Immanent Practice: Accounts of Optical Sound Filmmaking

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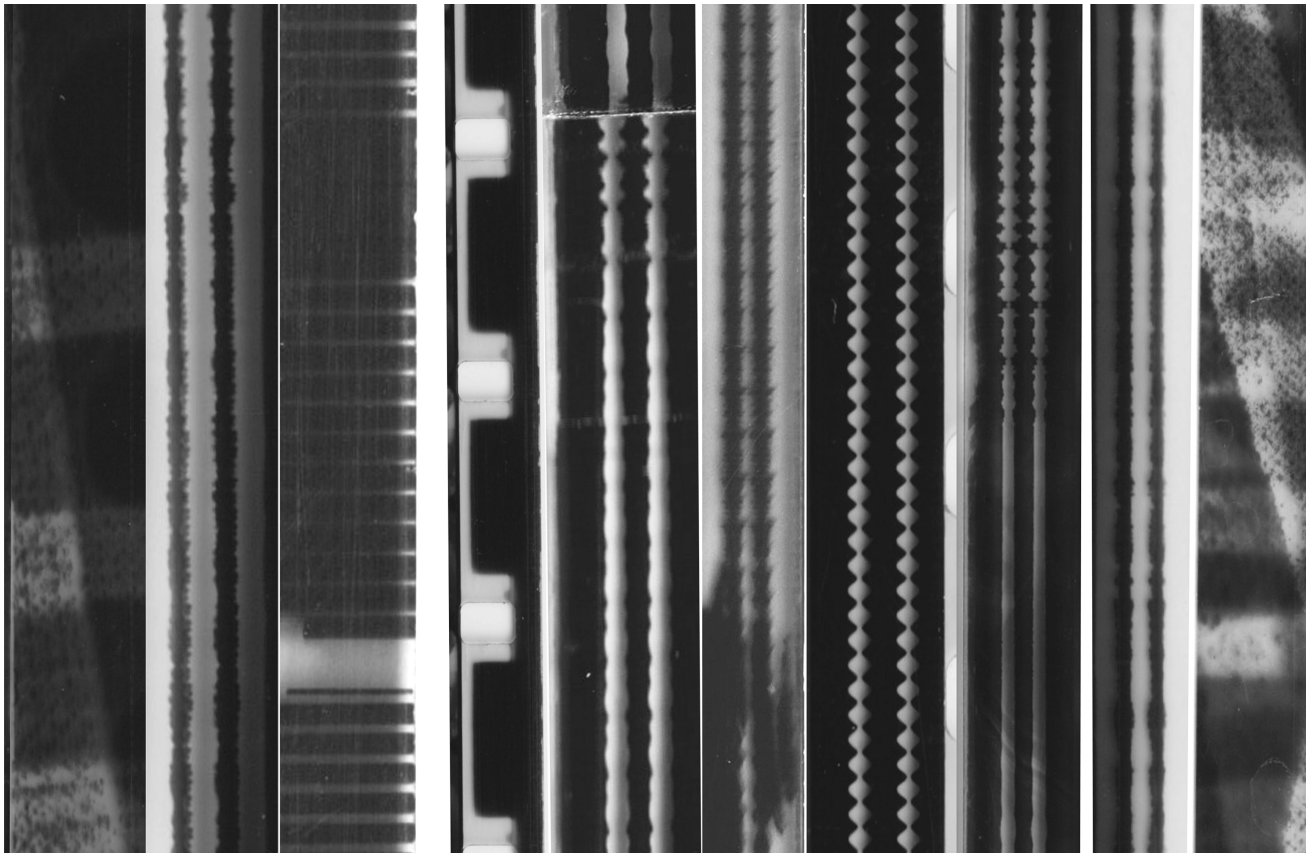

Figure 1: A collage of scanned 16mm optical soundtracks

Abstract

This paper offers an account of optical sound filmmaking practices; involving a form of photochemical synthesis where light and matter are used to create sound and image. Diffractively analysing interviews with optical sound filmmakers, we reflect on the concept of an 'immanent practice', which pays close attention to what the apparatus *does*, not what it is *for*. An engagement with film's chemical nature, the philosophical history of the medium, and the repurposed nature of the equipment used, firmly roots this work in materialist thinking. These practices are co-constituted with their material surroundings, where microscopic material behaviour has a profound effect on wider patterns in the making process, and vice-versa. We believe insights from our analysis offer an understanding of how 'immanent practice' can unfold within a system, allowing for a plurality of approaches as well as a deep understanding of, and care for, material assemblages.

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Keywords

Materialism, Immanence, Practice, Optical Sound, Photochemical film, Diffractive Analysis

1 Introduction

This paper offers an in-depth account and diffractive analysis of photochemical optical sound practices. Though not explicitly concerned with *new* interfaces for musical expression, we investigate material systems that are continually made and remade through ongoing practice. This study explores distinctly materially led approaches of synthesising audio, from a filmmaker's perspective. We unpack the concept of *immanence* in relation to practice, where ideas emerge from *within* the apparatus, and attention is tuned to lively 'internal' intricacies and affects, as opposed to fixed, pre-determined 'external' concepts.

Our research has emerged from a deep interest in practices of using optical sound technology, as well as a response to recent discourse around materialism, entanglement and *post-optimal* [69] understandings in NIME [48, 56, 60, 76, 98, 103]. This discourse has playfully questioned a necessity for newness in NIME, along with the creation of 'successful', 'finished' and boundaried interface designs. Proposed alternative views and design paradigms make space for the *old* [82, 91], fostering practices of re-use, repair and modification [76]. They celebrate fluid, unfixed *assemblages* [55], where various ideas can collide and 'curdle' [98], creating new affects, while allowing different machines, practices, voices, and material histories to unfold without collapsing into sameness [48, 54–56, 98].

