

Feedback Mayhem:

Compositional affordances of the halldorophone discussed by its users.

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ABSTRACT

This paper presents the improvisatorial and compositional affordances of a cybernetic electroacoustic instrument, the halldorophone [1]. The findings are based on interviews with two cellists who have composed for the halldorophone and their collaborators.

*The paper discusses the appeal of this dedicated feedback, string instrument that can be described as being temperamental due to the inherent complexity of a coupled system of strings being allowed to feedback. A theme emerges to what these successful performer-composers appreciate about the halldorophone, and can be summarized as it possessing: **a stimulating uncontrollability**.*



Figure 1. A halldorophone, one of two built in 2018.

1. INTRODUCTION

Preparing instruments, building experimental musical instruments and treating that instrumentation as compositional material has been an integral part of several musical practices since around the middle of the 20th century [2]. This aspect of musical culture has been boosted by the advent of digital technologies (spawning a tidal wave

of digital instruments) and has also found a confluence with the maker movement allowing for faster prototyping of new instruments (especially embodied interfaces) as can be seen in the proceedings of the NIME (New Interfaces for Musical Expression) conference.

The NIME research programme is about invention and development of new musical instruments. A relatively small number of contemporary, experimental instruments graduate beyond the prototype stage [3, 4], as adoption is not necessarily the purpose behind every NIME project (the focus often being on the development of new technologies and methods for instrument-exploration). However, the author aspires for the halldorophone to be adopted by professional musicians and this is seen as an integral part of the work. In the NIME literature the idea has been expressed that *nurturing a culture of use* for instruments being developed increases the likelihood of longevity and continuing use [5]. For this reason, the development-methodology of the halldorophone has been an on-going conversation with users who continuously inform the evolution of the instrument.

Having developed this instrument for over a decade and seen it in use by various composers and performers the author has come to want a more formal understanding of why people like to use it. The hope is that with better understanding, informed further development of the instrument will increase the likelihood of it achieving a wider adoption.

2. BACKGROUND AND PREVIOUS WORK

The halldorophone has been developed in its cello-like configuration since 2008, and a comprehensive technical description can be found in a 2018 NIME paper [1]. It is an electroacoustic string instrument loosely based on the cello, which makes use of feedback for sound generation, enabling individual gain control for each string and a sympathetic set of, two to four, strings below the main strings. The project can be summarized so: applying the well explored method of electromagnetically facilitated string feedback [6] into a dedicated, cello-like instrument.

This project should be viewed as belonging to the tradition of western experimental music practices forming in the mid-twentieth century, characterized by a curiosity of electronics as musical medium and of cybernetics as inspiration and artistic method [7]. Closer in time, the halldorophone can be seen as part of a re-evaluation of classical musical practices and a willingness to meld histori-

cally conservative tools and methods with the radical tools and practices brought to the fore in the aforementioned post-war era [8].

In terms of technics the halldorophone is an augmented string instrument, of which there are a few in active development, to name some: Tom Davis' Feral Cello [9], Eldridge and Kiefer's Feedback Cellos [10], McPherson's MRP [11], Polymeneas Lontiris' Feedback Resonating Double Bass [12] and Úlfur Hansson's Electromagnetic Harp [13].

Figure 2 describes the flow of energy in the halldorophone. It bears adding that the electronics generate enough noise for energy to build up in the system (depending on volume settings) without the player physically vibrating the strings.

