

The no-input pedalboard: practice, theory and reflection on the development of a new network-instrument

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Abstract

This paper explores the innovative performance interfaces of Noise Peddler, a no-input pedalboard duo whose live and studio work demonstrates how the repurposing of the effects pedal can lead to its organological reconfiguration from ‘tool’ to ‘instrument’. Through a discussion of the inherent paradox in pedal design (controlled by the hands but placed at the feet), this paper identifies a latent potential that is unlocked when the pedalboard is approached as the primary sound source and performance interface.

Lähdeoja’s theory of the network-instrument is used as a framework to understand how bringing multiple pedals – and pedalboards – together as an independent “*network of sound production and processing units, spatially extended and configurable by the player according to the desired sonic results*” (p.37) [21], creates a unique interface for musical expression. This model, alongside thoughts from a range of pedal manufacturers on the intended applications of their guitar pedals, provides the foundation for a practical and theoretical reconsideration of the possibilities for interaction with effects pedals. Noise Peddler exemplify these possibilities in a practice-led review of the instrument which explores the role of reconfiguration, mapping and novel performance gestures, straddling the boundary between academic research and the practicing artistic community.

Keywords

no-input pedalboard, network-instrument, tool, organology, instrumentality, reconfiguration, mapping, performance gestures

1 Noise Peddler and the no-input pedalboard

“...you can smash a guitar into pieces, kick and abuse the drums, but what kind of drama – other than sonics – can you get from a pedalboard?”

- Eilon Paz (p.7) [29]

“Remember the pedals don't have a sound of their own, they only react to what's going into them...”

- Dan Steinhardt (p.61) [3]

The no-input pedalboard is a modular and reconfigurable network-instrument which repurposes tools designed as signal processors for guitars (and other instruments) as the primary instrument for composition and performance. The traditional use of another instrument as a sound source is replaced by guitar pedals that can be driven to self-oscillate, or that are capable of generating sound of their own. The sounds from these pedals are then fed through chains of other pedals, where all performable parts of the network are originally designed to colour the sound of another instrument, but have now become the primary interface for musical composition and performance.

Noise Peddler is the no-input pedalboard project of Brighton-based musicians / composers Danny Bright and Lee Westwood. As an active band that writes, records and tours their own music, Noise Peddler is an artistic endeavour. At the same time, it is an academic research project that explores the potential of guitar pedals as musical instruments, and the no-input pedalboard as a network-instrument. Bringing together these two approaches, the project is poised between the worlds of artistry and academia, and active in both fields. Our research methodology is founded on a process of creative practice that follows an iterative cycle of instrument design, composition, performance, reflection and revision. As such, this paper is written from an autoethnographic standpoint, in the wake of work carried out since 2021 [6] which specifically engages with issues surrounding controllability of the instrument, rhythmic synchronicity between performers, pitch specificity, repeatability of compositional structures and recallability of polyphonic musical parts within a performance context, all of which have largely been achieved via the implementation of MIDI control. The project strives for long-term engagement with a musical system, in order to take advantage of the depth of knowledge that can be gleaned from this

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approach, and with the ethos that instrument design and musical practice cannot effectively be divorced. These sentiments echo the writings of Masu et al, who highlight the benefits of sustainability and long-term development in instrument design [24].

Born through a shared interest in guitar pedals and other guitar-related equipment, early work stemmed from experiments with certain effects that were able to be pushed to self-oscillate in order to generate their own sound. This fascination with the possibility of being able to replace the guitar (or any other instrument) with an effects pedal as the input signal and use the pedalboard as an independent no-input instrument spurred a long trajectory of iterations in the systems used (see [5] and [6] for a more detailed breakdown of these developments and their underlying research methodology).

In order to provide an experimental framework for the project, Noise Peddler has come to be guided by the following basic manifesto:

1. Guitar pedals are the only permitted sound source;
2. All performable units in the signal chain must feature a stomp switch or other foot controller (e.g. treadle), or must be originally designed as part of a pedalboard – this precludes the use of laptops, microphones, transducers, synthesisers or other traditional instruments;
3. All performable units in the signal chain should be off-the-shelf products available to the general public;
4. Guitar amps are the primary source of sonification.

