Pop-up for Collaborative Music-making

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ABSTRACT
This paper presents a micro-residency in a pop-up shop and collaborative making amongst a group of researchers and practitioners. The making extends to sound(-making) objects, instruments, workshop, sound installation, performance and discourse on DIY electronic music. Our research builds on creative workshopping and speculative design and is informed by ideas of collective making. The ad hoc and temporary pop-up space is seen as formative in shaping the outcomes of the work. Through the lens of curated research, working together with a provocative brief, we explored handmade objects, craft, non-craft, human error, and the spirit of DIY, DIYness. We used the Studio Bench - a method that brings making, recording and performance together in one space - and viewed workshopping and performance as a holistic event. A range of methodologies were investigated in relation to NIME. These included the Hardware Mash-up, Speculative Sound Circuits and Reverse Design, from product to prototype, resulting in the instrument the Radical Nails. Finally, our work drew on the notion of design as performance and making in public and further developed our understanding of workshop-installation and performance-installation.

Author Keywords
Collaborative-making, Pop-up, Hardware Mash-up, Studio Bench, Speculative Sound Circuits, Non-craft, Workshop-installation, Performance-installation, Reverse Design, DIYness

CCS Concepts
•Applied computing~Arts and humanities~Sound and music computing•Applied computing~Arts and humanities~Media arts

1. INTRODUCTION
This paper presents a three-day micro-residency in a pop-up shop and collaboration between a group of researchers and practitioners that was set up to investigate the spirit of DIY electronic music, DIYness and provide an archetype to observe and experience the work of Dirty Electronics [19]. We discuss the importance of working together in a temporary, pop-up space and the relationship between our adopted methods and creative outputs: sound devices, software, workshopping, making in public, performance-installation and discourse surrounding New Interfaces for Musical Expression (NIME) research.

The residency builds on our previous activity and the idea of curated research, working together, collectively under an umbrella research theme [1]. And we seek to develop our work through collective intelligence. As Adrian Shaughnessy argues: "… we need 'collaborative intelligence,' a term that describes heterogeneous networks of people interacting to produce creatively supercharged outcomes" [20]. Moreover, we bring forth our experience as musicians and of group performance, and how such collaborative practice can be applied to the design of NIME. We are also concerned with design being public-facing as a form of live art, where decisions and actions are responses to the immediate surroundings and social conditions.

We believe the design of new artefacts, interfaces and resulting music should be viewed as a holistic action and offer the term Studio Bench to describe a method for creating DIY electronic music. This method has been outlined in a paper by Patel [5] and employed in a number of projects [6]. Patel has described the transient nature of his work - going from workshop to workshop, occupying temporary, ad hoc making spaces and performing with his 'makes' - and has made the link between DIYness and nomadity, which he labels as the DIY Nomad (see Section 8 for a more detailed discussion) [6]. In this residency, we put forward the Studio Bench and the notion of the pop-up as representing an emergent, experimental space for sound and design.

Remix culture is applied to hardware and sound artefacts and viewed as the Hardware Mash-up [6], whilst ideas of speculative thinking and design [3] are developed to incorporate Speculative Sound Circuits [12]. The overlap between these two approaches is reflected on. This paper illustrates how these working methods coupled with collaborative making can lead to the design of new sound devices/instruments. In this Pop-up, the resulting device, the Radical Nails illustrates what could be considered as a Reverse Design trajectory where ideas of product and prototype are broken down.

Craft in a technological context is also considered, not craft in the traditional sense as presented by Pye - where there is an importance placed on skills, tools and traditional methods for making [7] - but craft with reference to idiosyncracies of handwork, expedient and naïve approaches to making and ad hoc working environments. These ideas build on Patel's research into DIY electronic music and non-craft with specific reference to the DIY Nomad.

In particular we situate our residency in the context of previous work undertaken by Richards as Dirty Electronics. Richards has considered the workshop as central to DIY electronic music citing such practitioners as Collins, Howse and Justka [11]. He does not consider the workshop as a separate event outside of sound-making and elevates the workshop to a performance-based activity [8]. From this, Richards has arrived at the definitions of performance-installation and workshop-installation [18]. Recent examples include the Sacrificial Floors Tour with Tim Shaw and Tetsuya Umeda [14]; and the Dirty Electronics Experimental Sound Workgroup as part of the Prague Quadrennial of Performance Design and Space where on-going making and workshopping became a public performance

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as part of the installation the Blue Hour [16]. Richards and Patel have previously undertaken research where workshop, design, performance, publication and discourse have operated as a single endeavour [9]. Our work brings together these activities and perspectives to further question and interrogate NIME.