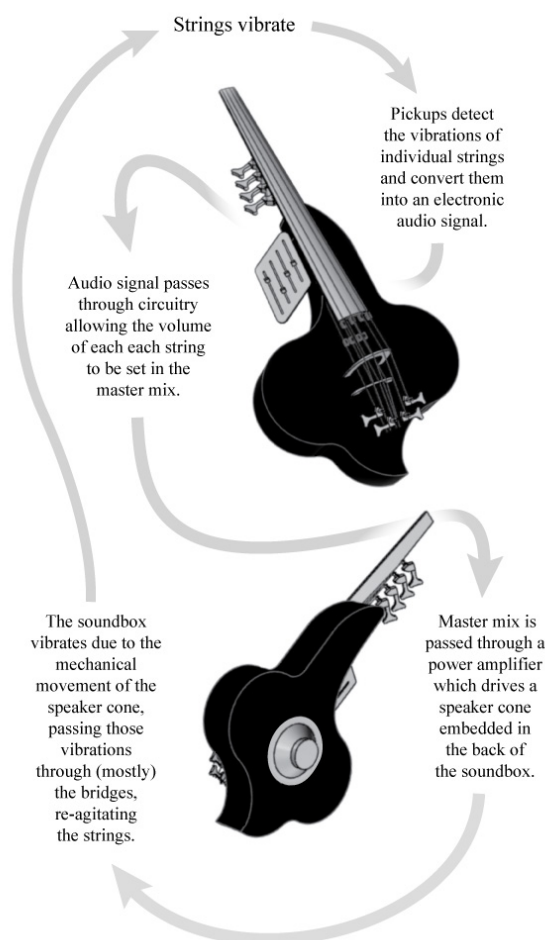


Figure 2. Diagram of the halldorophone feedback-loop.

2.1 Approach to Experimental Lutherie

The author, coming from an art and design background, has conceived of the halldorophone as a social object, as a thing to be adopted, contextualised and embedded in musical culture. Establishing a culture around the instrument has been actively effected by instigating collaborations, securing funding for commissioning compositions and cultivating relationships with composers and instrumentalists.

The invention of this instrument is an artistic expression and the innovation aspect of the project is of equal

importance. The approach to innovation has been to observe the character of the instrument gradually reveal itself as it moves through the world in the hands of its users, and respond to their feedback through iterative design. This design process is a deliberate effort that resembles a question more than a statement. Fortunately, composers and performers have been interested in using the halldorophone and, as a consequence, there has been a substantial body of work to base further development on.

2.2 Previous User Research

In over a decade of development informal user studies and interviews have been conducted with collaborators. These casual opinion and information sharing sessions have iteratively fed back into new features and refined configuration, making the instrument what it is today.

3. METHODOLOGY

In late 2018, interviews were conducted with two halldorophone users, chosen because they have composed and performed their own music on the instrument and have done so independently of the author instigating a collaboration, also interviewed are their collaborators on projects involving the halldorophone.

3.1 Principal Interviewees

Hildur Guðnadóttir (IS) and Max Lilja (FI) are both classically trained cellists who are interested in using electronics as part of their music making, they professionally compose and perform their own music internationally, write for film and TV [14, 15], as well as maintaining various collaborations with a wide range of successful music acts.

Guðnadóttir has had extensive access to three halldorophones over the past decade (making her the most experienced halldorophone player to date) as of recently she refers to it as her “main instrument”¹.

Max Lilja had a halldorophone on loan for nearly a year (2015-2016) prompted by a collaboration between the author and Finnish composer Esa Lilja² (FI), during and after working with his namesake, Max used the instrument in his own projects.

3.2 Complementary Interviewees

Further interviews were conducted with Stephen O'Malley (US) of renowned doom/drone band Sunn O))) who has collaborated with Guðnadóttir in past years, most recently in studio (2018) for their upcoming album³. Studio engineer Steve Albini (US) engineered that recording (also recording the halldorophone) and was happy to share his opinion of the instrument. And previously mentioned composer and musicologist Esa Lilja who

¹ H. Guðnadóttir, personal communication, Dec 29, 2018. Other quotes by her in this text are from the same interview.

² No relation.

³ “Life Metal” released through Southern Lord, 2019, on which Guðnadóttir plays halldorophone.

composed the piece *Hrímhvíta Móðir* (2016) for halldorophone and soprano voice (Martina Roos).

3.3 Interview Format

The interviews followed a strategy of intensive interviewing [16] with the flow of conversation ranging from loose exploration of topics and feelings to more focussed, semi-structured questions. The list of prepared topics and questions covered multiple angles of working with the halldorophone, such as: performance, composition, production. Furthermore, the progression of the interview was grouped into core themes:

- The user's physical and emotional relationship with the instrument.
- How the instrument contributed to or affected the formation of musical thoughts.
- How the instrument affected the user's relationship with other musicians.

These themes are informed by the work of Thor Magnusson on how to conceive of musical instruments' place in the world [17, 18]. The themes are intended to aid us in conceptually placing the halldorophone among other instruments with shared traits and other items of organological nature.