One of the fascinating things about the guitar pedal is the paradox in its design. Inherent in the name is the suggestion that it is made to reside at your feet, and the unit has a stomp switch to engage the effect. At the same time, fine control over the various parameters is designed to be manipulated by hand, although this is hard to achieve when it's on the ground, and your hands are wrapped around a guitar. It is through the elevation of the pedalboard to a tabletop interface and the liberation of the hands from another instrument that the broader potential of the effects pedal as a live creative device is unlocked.

However, this transition from a set-and-forget interface, situated at the periphery of the performance space, to the primary sound source and platform for musical engagement, invites a series of questions: i) do we think of guitar pedals as instruments by design, or tools to augment our other 'real' instruments? ii) if it is not one to begin with, when does the guitar pedal become an instrument? iii) does the role of the pedal change from tool to instrument when we elevate it to the desktop and 'play' it? iv) or is it instead a tool that makes up part of the augmented space of another instrument (see, for example, Deyell's 'guitarspace' [9])? v) finally, if the pedal is able to undergo this transformation in terms of function, what are the implications in practice? A reflection on opinions from pedal manufacturers, alongside academic writings on organology and performance systems, allows us to paint a clearer picture.

2 Organology – from tool to network-instrument

In his book *Sonic Writing*, Magnusson asks a poignant question: “...wherein lies the difference between an instrument and a tool? ...Unlike tools that serve as a medium for making a particular task easier, ...musical instruments are more than mere media for the transmission of a message or achieving an end goal: they are an end in themselves.” (p.18) [23]. A distinction is made here between a device that may facilitate music, and one which is self-sufficient as a channel of musical expression. One uses a tool to make a certain task easier, whereas engagement with an instrument is full, immersive, and it is both the way we lose ourselves in play, as well as the emergent sonic result, that are significant. Coessens & Östersjö, in their consideration of instrumental resistance and affordances, identify a similar distinction: “*The search for musical content, for a resonating interaction, does not result from the incorporation of the instrument as a transparent tool, but rather from the affirmation of its resistance, which it amplifies and plays with*” (p.338) [7]. In this sense, it is the site of resistance (the opposite of what we seek from a tool) that draws us in, and which helps shape this quality of instrumentality.

Leaning into its etymological roots, Magnusson goes on to define a musical instrument as “...any sonic system with which we extend mind and bodies, requiring the practice of refined movements, with the purpose of making music” (p.18) [23]. This foregrounds a physical engagement with the instrument that highlights the act of tactile play, alongside the refinement over time of specialised gestures through which this engagement takes place.

Furthering this line of thought, he suggests that it is in the combination of the interface, mapping layer and sound engine that the digital instrument truly becomes an instrument [23]. Whilst it is not a digital instrument, this quandary is particularly pertinent to the no-input pedalboard, with design features that are geared around processing other instruments, and a dependency upon its incorporation in what Lähdeoja calls a network-instrument – “...an augmented instrument, defined as a network of sound production and processing units, spatially extended and configurable by the player according to the desired sonic results” (p.37) in order to function musically. His writing outlines such a performance system as “...user-configurable, hybrid and modular” (p.41) [21]. The idea of a network-instrument is directly applicable to the no-input pedalboard, where the modules may be thought of in totality as an instrumental environment, and are reconfigurable in line with the needs and desires of the player.

In the context of the guitar, Lähdeoja suggests that it is only in the interaction between the various ‘modules’ of the guitar’s network-instrument (amp, volume and tone pots, pickups, pedals, etc) that the timbral voice of the guitar is truly realised [21]. In the same sense, the pedal is still dependent on other elements – a means of sonification, at the very least – to be both audible and playable, and it is in this network environment that its instrumentality is unlocked.

Taking stock of these philosophical perspectives, we might argue that the effects pedal, whilst designed as a musical tool, is endowed with instrumental qualities when:

- it becomes a vehicle for music-making independent of another instrument;

- it is playable, and we physically engage with it (as the primary performance space);
- it offers some form of resistance;
- it becomes part of a network-instrument along with a means of sonification.

3 No-input and feedback systems

Whilst the focus of this paper is exploring how Noise Peddler use no-input pedalboard systems to approach the pedal as part of a network-instrument, it is also important to acknowledge how the project builds on, and in some cases moves away from, the rich history of practices in no-input and feedback performance, and the design of related systems.