Throughout the paper we use the terms 'sound(-making) object' [6] and 'makes'. The sound(-making) object is the physical artefact, the material of the instruments that makes sound: for example, appropriated pieces of wood, circuits, wires, and electronic components. Makes refers to physical artefacts but also to performances, composition and our general creative output.

2. COLLABORATIVE MUSIC-MAKING

The Pop-up began through correspondence with Dann Downes, musician and researcher in communications interested in observing and experiencing DIY electronic music practice [2]. The Pop-up was also intended as an archetypal Dirty Electronics workshop/event where these observations could be made. From this premise, we followed our method of curated research, as outlined above, and developed a thematic provocation to which participants could respond. The provocation included a set of muses on, amongst others, handmade objects, craft, human error, and the spirit of DIY [19].

The Haymarket Shopping Centre in the city centre of Leicester provided the location for the Pop-up. The Shopping Centre opened in the early 1970s and is one of oldest shopping centres in the UK housing many leading retail outlets. The malls of the Shopping Centre act as a thoroughfare linking parts of the city resulting in significant footfall. Brutalist concrete and glass and a main hall leads to a reverberant and noisy space. 'Our' shop was not chosen but a consequence of available spaces in the Shopping Centre. This happened to be a generous gallery-like space with large windows, open doorway and white walls, pillars dividing the space, and concrete floor. The space was bereft of furnishing barring a few trestle tables and chairs, and all workshop and performance infrastructure was brought to the space. Like our previous curated research, our activity was low-budget and self-funded [1]. Much of our planning was influenced by materials at hand and available resources, and we pooled equipment for the Pop-up through begging and borrowing.

The approach to the Pop-up was important for a number of reasons. The temporary basis and short duration of the Pop-up was intended to give our work an intense focus as well as working with limitations, time and resources. In terms of design, the Pop-up offered an environment in which rapid prototyping could take place. Immediate responses would be sought for design problems and creative outcomes for the installation. The temporary workspace also gave us a neutral space, a space that was not predisposed towards engineering, design or sound-making, but a space that was open to interpretation for shared practice. The Pop-up was to act as a tabula rasa (clean slate) from which new work could be created.

Collaborative making arguably began from the outset of the Pop-up when ideas and responses to the brief were put forward by participants and reflected upon by the group. Prior to the Pop-up, there had been a deliberate attempt to keep pre-determined plans to a minimum so that decisions could be made collaboratively in situ. For example, there had been no decision made or agreement on what we were going to make during the residency, both in terms of sound(-making) objects and music. It was only through collaborative intelligence that we began to evolve a collective course of action for the remaining days of the residency. In order to address our aim of interrogating the spirit of DIY, the methods of the Hardware Mash-up and Speculative Sound Circuits were put forward and the mash-up of the Bed of Nails [15] and Simple & Radical [21] were chosen as the subject matter for our makes. The results of this mash-up and collaborative making are discussed further in Section 5 of this paper.

3. HARDWARE MASH-UP

Previously, Patel has explored the idea of the hardware remix or Hardware Mash-up by merging different circuits of instruments [5]. This resulted in the mashed-up instrument Gilora, a sound(-making) object that combines two instruments: firstly, the Faraday Dirty Kinetic Synth, of which, the original design of the Faraday Dirty Kinetic Synth is based on the Dirty Carter Experimental Sound Generating Instrument (2010); and secondly, the Turtlebox that is based on the Bed of Nails as discussed in detail in Section 5. The marriage of these two instruments is what Patel refers to as the Hardware Mash-up. Drawing on his experience as a DJ, Patel uses the remix analogy associated with electronic dance music to combine circuits. By adapting existing sound(-making) objects and their combination, a new way of working and experimenting emerges. Like the DJ's cut and paste techniques, this process helps the DIY Nomad to re-edit, review circuitry and blur the boundaries of what is considered something new or old. The Mash-up also allows for connections to be made between different musical cultures, for example, Patel's DJ background and invested interest in noise and live electronics. The Hardware Mash-up has been further investigated by combining Gijs Gieskes' Analog Hard Disk 2 [4] with the Turtlebox [6]. In turn, these experiments led to the conceptualising of the Hardware Mash-up.