From the collected material, chosen for being reported on was that which seems specific to the principal interviewees musical relationship to the halldorophone (much in the inevitable comparison to the cello) and statements about the identity of the instrument of which there seemed a consensus among all the interviewees. Also reported upon is a tangent of the conversation, which came as a surprise to the author and is included in the discussion.

4. INTERVIEWS

4.1 Relating to the Instrument

Instruments are intimate vehicles of non-linguistic thoughts. As artefacts we bond closely with our instruments, and it is important to understand the parameters of that bonding, how an instrument is discovered and grown into by a new user.

Asked to define the halldorophone, Guðnadóttir answers with a single word and a laugh: "hávaðaselló" (e. noise-cello). Prominent resonance peaks and lows in the acoustic response of the soundbox (which is intentionally undersized according to conventional wisdom [1]), together with the inherent complexity of a system of feedbacking, coupled strings thwarts, consistent, clean playing of specific notes across the tuned register using the feedback as a driving mechanism.

This obstructive quality of the halldorophone has been preserved in the development process, mostly by offering no on-board signal processing (band-pass, band stop, EQ or such) which would allow for a more deterministic playing, based on the intuition that this is not what is

most interesting about this instrument configuration⁴. As a consequence, small changes in conditions when letting the system feedback (changed gain levels, fretting of the strings, variation in physical contact with the instrument) can have unintended effects: bringing out unexpected harmonics of a sounding string, suppressing the fundament of another, hitting a resonance peak favoured by the whole system and have it howling in a split second (which is fantastic, if slightly terrifying).

The halldorophone is described as being "demanding of your attention" by both Guðnadóttir and Lilja, they talk about the need to be fully present and focused or face the risk of losing control. This is mostly framed in the positive, as per Lilja:

*The second you think: now I have it! It's too late. It takes you somewhere else. [...] It is the key feature in it. That's why it's so interesting and it's not creating problems because it's creating music...*⁵

Guðnadóttir expresses a similar sentiment:

You need to be a 110% present physically, if you even move your knee or something he might decide to stop and I find that thrilling. How you have to adjust your whole approach to the instrument and how conscious I have to be of my whole body...

Recent research finds that under certain conditions, musical interfaces with an inbuilt barrier to effortless cognitive processing, a quality dubbed "disfluency" by the researchers, are experienced as positive by musicians using the instrument. Presumably because it allows the musicians to meaningfully leverage their existing skills, summarized thus by the researchers: "...disfluency supplies the friction necessary to prompt the fuller engagement of cognitive abilities" [21]. This research is useful as a framework to understand the positive sentiment toward the temperamental quality of the halldorophone expressed here.

4.2 Epistemic Qualities

All instruments frame our perception of the musical possibilities available. A new instrument frames our thinking, influences our musical work and reconfigures how we relate with other musicians.

Electronic and acoustic: phone jack connectivity (guitar tech, stomp pedals etc.), mixer-like slider knobs for gain control, cello-like configuration of strings and set up to feedback like an electric guitar left leaning on an amp stack. All this existing music technology constituting the halldorophone is very familiar to contemporary musicians and each discreet part (strings, volume slider etc.) has an inscribed culture of use, which is lent to the overall intel-

⁴And that electro-mechanically driven, cleanly sustained notes are more appropriately explored with use of string specific exciters as in the MRP [11] and Moog Guitar [19] or with products like the Sustainiac [20].

⁵M. Lilja, personal communication, Dec 10, 2018. Other quotes by him in this text are from the same interview.

ligibility of this new configuration, of which Guðnadóttir says:

Yeah! You can go the string-route and then tap into, which I've always been super into, the electronic domain also. I have very little interest in sitting and programming, I like to have things physical...

The integrated combination of strings and electronics in a sound generating schema is perceived as positive by Steve Albini:

*I like that unlike a lot of electronic instruments it has a useful acoustic character, it isn't just a voltage source, and it allows for drastically different performance techniques that are useful, rather than merely novel.*⁶

The instrument, greater than the sum of its parts, however, is a system intentionally set to feedback on strings and when the interviewees describe the feel of that, a sense of co-composer, or a second voice often comes up. When asking Lilja: “does it ever feel like it [the halldorophone] is composing with you?”