The concept of using a feedback or no-input system in musical practice – or indeed the use of pedal-type effects processing within one of these systems – is not new. David Tudor was a pioneer of feedback systems that employed microphones, pickups, speakers and resonant materials, as well as electronic sound making systems with ‘no-input’. His work has been built on extensively, including Nicolas Collins’ ‘Pea Soup’ [8], Bowers and Haas’ ‘hybrid resonant systems’ [4], and through a range of research including that brought together by the Feedback Musicianship Network [14] (see [12], [22], [15] for examples, as well as [37] for a useful overview).

The no-input pedalboard systems of Noise Peddler differ from many of these projects in that they do not feature acoustic or resonant feedback and do not employ transducers in the creation or manipulation of sound beyond the use of guitar amplifiers at the end of the chain. The fact that the project is predicated on using pre-existing/off-the-shelf circuits in new combinations means that the systems have more in common with the type of no-input mixer systems popularised by Toshimaru Nakamura, and explored in depth by Mudd & Brown [25], or with the no-input performance systems of some noise artists [28]. A number of these practitioners have incorporated hand-manipulated pedals into their no-input mixer performance systems or in some cases as the basis of pedal-based feedback systems [28]. What links many of these projects is the desire to explore, or take advantage of, the “*entangled notions of agency*” that are created by a system that “*foregrounds unpredictability*” (p. 1) [12] or even becomes “*out of control*” (p. 159) [28].

Early Noise Peddler systems deployed feedback in a more integrated way across the signal chain in a bid to explore these more chaotic, unpredictable relationships [5]. However, our longform creative engagement with the systems has revealed fruitful new ground by moving away from the unpredictable or chaotic. Instead, the feedback elements (often in isolation at the opening of the signal chain) form one part of a larger network-instrument that facilitates controllable, repeatable, polyphonic music. This approach retains the aesthetic, timbral and sonic benefits of a pedal-based no-input feedback system, and – as guitarists – enables us to harness the ghost of guitar-based music [6], whilst also working with, and against, the resistances of the performance interface. Some practitioners composing with no-input mixing systems have tried to incorporate repeatability, reflecting that the “*sonic result was relatively poor, as the recreatable sounds were the least interesting*” (p. 4) [25]. For Noise Peddler, approaching the no-input pedalboard as an expanded

network-instrument has enabled us to foreground the qualities of controllability and repeatability as critical affordances of the instrument and defining features of our compositional and performative practice.

4 A pedal community vantage point

As exemplified in the models proposed by Lähdeoja [21] and Deyell [9], the pedalboard is widely conceived as part of the guitar’s extended instrumental space. Even the language used most commonly to refer to them (‘guitar pedals’), and the targeted marketing used to promote them, places them solidly within the network-instrument of the augmented guitar, or the ‘guitarspace’.

Lähdeoja, in his consideration of the wider network-instrument of the guitar, highlights the issues connected with the positioning of the pedalboard in the periphery of the performance space, and the lack of finer control it affords. With the pedalboard situated at the feet of the player, the range of available performance gestures for our engagement with it is limited, encouraging a shallower level of interaction. In this formation, “*...the player chooses a specific sound for a musical part with “on/off” effect switches, playing with the same timbre until the next “monolithic” modification. The instrument offers a vast range of sonic possibilities, but little means for real-time control...*” (p.43) [21]. This observation draws attention to the wealth of potential that the de facto positioning of the pedal within the typical performance space sidelines, recognising the issue of accessibility of controls inherent in the pedal’s design.

Within non-academic communities, the same question of function is explored in interviews with a range of pedal manufacturers. Jamie Stillman of EarthQuaker Devices describes a design process which is focused on offering access to sounds with minimal need for engagement: “*With pedals, ...you don’t have to overthink it, it’s made to make music with and that’s ultimately my goal: make a pedal that does cool things with the most minimal amount of controls possible. Set it how you like it and forget about it. Go back to making music, because that’s what you’re trying to do*” (p.39) [3]. The idea that direct and real-time engagement with the interface of the pedal is distinct from the practice of music-making situates the pedal as a tool, as opposed to an instrument, in the eyes of Stillman.