The Hardware Mash-up can be considered a design approach or method that could be applied to other sound sources in the creation of NIME. It is important to note that the Hardware Mash-up is not the same as a hardware hack. The mash-up is influenced by the idea of dualism and mixing two sources, much like a DJ and their use of turntables. DJ sound sources are often referential. On the other hand, Wark, in A Hacker's Manifesto, considers the hack as a means of arriving at abstraction through the combination of different and unrelated mediums [23].

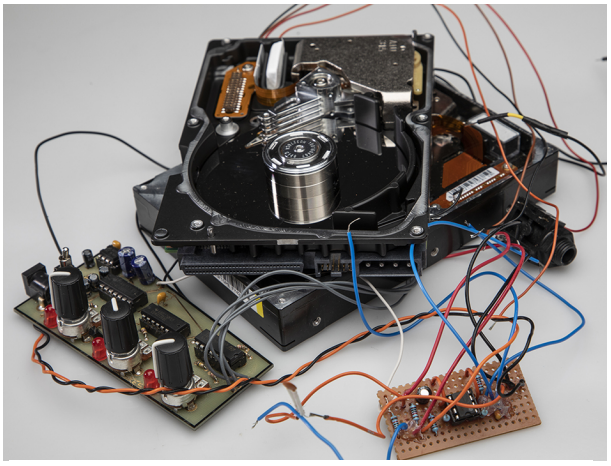

Figure 1. Hardware Mash-up

4. SPECULATIVE SOUND CIRCUITS

In addition to Patel's research on Hardware Mash-up, Richards has considered the idea of Speculative Sound Circuits borrowing on current design approaches [3]. He argues that speculative, as opposed to purely technical approaches can help shape new artistic practices [12]. Richards summarises the approach as a: "part-playful, part-absurdist methodology … where unlikely or disparate technological devices and objects are speculatively combined to make sound-based performance" [12]. Central to the idea of Speculative Sound Circuits is creating sound

devices/instruments through employing the use of polar opposites. Such opposites are used by Dunne and Raby who discuss creating an A/B list, a sort of manifesto of juxtaposed design: for example, "Makes us buy - Makes us think; Ergonomics - Rhetoric" [3]. Their 'manifesto' can also be seen as borrowing from classical rhetoric and dialectics: the use of oppositions - thesis, anti-thesis - to arrive at a synthesis. An example of this approach can be found in Richards' *Speculative Circuit* that combines the circuits of the Bed of Nails and Casio fx-19 and fx-102 calculators [10].[1] Speculative Sound Circuits rely on contrasting, disparate combinations of electronic circuits and technological objects. At the root of this approach is a focus on the post-optimal, beyond efficiency - cheaper, lighter, faster, stronger - and a design process that deals with poetics, that which is reflective, relational, and/or of the imagination.

5. RADICAL NAILS

The Pop-up for Collaborative Music-making allowed us to further reflect on our approaches and explore the Hardware Mash-up and Speculative Sound Circuits and how they may overlap. As described in the introduction, the Pop-up was a vehicle to go in search of the spirit of DIY electronic music and DIYness. The combination of these aims-of-sorts resulted in our makes: the Radical Nails. The Radical Nails is a Hardware Mash-up and a Speculative Sound Circuit that mashes-up the Dirty Electronics' Bed of Nails and the Simple & Radical.

The Bed of Nails could be considered a sculptural art object in itself, using a variety of mixed materials such as wood, nails, wires and electronic components. The main body of the instrument uses freeform construction methods, and a piece of scrap wood is used as a base for eight nails. Wires are then wrapped around the nails and connected to an Integrated Circuit (IC). An op-amp circuit is used to generate analogue feedback when the nails are touched in certain configurations. The circuit, as well as referencing the breadboard and its origins, also borrows from ugly construction methods where electronic components are directly connected by their legs or through wire-wrapping and circuit board-less constructions that draw on Manhattan style and dead bugging techniques. This type of construction is favoured in many Dirty Electronics' instruments [9].