Yes... Quite often. I'm just following where he or she is going. Yes definitely. It has such a strong will, it will go somewhere for sure if you don't stop it.

The question is leading but Max's anthropomorphizing of the halldorophone is a tendency noticed by the author when users describe interacting with the feedbacking system, it is tempting to associate this linguistic slip with an underlying feeling of a compositional agency residing within the instrument. Consider this reflection by Guðnadóttir on mastering a passive instrument:

I sucked as a cello student; I was a terrible classical, cello-virtuoso-student. I always thought it was more interesting to receive than to dictate... That thing about taming the instrument, which is something you are aiming for when you are practicing 7-8 hours a day. When you study like that there are lots of rules about what is right and what isn't, that never really appealed to me. I am more interested in how things might be...

This statement signifies an approach to music making as a process of discovery, one where she is ready to receive from the instrument as well as the instrument receiving from her. A form of dialogue where music emerges through investigation, not through defined pre-conceived expression that is conveyed through an instrument serving as mere medium.

4.3 Relating to Others

Music is a social communication and a new instrument will offer new language, a new vocabulary to express oneself with. Perhaps it is useful here to reflect on a contrasting approach to music making than the halldorophone affords: as elaborated on by Emily Dolan in her exploration of the musicality represented by keyboard instruments [22], as resting: “...on the premise of a com-

poser in technological control; the work concept requires obedient instruments, performers, and ultimately audience members and musicologists.”

Taking a cue from Dolan, we might consider the halldorophone a disobedient instrument, as such, how will an instrument that resists being dictated to alter the interactions of people working with it? Composer Esa Lilja gives us an indication:

*The main difference is that the instrument is designed by a fellow who is not a musician and it shows to some degree. [...] Because nobody can write for that thing [halldorophone] you have to find a new way to work with it. Your [the author's] instrument is sort of a perfect tool for that, to re-think many things, how to write for a thing which doesn't sound [acoustically] in many places [across the register] and then you have to consider the musician who needs to play this stuff. Which all would have been a lot easier with a cello with added distortion but then I wouldn't have written the music which we wound up with.*⁷

Expressing that he has to engage the instrument and performer in the task of developing a vocabulary during the process of composing due to the unfamiliarity and unpredictability of the instrument.



Figure 3. Hildur Guðnadóttir and halldorophone at the Barbican in 2017. Photo: Dave Pettit.

Temperamentality and unpredictability takes on a different significance in the live setting, as per Guðnadóttir:

Like when we played the Barbican for 2000 people, when I was totally solo, before playing with the band [Sunn O)))]. Then he just decides to completely screw with me! And like that you are naked on stage, you know. But that also brings its own energy, of course it's totally masochistic, it's a masochistic energy putting yourself in that situation. I still think it's interesting and I like it. You have to ask yourself, in real time, in front of an audience: How are you going to deal with it, decide now! And how can you get him to cooperate! I think it's part of the en-

⁶ S. Albini, personal communication, Jan 2, 2019.

⁷ E. Lilja, personal communication, Jan 8, 2019.

ergy of doing experimental stuff. And as a consequence, your own energy is transformed, when you are also waiting for what comes next, along with the audience.

We can view Guðnadóttir's challenging but positive experience of having to negotiate with the instrument live in light of the previously mentioned research on disfluency as part of an instrument schema [21]. In her own words making her feel: "more present and focused". But we may wonder if that feeling translates to the audience. Stephen O'Malley reflects on the same performance by Hildur:

*She has played with us [Sunn O))) a few times over the past few years back, once [as opening act] at the Barbican. It was amazing, she filled that whole room with deep sound and she was completely there. That's a hard thing to do, to be alone like that on a stage with sound, complete and vulnerable.*⁸

And indeed the same research as cited above does suggest that an instrument with disfluent characteristics allows the audience to better appreciate a performer's skill, some of that "presence and focus" may be coming across...

5. DISCUSSION

The character of the halldorophone, as perceived by its users has become somewhat apparent: it invites them in with a conservative configuration of elements (cello-like) allowing them to repurpose their playing skills (to an extent), adding the cognitively available affordance of string feedback (as contemporary musicians predominantly understand the phenomena of electric guitar feedback).