On the contrary, in response to the conflict between marketing necessity (with a customer base largely composed of guitarists) and the wider possibilities of implementation, Empress Effects founder Steve Braggs discusses the impact of this dilemma on the design of the highly customisable modular multi-effects unit, ‘ZOLA’: “*With interest coming from all sides, there is real demand for putting the platform into devices that are better suited to other uses than guitar pedalboards... We definitely have considered other versions of the ZOLA. People are asking, “Why does it need noise stomp switches – do you really want to have it on the ground?”*” (p.71) [3]. Voicing an intention to produce formats that can be integrated with Eurorack or geared toward tabletop use, it is clear that Braggs is concerned not just with offering maximum configurability and range of features, but with designing an interface that can be placed at the centre of the creative space and ‘played’ by the user as an instrument.

Similarly, Joel Korte of Chase Bliss Audio, whose pedals are known for their expanded functionality and ‘tweakability’, promotes access

to all parameters via one-to-one mappings in a way which supports playability and personalisation of the pedal: *“I think people like to have the tactile experience, to be able to have access to all their effects and not have to menu-dive. There's also the modular nature of it, where you can switch the order of things. You can easily swap something in and out if you want to try something else, which I think is really attractive.”* (p.368) [29]. Korte frames the pedalboard in a way which is both configurable and centralises it as a potentially defining feature of a musician's practice, echoing Magnusson's suggestion of an instrument being *“...an end in themselves”* [23].

Companies such as Chase Bliss Audio, Empress, Meris and Drollo FX are representative of contemporary pedal manufacturers oriented toward more experimental or pioneering pedal design. Their ranges are often characterised by styles of effects imported from other areas of the music industry, and their pedals are promoted on social media with a market strategy that presents the pedals as tabletop devices designed (at least in part) for use by hand with a range of instruments beyond the guitar, including drum machines, synths, voice and even field recordings (see the YouTube demos of Knobs for many prominent examples of this [16]). Their products commonly offer affordances far beyond the scope of the traditional pedalboard or the needs of the traditional guitarist, including studio-based audio routing options such as stereo I/O [18], extensive MIDI control of effect parameters [17], functions that introduce noise as a variable to be blended into your signal [19], and dedicated oscillators and filters the likes of which are much more at home on an analog synth [9,1]. As Dave Hunter suggests, *“[s]maller boutique manufacturers are putting in greater effort than ever to design and build pedals that deliver the best of the golden-age sounds, alongside unprecedented new, wild, creative, and experimental possibilities”* (p.329) [29]. This broadening of pedal functionality via the introduction of features typically found outside of the world of the guitarist suggests an interface intended for use more as an instrument in its own right, rather than a tool to colour the sound of another instrument. The need for hands-on manipulation in order to explore the full potential of these feature-rich devices also suggests that their design coincides with tabletop use, a practice which conflicts with the need for both hands on another instrument.

Two excellent examples of contemporary practice which navigate the paradox of the pedal as both foot and hand controller can be found in the works of JAM Pedals founder Jannis Anastasakis (who uses a complex tabletop pedalboard with guitar, synth and field recording inputs [36]), and Wilco guitarist Nels Cline. During a live performance for EarthQuaker Devices, Cline divides his board into two, with one half of the signal chain at his feet, and the other half elevated in a tabletop setup, allowing finer real-time control over certain parameters at the end of the chain. The guitar is still used as the sound source for the performance, but the nature of the setup illustrates how the change in orientation of the pedals allows for, and encourages, different kinds of performance and interaction [11].

Situating this alongside the extremely hands-on, virtuosic, pedal-oriented performances of other artists such as Nick Reinhart of Tera Melos [30] and Radiohead's Ed O'Brien [35], we find situations where the pedalboard moves out of the periphery of the performance space and becomes part of the primary interface within a larger network-instrument. In these cases, one might argue that the original

instrument – be it guitar, voice, harp, saxophone, etc – becomes an interface for the performance of the pedalboard itself.

Coming from a slightly different perspective, some content creators and pedal designers within the online guitar and pedal community have drawn on the history of no-input mixing practice and noise-based feedback systems explored in section 3 above. These include Rublev [31] and Simon the Magpie [32], who have explored the capacity of the effects pedal as a sound generating device in a feedback system. As part of a series of YouTube videos investigating no-input feedback systems, Rublev demonstrates the potential for feedback by routing stereo guitar pedals back into themselves. The performance is a tabletop system, designed to be controlled by hand. These examples of the use of the guitar pedal as a sound source offers an illustration of the scope for the pedal to become an instrument in its own right, through direct physical engagement, its independence from another sound source and its integration into a network-instrument comprised of other pedals and an amplifier.