The Simple & Radical contrasts starkly with the Bed of Nails in that it is a digital wavetable synth, direct digital synthesis (DDS), with a single microprocessor/chip. The chip was designed as a swappable chip, provocatively named the Radical Chip, for the Mute 4.0 Synth [13]. The Simple & Radical stemmed from the idea of decommodifying the Mute 4.0 Synth by taking one part of the Synth, the digital wavetable synth/chip, and creating a specifically DIY project that could be done in workshops as a stand-alone synth built on stripboard. This adaption and appropriation of the chip was preconceived and engineered in the design of the original Mute 4.0 Synth: hence being swappable. For a more in-depth discussion on the Radical Chip and Simple & Radical, see Microcomputer Music text [17].

Reflecting on the Radical Nails, we can further consider how the methods of the Hardware Mash-up and Speculative Sound Circuits overlap. Firstly, both methods revolve around the idea of dualism, where two or more circuits are combined or mashed-up to create a synthesis in the form of a new sound(-making) object. This dualism also emphasises a relationship or dialogue between the mashed-up or speculative parts. The idea of juxtaposition also plays a key part in the design process. Secondly, the methods rely on the appropriation of existing circuits, borrowing from what already exists to create a sound(-making) object through recontextualisation. Finally, there are also elements of recycling of materials at play in both methods.

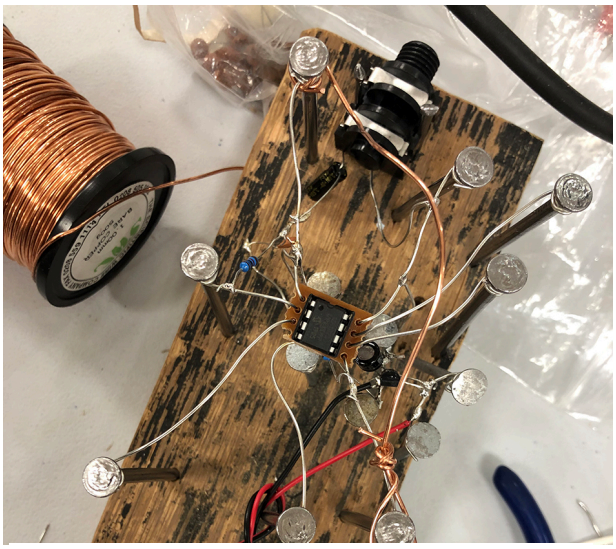

Figure 2. Radical Nails

6. DIYNESS

One question that arose from the Pop-up was: How can a circuit like the Simple & Radical become more DIY and capture Richards' work as Dirty Electronics? Particular DIY traits were taken into account: the hand-made, crafted, personal, bespoke, rustic, expedient, self-sufficient, assembled rather than engineered, and that which appears low-tech. Ideas relating to noise and control/lack of control of sound [6] were also reflected upon. We offer the term DIYness to encapsulate these traits and as a noun to describe indicative DIY practice. For example, the original design for the Simple & Radical used stripboard. Although a prototyping environment, the geometric and grid-like layout of stripboard arguably limits the idiosyncrasies of handwork in the construction of a circuit. The analogy of handwork being quantised can be used. The freeform construction method of the Bed of Nails was viewed as being more 'expressive' (with reference to the Simple & Radical) and demonstrating the quality of DIYness, and directly led to the design of the Radical Nails in the micro-residency.

In addition to the Radical Nails, the very nature of the Pop-up - working in a transient, make-shift space to design NIME and make music and perform - further illustrates the concept of DIYness.

7. REVERSE DESIGN

More accurately, the Radical Nails is a mash-up of the sound(-making) objects rather than circuits. The singular circuit of the Simple & Radical is constructed in the format of the Bed of Nails. The mash-up occurs in terms of the interface: touching nails to control the synth. The Radical Nails also follows the design methodology of a Speculative Sound Circuits and the idea of using polar opposites as described above. Referring back to Dunne and Raby and their A/B manifesto, we can draw up a list

[1] *Speculative Circuit* performed by Max Wainwright, Monika Jagerova, Bruno Cunha (Clarinet) and Sam Topley, Czech Radio, Prague, 24 November 2017. Part of *Making for Radio* broadcast [13] (at 19:56).

of oppositions with reference to the Bed of Nails and Radical Chip/Mute 4.0 Synth.