Once they engage the deterministic parameters of the system: individual gain settings for each string (with some connectivity variance between individual iterations of the instrument) they find a cybernetic loop of coupled strings that can quickly be made to behave in a very complex way, but (crucially) can be dialled back to being manageable when needed. In other words: It obstructs their fluency, but in a stimulating way by adding a layer of possibility: that of complex interaction with the electro-mechanical behaviour of the instrument (the string physics, acoustic response and electronic amplification circuitry).

This is a condition for meaningful art to take place for Sally Jane Norman [23]: "Re-contextualisations of materials, or shifts in the ways we frame and focus our attention, perception, and values, generate resistance when they disrupt the status quo: innovative or unprecedented (as opposed to prescriptive and programmatic) use of artistic materials creates an energetically charged cut-off point with respect to conventions."

More specifically to music Thor Magnusson offers a reflection on what constitutes a good instrument [24]: "A good musical instrument, therefore, exhibits the duality

of shifting between being a means to an end and an end in itself". It would seem the halldorophone embodies some of those qualities, to quote Guðnadóttir when asked if the halldorophone has affected her cello playing:

...Well I just play the halldorophone a lot more these days. In concert and recording, I've been using it a lot more than the cello.

5.1 More Mayhem

When the principal interviewees were asked to speculate about improvements to the halldorophone they expressed curiously similar ideas: Guðnadóttir revisited an idea from a previous conversation with the author (years ago) about a second actuator being built into the instrument:

Maybe more than one speaker? A second speaker or transducer, with a different character of sound, pitch shift or something? And add control on the mixing panel so you can pan or fade it in and out. It could give you, like, a dialog so you could widen, hmm, maybe pitch shift one speaker up and down on the other. Then you could get, kind of, like a stereo image...

Lilja offers a similar sentiment of increasing complexity through more actuators in the system:

... Now that we talked about the possibility of another instrument interfering with the frequencies [previous discussion about feeding external signal sources into the halldorophone] and, I don't know, maybe there was a bad connection but I also mentioned that, or was it you who talked about building a two body halldorophone at some point? I think that might open a new space... I don't know how that would work.

Author: Would you like to have another performer with you is that what you mean?

Hmm yes, that to, but if you could have a halldorophone with two bodies...

Author: That's a really interesting idea and I have no idea if it came from me but it's a good one. Kind of like there would be a separate system making the whole thing a bit more complicated?

Yeah exactly! They could be somehow linked, maybe also physically so they would interact... Hmm, yeah.

The similarity of the ideas Guðnadóttir and Lilja express here is surprising as they do not know one another, so they arrive at the thought independently (although, perhaps with some cross-pollination by the author). And also, because it can be seen as a desire for more complexity, which is counter to what the author had expected. The message is clear: These users who are very familiar with the instrument are curious about adding nodes of actuation into the system. Perhaps people born into the digital age are more comfortable and interested in engaging media that are not fully in their control, media that can push back, yielding surprise and insecurity?

⁸ S. O'Malley, personal communication, Jan 5, 2019.

6. CONCLUSIONS AND FUTURE WORK

In this paper we have discussed the halldorophone, a new instrument based on a feedbacking, system of coupled strings and have investigated its appeal to musicians who use it, in this case: proficient, experimentally minded cellists with a background in electronic music.

Based on the interviews presented here we can say with some confidence that there is a place for such an instrument in contemporary music making as these active, successful musicians find that it adds to their vocabulary and has opened up a space of affordances they are curious to investigate further. We have found that the main quality of this instrument, as perceived by its users has become apparent: It obstructs their fluency, but in a stimulating way as it adds a layer of complex interaction to an instrument that is otherwise quite familiar. And they desire more of that complexity to investigate

To proceed with the work, building more halldorophones at a faster pace is healthy for the project as this means faster development and refinement of features and, crucially, puts the instruments in the hands of more users. To this end the author has started building a workshop/lab dedicated to the development of halldorophones⁹ and has begun the work of reaching out to institutions with mandates of supporting experimental musical practices to house these instruments and provide access to interested users.

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⁹ On Spetson 128, Athens, Greece.