These examples drawn from contemporary artistic practice illustrate how musicians are working to overcome the paradoxical nature of the guitar pedal's design: by the elevation of the pedals to be controlled by hands and, much less commonly, the removal of another instrument as an external sound source and the use of feedback to generate self-oscillation. Taken together, they illustrate the latent potential of the pedal as a tactile interface for musical composition and performance and suggest a series of methods to harness this potential. As a project that seeks to explore the limits of the effects pedal as a musical interface, Noise Peddler brings these different approaches together, alongside a series of other strategies developed over a longform iterative research and development process, in order to construct a new coherent network-instrument from the no-input pedalboard.

5 The no-input pedalboard in practice: technical considerations and affordances

5.1 How does the no-input pedalboard constitute a unique instrument?

We have established that the effects pedal presents a series of paradoxes in its conception, operation and use. On a basic level, it is a device that is designed to sit at the feet but has an interface for fine manipulation by hand. Effects pedals vary in their function greatly, and in each case the relationship between sonic effect and interface or parameter design can be different. As illustrated above, this is underpinned by the particular design ethos of the company and can range from simplicity-driven ‘set and forget’, to something that encourages a creative exploration of the potential sonic world the pedal can elicit. Many artists bring together collections of effects pedals into a curated pedalboard and integrate this into their performance systems in a way which brings the effects pedal into the larger network-instrument of interfaces such as the guitar. It becomes instrumental as part of, and in the context of, this extended system of ‘guitar / effects pedal(s) / amplifier’, and in the case of artists such as Nick Reinhart or Nels Cline, for example, operates in such a way as to be a fundamental part of the instrument they play, whether that is with their hands or feet.

In each of these instances there is a common factor – the guitar itself (or any other input instrument) as the dominant interface for

generating sound. The effects pedal shapes this input and is ‘played’ as part of this network. However, latent potential in these devices is unlocked when we develop a system not dependent on that input, instead endowing the pedalboard itself with the qualities of instrumentality. This is the research paradigm that the Noise Peddler project works from: by removing the input and building a performance interface exclusively from effects pedals, we can exploit the resistances and affordances inherent in the paradoxes of their design to see what new relationships between interface, performance gesture and sound are possible and how this shapes musical practice with the no-input pedalboard as an instrument. To achieve this, Noise Peddler has leveraged new understandings of instrument design outlined above in a series of ways.

5.2 Developing a playable system

In order to make the no-input pedalboard a playable instrument, Noise Peddler have taken a number of actions which disclose the performance potential of the effects pedal and address its design paradoxes. The first – and perhaps most obvious – of these is to elevate the pedalboards to table height, allowing them to be performed with the hands and opening the potential for real-time manipulation of the parameters across multiple pedals simultaneously. By removing the guitar from the performance system, the hands are free to engage directly with the pedals as performance interface.

Although ergonomics is already a factor in the design of individual pedals, bringing multiple units together into a no-input network means that wider consideration of interface complexity is necessary. Alongside the sheer number of fine grain controls that populate the interface, this complexity manifests in a range of ways including the configurability of signal routing options, the mapping of parameters to pedals and the learning of performance gestures. These issues all play a part in the development of a musical language for the instrument, in the repeatability of sounds and in the mastery of the new instrument from a performance perspective.

5.3 Layout & design principles

To create interesting musical materials, the signal path is routed in a more sophisticated manner than the average guitar pedalboard, with multiple different oscillation sources providing unique sounds, utility pedals splitting this audio down discrete pedal chains, looping capabilities positioned in numerous points across these chains, and a highly unconventional order of effects which defies guitar pedalboard traditions (see, for example, an explanation of Noise Peddler’s current signal paths in conversation with Sonic State [33], in comparison to a traditional pedal order as outlined by That Pedal Show [34]). These factors result in a system that facilitates multi-voice, contrapuntal musical material from a single instrument, but also creates barriers to embodied performance and instrumental mastery.

Through working with this complex distributed network, achieved across multiple units, each contributing different elements but also interacting in a non-linear fashion, Noise Peddler has developed a series of strategies for management of the no-input pedalboard network-instrument. One key strategy is the development of a set of pragmatic layout and system design principles, refined through an

iterative reflective process over a number of years of composition and performance (for a more in-depth outline of the historical evolution of the project see [6]).