Table 1. A/B list - Bed of Nails and Radical Chip/Mute 4.0 Synth

Bed of Nails	Radical Chip/Mute 4.0 Synth
Handmade	Machine-made
DIY	Product
Crafted/non-crafted	Engineered
Temporary	Permanent
Assembled	Designed
Open (source)	Closed
Found (materials)	Established
Natural (wood)	Synthetic (silicone)
Analogue	Digital

At arriving at the Radical Nails mash-up, our makes followed a Reverse Design trajectory, not the traditional path of prototype to product, but from product to prototype. Or arguably from a product to a DIY product - something specifically designed for DIY. We deconstructed the Mute 4.0 Synth focusing on just one part of the Synth, the single microprocessor/chip for wavetable synthesis. The design of the Mute 4.0 Synth was traced backwards, disposing of the printed circuit board (PCB), potentiometers and control interface to find elements of the Synth that could be re-appropriated in a fresh prototyping environment.

What can we explicitly learn from this design approach in terms of NIME? Reverse Design is based on the idea of breaking down a fixed form or structure in an attempt to re-evaluate the constituent parts of a sound(-making) object. This is not hacking, but more an attempt to explore, what might be considered, primitive forms and systems: to peel-away peripheral functions of systems or processes associated with product design such as optimisation and up-scaling. The idea of musical instrument/sound(-making) object here does not necessarily have fixed or demarcated boundaries or can be considered 'finished' but is transient and emergent. Additionally, a rationale for Reverse Design is to find bespoke solutions to instrumental set-ups, and to give a sense of autonomy in design processes and instrumental use. It is not the artefacts themselves that, in Wanderley's words, result in "idiosyncratic devices that only serve their inventor and offer little, in technological terms, back to the community" [22] but the methods that can be drawn upon when considering the design of musical interfaces and sound(-making) objects. These 'primitive' and customisable set-ups offer a sound-making environment suited to rapid experimentation, both in designing NIME and resulting music.

8. NON-CRAFT

One of the themes of the Pop-up that kept recurring was the idea of craft, in particular whether craft was a characteristic of DIYness. Patel has questioned the role of craft in DIY electronic music and has considered non-craft as an element of what he calls the DIY Nomad [6]. The term DIY Nomad is used to describe this new DIY electronics/noise practitioner, someone who does not own any tools per se and has a casual relationship with the tools for building sound circuits. The DIY Nomad does not necessarily have a workbench nor a fixed workspace, and this differs from the theory of Pye [7] whereby the craftsperson typically builds a long-term and deep relationship with their tools and workspace, often to the extent of their tools being meticulously ordered and placed in the workshop. In contrast, the DIY Nomad may not work strictly in crafts or relate to be a craftsperson. The idea of craft has traditions associated with it often emphasising hand skills and expertise with tools as outlined by Pye [7]. Patel suggests that the DIY Nomad should have the creative licence to use limited skills to define the scope of their work. Faults, mistakes, inaccuracies, and 'poor workmanship' are celebrated. As a result, this allows the maker to focus on other important aspects of the sound(-making) objects in particular their potential for performance. The DIY Nomad aspires to build objects which have individual characteristics that are unique; and, most of all, have their own quirks.

Another important aspect of the DIY Nomad is the physical aesthetic of the sound(-making) object and its portability: for example, the Radical Nails. In relation to the micro-residency, during the making of such an object, there is no design as such, pre-determined graphical layout, drawings or sketches. Through expediency, quickness and immediacy, trial and error, and in the act of construction the look and the feel of the sound(-making) object emerges often being messy, unrefined, naïve, and arguably ugly.

The Pop-up allowed for a messy, unrefined space to emerge that enabled a down-to-earth way of 'doing' and 'thinking'. Tools were brought out sporadically, and components and materials were strewn arbitrarily across a workbench. Participants could harness their 'inner DIY Nomad' and work at their own pace with their own limited skills and experiences. One advantage of making the Radical Nails, for example, was that it allowed for each participant of the Pop-up to create their own bespoke version, as well as not having to strictly rely on craft. The construction of the Radical Nails shuns the idea of a traditional synthesiser. It can be non-ergonomic and crudely made with limited technical ability. There are minimal parts and components with primitive construction methods such as nails hammered into a piece of scrap wood, and wires wrapped around these nails giving a temporary appearance. Each participant of the Pop-up was able to customise their own sound(-making) object through placement of the components and decoration. In the context of the Pop-up, perhaps the quirkiness and unpredictable nature of the object would not have happened if it was made, for example, in an electronics lab. Non-craft paradoxically rejects craft in the creation of handmade objects, and, in this context, questions the importance/unimportance of craft in relation to DIY electronics music practice.

