge and neck, and connected this to difficulty and discomfort of playing experience:

P3: *"What was a bit challenging, or annoying, is that the bridge is less round (flat). So I kept hitting D string while I was playing other strings. I tried to adjust to that, but still. My own violin has more curvature on the string."*

P5: *"The string are not as close to each other. It's quite difficult to keep doing what you are used to with your own instrument, but you adapt. It requires more attention and you are more likely to make silly mistakes."*

P7: *"I am quite familiar with that, I've played it a lot. They are a nice instrument. If you put a new bridge on that it could sound pretty decent... The bridges they come with are a bit fat and chunky."*

It seems plausible that the above comments could be turned into design changes with minimal interpretation. However when the quality of the sound and playing experience are mentioned, the essential qualities seemed harder to describe and difficult to relate to physical properties or behaviours of the violin:

P3: *"Well it's small sound. And it has the sour sound of new string. The sound I usually have on new strings on my violin. But I don't think these are new strings. So I think it just stays."*

P5: *"It's basic. It plays but you can't work around too much. Not color, not feeling. You want an A, you get an A, but that's it."*

There appears to be difficulty in identifying appropriate words to describe these differences; P7 invented a term, *"bowy"*, to describe their experience. Generally the interviews demonstrated a verbal pattern of comparisons made in a *goldilocks* form of "W is X Y than Z", where *W* and *Z* were the two violins, *X* a determiner such as *more, less, a bit*, and *Y* a violin feature. Another method of describing the factory-made violin was to use the idea of *"a good violin"* (**P1**) as a counterexample, which has some similarities with the way luthiers' tacitly test against *"absolute, perfect sound"*. Overall, this suggests a useful but limited contribution of verbal feedback from players.

5. DISCUSSION

Violin makers do not rely on explicit means of creating or evaluating their work, such as evaluation criteria and player reports. Instead they rely implicitly on their tacit, embodied abilities and experiences. Though these ways of knowing are often personal, subjective and unverifiable, they enable the realisation of fine instruments. Similarly in DMI design there are no explicitly "inviolable laws" [12], and as Jorda states:

> Digital lutherie should not be considered as a science nor an engineering technology, but as a sort of craftsmanship that sometimes may produce a work of art.

NIME frameworks, which are positioned as fundamental to DMI creation, commonly offer DMI designers analytical and descriptive ways of working only. They do not support the craft aspects of DMI design, nor do they describe fine details or how to realise them. We have introduced the term NIMEcraft - meaning the micro scale differences between otherwise identical instruments and their underlying design processes - to highlight this shortcoming, and to discuss how DMI designers as craftspeople can be better supported. We explore the implications of NIMEcraft for NIME frameworks, dissemination, crafting tools and evaluation.

5.1 Implications for NIME frameworks

Our results indicate that the tacit and embodied knowledge of instrument makers is paramount to the realisation of a fine instrument. The primary implication for NIME frameworks therefore is that they should consider accounting for and supporting the development of these forms of knowledge as described by Kettley [15]. Furthermore, at varied experience levels the violin makers applied frameworks in different ways, demonstrating an opportunity for NIME frameworks to target specific experience levels. In terms of utilising player feedback in design processes, our results show that NIME frameworks could better account for the differences in tacit knowledge between designers and players. Particularly, user-centric and participatory design processes risk assumptions about design intuition in non-designers [8].

5.2 Implications for NIME dissemination

No infrastructure exists today that is exclusively focused on NIMEcraft dissemination; fine details of instrument craft are often subjective and thus are unsuitable for inclusion in scientific papers, and performances exhibit only the final form of the instrument without reference to its design process. By comparison, violin making is centred around an apprenticeship model with a rigorous focus on acquisition of embodied design expertise, similar in intensity to studying in a music conservatoire. Jorda's teaching framework [14] appears to be a step towards a self-sustaining culture of NIME practitioners, but there is clearly more to be learned from long-lasting instrument making cultures in this regard. Additionally, the violin makers emphasised the importance of continually exchanging craft practice in person and online. Given that the NIME community is experienced with facilitating events and online communication, it could strive to develop means to support these vital activities.

5.3 Implications for NIME crafting tools

Through inquiring as to the influence of scientific tools on violin making, our results suggest that some tools are better than others at supporting instrument craft processes. Particularly, the impact of tools that were created to support scientific or engineering knowledge were downplayed compared to slow motion vibration visualisation, which facilitated subjective interpretation through being relatable to embodied experience. Though many DMIs support embodied interaction by the player, the design tools for creating them take a scientific or engineering mindset that diminishes the role of the *designer's* embodied knowledge. Our results suggest that such engineering tools may be less than ideal for encouraging the development of NIMEcraft skills. Thus, we suggest the community should consider creating

DMI design tools with the same attitude with which it creates instruments for musicians.

5.4 Implications for NIME evaluation

For professional violin makers, there appeared to be an indirect relationship between a player's indication of preference and violin structure and behaviour, leading the makers to develop and rely on their own internalised sense of quality. NIME evaluation instead frequently relies on an audience response to a performance, or a player's judgment [1]. Supplementing audience and player interpretations with the subjective evaluation of NIMEcraft by the DMI designer and other designers has the potential to create a more complete, nuanced and constructive instrument evaluation. This would have the added benefit of encouraging DMI designers to deepen their expertise in the evaluation of fine instrument craft.

6. CONCLUSION

We have identified a subset of craft, termed NIMEcraft, to highlight the need for more investigation into micro scale differences across identical instruments and their underlying design processes. We have established traditional violin lutherie as a model of instrumental craft culture that NIME can learn from to improve its frameworks, dissemination, tools and evaluation. In doing so we have explored the importance of an instrument designer's tacit and embodied knowledge. By highlighting NIMEcraft as an important factor in DMI design beyond familiar science and engineering processes, we encourage further discussion about how such skills and methods can be learned and shared.

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