These principles include:

- Breaking down the system into sections, each with a core function (self-oscillating sound generation, pitch manipulation, envelope or pattern shaping, timbral shaping, temporal effects) that provides a framework for the instrument;
- A significant level of symmetry between the two connected systems, with scope for differentiation in terms of the actual effects each performer uses;
- The implementation of MIDI as a means of enabling parameter recall, pitch coordination and tuning, and tempo synchronisation between boards;
- Use of loopers in multiple different positions across the boards;
- Designing systems that fit within a limited performance space – used as a vital factor in limiting excessive complexity and ensuring playability with two hands.

These strategies allow the no-input pedalboard to be approached more systematically as a performance interface. They also enable multiple effects pedals to be combined into a coherent system, connected and organised in a way that moves them beyond their individual capabilities and into a modular, reconfigurable network-instrument which affords potential for new musical gestures and sounds.

5.4 (Re)-configuration

As a unique performance interface, the no-input pedalboard supports creative work through its reconfigurable and modular nature. This aspect of the design of the network-instrument affords a great number of musical and creative possibilities which are available through the many inter-dependent combinations of the pedals within the system. In this sense, there are always opportunities to make things more or less intuitive. In practice, some balance must be found between the musical and compositional affordances of the chosen configuration and the user’s ability to understand how things are functioning and interacting in this layout, whilst being able to react to things in real-time. A frequent spatial reconfiguration of the network – or the use of a complex routing system – comes with the trade-off that it is no longer visually clear which order the modules chain together in, and this lack of visual feedback makes problem solving, improvisation and mental recallability extremely taxing. Another problem arises from the fact that many pedals have shared functions. When there are many positions within a chain to alter the same parameter of the signal (e.g. volume), it becomes easy to forget which has been turned up or down, especially in the heat of a performance.

Lähdeoja suggests that the variable configuration of the network-instrument instigates “...*compositional strategies based on the affordances and the constraints of the network and its constituent modules. In this case, composition and sound creation form an emergent phenomenon stemming from the modular instrumental environment*”

(p.43) [21]. Whilst the no-input pedalboard has no traditional repertoire or set of practices – no existing habitus [7] – aspects of its musical voice are embedded in the components introduced into this network, their order in the signal chain, the way they interact with one another, and the kinds of interactions that their design encourage from the user. Inversely, as Windsor et al state, “...the morphology of the instrument has itself been determined by the effectivities of the human body... Instruments, therefore, come to embody the effectivities of their users and possess inbuilt affordances” (pp.108-9) [38]. As such, the no-input pedalboard forms a highly personalised system that reflects the knowledge and practice of the user, at the same time bringing with it the embedded knowledge and affordances of the guitar culture from which it stems.

Both Magnusson and Alpers highlight this embedded knowledge, Alpers stating that “...we are speaking of objects whose creation and whose musical capabilities are infused with information and conceptual structures that reflect the history and styles of musical sounds. That is to say, the material objects we think of as musical instruments are culturally freighted right from the beginning” (p.41) [2]. The implication of this is that, to some extent, the site of the composition itself moves from being an emergent product of the instrument, to becoming the design of the network-instrument itself. For Noise Peddler, the configuration of the boards becomes an act of composition. “Based on this conceptual system,” argues Lähdeoja, in his discussion of the guitar as network-instrument, “...the electric guitar and its augmentations (pedals, computers, etc.) become an object that can be composed, designed (objet composable)” (p.46) [21]. Or, in the words of Lachenmann, “[c]omposing means: building an instrument” (p.56) [20].

5.5 Mapping and performance gesture in the network-instrument

“...most pedals share a basic common design and control interface, based on knobs, switches and toggles. However, even something like a simple footswitch can vary from pedal to pedal, shaping how you can interact with it and what you can achieve” - Bjorn & Harper (p.12) [3]

Interdependent with the way the network-instrument is configured, and part of the balance between affordances and resistance in the design of the no-input pedalboard, is the way that parameters are mapped across the boards. This mapping of parameters to controls – and thus sounds to gesture – is an integral part of the performability and useability of the instrument and is one that is intimately bound to our personal practice as individual musicians. Our mappings take place in two ways:

- Mental – with multiple ways of achieving certain sounds (e.g. a change in gain, a shift in octave, the sustain of a loop), the mental assignment of particular pedals to these roles becomes both a compositional and a design decision that may change from moment to moment within a musical work, or throughout the course of a performance;
- Programmable – other programmable pedals such as the Keith McMillen Softstep and 12 Step present the opportunity to create innumerable mappings for the parameters on any pedal that can be controlled by

MIDI commands, and these mappings can change at the click of a button.