9. STUDIO BENCH

Patel's priority was to utilise the Studio Bench in the Pop-up. The Studio Bench is a holistic practice where what could be considered as three separate activities - electronic instrument making, studio recording and live electronics - are brought together [6]. These separate activities are normally carried out in distinctive spaces such as a workshop, recording studio and live club/gig environment. In Patel's practice, these worlds and cultures collide as part of an ongoing 'making' activity where the barriers between different cultures break down. The Studio Bench encompasses music-making approaches found in DIY electronics, noise music, DJing and record selecting.

The Studio Bench gives rise to the ability to move between spaces freely and work on the periphery of cultures. The DIY Nomad is a term used to describe an artist/maker constantly on the move, where, for example the workbench is used for making and exploring sound(-making) objects. The workbench is considered transient and expedient allowing for quick and dirty approaches. An important part of the Studio Bench is that objects are not just made, but also played and recorded. This also creates an ad hoc studio where portable devices, such as mobile phones, are used for recording [6].

With specific reference to the Pop-up, the Studio Bench was definitively employed resulting in a number of outcomes. The temporary workbench afforded a range of methods, such as the Hardware Mash-up and Speculative Sound Circuits, to be used

in the collaborative process of designing and making the Radical Nails. The Studio Bench as an approach led to a number of improvisations and recordings with the Radical Nails that were made using a portable studio consisting of DIY speakers and a handheld recording device, the outcomes being two short pieces that can be heard on the blog [19]. The temporary workspace and studio also gave way to a performance space, where the makes were also scrutinised collectively in public as part of a wider performance-installation during the finale of the Pop-up for Collaborative Music-making.

In terms of evaluation, the Studio Bench was particularly effective in the Pop-up allowing making and performing to co-exist holistically over a short period of time in a temporary setting. The malleable nature of the Studio Bench also permitted collaborative work across a range of disciplines including design, music and performance. During the micro-residency, there was a certain convergence where the idea of the workbench, studio and performance-installation merged into one. We were working in the Pop-up together, therefore results were expedient, in the moment and influenced by the state of flux such as being in a temporary disused shop space. The workbench blurred into a studio, and the Pop-up became an art gallery/performance venue. Not only was the performance-installation an outcome, but the Studio Bench allowed the musical output to be instantly streamed after recording took place in situ [19] rather than following the traditional channels of music mastering and distribution.

The Studio Bench provides the opportunity not to be fixed and restricted to one space such as a lab or a workshop when developing NIME. It allows for a new approach rather than being wedded to a specific tradition. Through adopting the Studio Bench approach, there is an ongoing deterioration of the distinct uses of designated spaces - the workshop and studio - and the typical maker space with a workbench; ultimately the traditional type of space for music making is eroded. Overall, the Studio Bench provides a sense of self-sufficiency, a sense of control and ownership that ultimately leads to something that is arguably authentic and original such as the Radical Nails, resulting music and performance.

10. COLLECTIVE MAKES

Figure 3. Making in Public

10.1 Collective Makes

The disused shop provided us with a clean slate from which to work. Initially, participants decided to split the space in two using rope barriers: first, a messy space to work in; and second, a gallery-of-sorts to exhibit and perform/rehearse in. This was done rapidly with a collective consensus, and it was important to build the space quickly due to the short timeframe of the micro-residency. Our pop-up and collective making was placed in a busy shopping centre, and we wanted to interact with the public and for the public to intervene with our work. Working in this environment set the pace for dynamic discussions and decision making. The temporary, pop-up workbench was placed next to the large shop window inviting curious passers-by to stop and observe our makings. This influenced the way we worked due to the fact that we were always being watched and 'performing'. The Pop-up for Collaborative Music-making was described to the public as an emergent artwork, culminating on the final day in a performance/presentation.