There are issues inherent in such flexibility of mapping, which requires a great deal of variables across a range of devices to be held in memory at any given time. Whilst the ergonomic design of the pedal means that a change in parameter is generally intuitive (you turn the volume knob clockwise, the amplitude increases – you turn it anti-clockwise, the amplitude decreases), our practice has revealed many instances where this linearity and predictability is not the case. For example, a melody on the no-input pedalboard might require the use of four different interfaces, one generating the original pitch, one to move between intervals, another to create glissandi and another to create an envelope for the note (see the opening melody to Noise Peddler’s composition *Soft Stepper* as an example of this [27]). These mappings are often flexible, and to be determined depending on the demands of the moment within the musical work and with how the various signal chains – and the hands of the performer – are occupied at that given point (i.e. is the chain currently holding a loop, processing other signals, or set to specific values for another musical event to come? Is it possible to physically reach the necessary pedal at this point, with the other hand required in a different part of the performance space?). Thus, for each variable of the sound, there are often a range of ways of adjusting them on different interfaces. Such a division lacks the intuitive nature of most acoustic or purpose-built instruments, and this issue is exacerbated by the modular nature of the system, which allows for a practically infinite order of reconfigurations of the various units, which will be dependent on the specific pedals a performer has access to. Efficient configuration and mapping can only be established through the trial-and-error of composition, rehearsal and performance of new repertoire, and through long-term development of the performance system, and these factors both feed into, and are affected by, the performance gestures unique to the instrument.

As Hunt et al point out, “...by altering the mapping, even keeping the interface and sound source constant, the entire character of the instrument is changed. Moreover, the emotional response elicited from the performer is shown to be determined to a great degree by the mapping. Whereas the input devices establish the physicality of the system and the synthesis methods govern the sound quality, the mapping somehow affects how the player reacts psychologically and musically to the instrument” (p.429) [13]. Interesting performative problems arise from this mapping affordance which, once again, can act as a form of resistance in certain circumstances. Mapping considerations are a personal, player-specific issue that requires a careful balance between necessity and ergonomics, as summarised by Bjorn & Harper: “A great board with the best pedals isn’t worth much if you can’t easily activate them, or make adjustments. An often-overlooked aspect of pedalboard design is ergonomics, with questions like: which pedals do I use or tweak the most? How am I positioned when I play?” (p.57) [3].

6 Leaning into the resistances

The process of endowing the pedalboard with qualities of instrumentality, of increasing the level of physical engagement with it but also increasing the demands placed upon it, and of complexifying its nature as a network-instrument, results in the performer rubbing up against substantial resistances in the instrument, as explored above. In our experience, however, it is these very resistances which offer a unique opportunity on both compositional and performative levels, and it is the act of leaning into these resistances that creates a platform for new musical affordances.

On a performative level the board is flexible and controllable, to the extent that the user is able to understand how each sound is being made and how the signals are routed, with parts often overlapping down each signal path. Changes in sound can be challenging and slow, and it is easy to get lost in understanding where a particular sound is coming from, or what is manipulating it. The amount of rehearsal required is proportionate to the specificity and complexity of the music being made. Whilst the pedalboard is capable of a broad array of different voices and timbres, it can take a lot of mental acrobatics and physical parameter changes to move between them.

From a compositional perspective, there is a huge learning curve in order to execute work with sophisticated or specific structures and voices. A large part of this process is in establishing the architecture of the network (reconfiguration, mapping of parameters, developing presets) and understanding how the work can be technically executed (developing a repertoire of performance gestures), all of which comes before any realisation of the music is attempted. Once this is in place, even when this process may have been excruciatingly difficult, the repeated execution of the work may then be very easy. At other times, there is a physical virtuosity which remains in each performance of the music. In this sense, the no-input pedalboard benefits from both physical and mental mastery of its parameters, and in a commitment to long-term development.

Ethics Statement

This project is undertaken by and based in the artistic practice of the authors. The research has been carried out in line with the ethical standards and practices of their affiliated institution.

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