Once the space was set up, we began making the Radical Nails. Scrap wood for the base of the sound(-making) object was cut and sanded. There were variations in the size and shape of the bases. We also aimed to incorporate a range of activities and materials in the Pop-up, and pre-considered making prints from lino cuts to create posters. However, the lino cuts were used to make prints on the wooden bases. This gave another bespoke quality to the DIY sound(-making) objects. During the earlier stages of the Pop-up, we worked in unison like an unofficial assembly line. Components were counted, shared and wires cut to size. And nails were hammered into the wooden bases to create terminals for wire wrapping. Richards' gave instruction on interpreting the schematic of the Simple & Radical, and the group debated on how to practically construct a Hardware Mash-up.

It was at this stage that further evidence of collective intelligence emerged in relation to the design layout and construction of the circuit in its new form as the Radical Nails. For example, group discussion arose around the design of a switch to change the parameters of the sound(-making) object (a dangling piece of wire to ground we termed 'silly switch'), and hacks and mods to create different control voltages on the analogue inputs of the micro-processor. There were also parallels that could be made between a group of musicians improvising or jamming and the broader concept of collaborative making, where through the exchange of ideas and trial and error procedures design solutions were arrived at.

As we completed our makes, we also discussed across the workbench the synergies between the build and installation, and how our makes could be used in performance the next day. This was also followed by thinking about ways in which to interact and perform with the sound(-making) object.

10.2 Performance-installation

In working collaboratively, it was important that various skills amongst the participants were drawn on and responsibilities delegated. The group used the next day to dress the gallery space for performance. An art gallery and performance space emerged from the empty shop. Documents relating to DIY electronic music such as schematics, images and posters were hung on the walls. Performance ecosystems were built with DIY sound systems utilising a range of speakers and transducers. These speakers were hung off the ceiling or placed on the floor around the shop. For example, a Radical Nails was connected to a bass shaker, and acoustic objects were placed on top of the shaker that resonated and rattled. Whilst other sound(-making) objects were played through speakers hung from the ceiling that could be spun. This motion enabled the sound to be diffused in the shop. The audience/attendees were also given licence to interact with the sound(-making) objects, transducers and acoustic objects and spinning speakers. In addition to spinning speakers, we installed a DIY flickering light system as an attempt to get away from the one-dimensional fluorescent strip lighting of the shop. The light system was built using fluorescent light starters and incandescent lightbulbs. Multiple bulbs were strung around the room that could be manually swung to create light 'shapes', gestures and moving shadows.

11. DISCUSSION

Pop-up for Collaborative Music-making provided a catalyst to build on our previous research [1] as well as further develop our methods for and approaches to NIME. A provocation, referred to as curated research, acted as a design brief from which participants could respond, and how our activity resulted in what could be considered a cultural, rather than commercial product. The very essence of pop-up - temporary, ad hoc, emergent - became a critical guiding principle of the research that directly influenced resulting makes. Collaborative making was necessitated by challenges presented of working in a temporary space within a limited time span. Group discussion, teamwork, collaborative intelligence and pooling of skills helped tackle these challenges. The Pop-up provided a tabula rasa from which new synergies between disciplines could be made, and the expedient nature of the Pop-up questioned the role of the craftsperson, luthier, artist, and engineer in the design of NIME. The non-specialist and DIY Nomad were highlighted in addition to how a non-crafts person adopts different tools and spaces for creative means. We went in search of the spirit of DIY, DIYness in electronic music and what epitomised the hand-made and to decommodify, strip assets, democratise and personalise existing products. The design of our interfaces and makes followed a Reverse Design trajectory, not prototype to product, but product to prototype. The digital wavetable synth of the Mute 4.0 Synth [13] was appropriated and a series of reductionist iterations - Radical Chip, Simple & Radical - and making collaboratively led to the Radical Nails. The Studio Bench was further explored: the Pop-up provided a temporary workbench, studio and performance space, where instrument design and music-making in situ informed each other. The Hardware Mash-up and Speculative Sound Circuits were exploited in the resulting design of the Radical Nails.

Our results can be seen as a set of overlapping forms and extended processes: instrument as composition, open workshop, workshop-installation, making in public, and performance-installation. This in turn helped formulate a deeper understanding of the spirit of DIY in the context of NIME.

12. ACKNOWLEDGMENTS

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