Inspired by this research, we situate ourselves within a 'flat ontology' paradigm [50, 74, 75, 105], but maintain a rejection of inert, static 'flatness' of practice. Our work seeks to explore material liveliness within accounts of making, where, as described by Deleuze in his 1994 work, *Difference and Repetition*, concepts are made, remade and unmade 'along a moving horizon, from an always decentred centre, from an always displaced periphery which repeats and differentiates them' [66, 108].

In this paper, we will explore immanence as a philosophical concept, as well as the implications of theories of vital materiality in design and practice. We will briefly describe a corner of optical sound technology's materialist history, situating the practices outlined in the study. We present an *immanent* form of diffractive method, where accounts of optical sound practice are read *through* the structural attributes of the film apparatus. Alongside this structure, we read these collected accounts through theories of immanence, vital materialism and entanglement, paying attention to ways in which apparatus shapes practice and vice-versa. We present this analysis in five sections, relating to transduction, frames, difference, repetition and chemicals. In order to preserve the richness of detail and humour of these accounts, we recommend reading the analysis alongside the referenced quotes, which can be found in the appendix. We will discuss certain patterns, arising from this analysis; exploring situational, bricolage understandings of practice, as well as the notion of open material systems, where machines and processes proliferate through in-person encounters and tacit understandings of equipment. Finally, we propose a list of attributes that may characterise 'immanent practice'. We do this not with any dogmatic aim, but as a way of prompting further consideration of materialist practices of <design-use> in the NIME community.

2 Background

2.1 Immanence

Immanence is a word with a long and contested philosophical history. Relating to a state of being inherent, stemming from the latin *Immanare*, meaning *to dwell within*, it is often used to distinguish between knotty theological paradigms. In Western Philosophy, the term is strongly associated with Spinoza, who argued for a divinity from within the immediate world (*God is Nature/Deus Sive Natura*), as opposed to God as transcendental other [64, 109]. This immanent position extends far beyond this corner of Western Medieval thinking, forming the backbone of many cultures and spiritual practices worldwide. These worldviews are marked by an attendance to the agency of nature and the non-human.

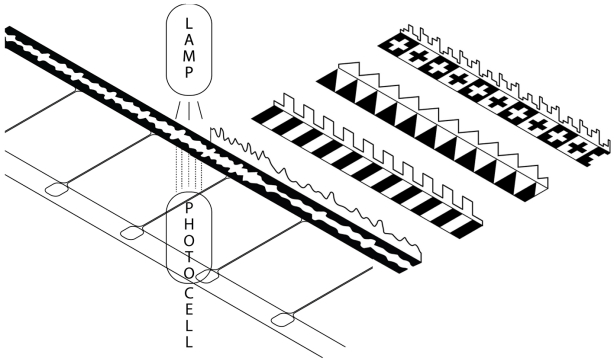


Figure 2: A diagram of optical sound technology

First Nation Ashinaabe cultures recognise sacred presence as encountered through everyday practices, within and as part of spirited nature. An agential understanding of the non-human is evidenced by the verb-based structure of the languages of the great lakes, where, instead of passive names, natural entities are named through active words that mean 'to be a hill', or 'to be a long sandy stretch of beach' [86].

Chan and Zen Buddhism have been described as a practice of 'radical immanentism' [71], where 'in awakening, immanence turns out to be transcendence' [72]. This spiritual practice turns its attention to immediate material reality. Dōgen's 13th Century *Sansuikyō* (the Mountains and Waters Sutra), describing 'Green mountains, always walking', draws attention to the vitality of the world itself, which actively embodies direct truth and meaning, and in doing so, teaches [99].

Deleuze's Philosophy of Immanence builds directly on Spinoza's Flattened Ontology, and the concept of 'Univocity of being' [64, 109], where 'all heterogeneous entities of an assemblage can be conceived at the same level' [114]. Within this flattened material plane, or *plane of consistency* [65], the structures and meanings that make up the world around us are *immanent* and relational. Immanence here relates to an understanding of cause, where what may be termed Nature, World, Life, God or Reality is *self-causing* as well as *world-causing*; both the cause of itself and of all things. According to this worldview, which closely relates to theories of entanglement, reality is not defined by universal ideas belonging to another plane, but emerges through co-constitutive relations. For Deleuze, everything is 'matter in variation that enters assemblages and leaves them' [65]. And so, an immanent standpoint requires a recognition of the vitality of materials, as well an attention to a variation of lively material relations within these assemblages.

2.2 Vital Materialism in Design and Practice

The idea is crystalline, the fact fluid

(Brand, 1995 [58])

We are witnessing a growing critique of instrumentalist design approaches, that view physical materials as a means to an end to achieve a pre-imagined final form. These approaches adhere to an Aristotelian *hylomorphic* model of seeing the world, where matter is dead until some external form or force imposes life, in the form of activity towards a predetermined purpose [63, 106]. Jane Bennett, influenced by Deleuze's theory of Immanence, has countered this view with a theory of *vital materialism* [51]. Bennett holds the view that 'vitality is immanent in matter-energy', questioning our habit of 'parsing' the world into *passive* matter (it) and *vibrant* life (us) [85]. She puts forward a theory of materiality that is 'as much force as entity, as much energy as matter, as much intensity as extension' [51]. Ingold, in his materialist essay, *Textility of Making*, weaves this vibrant matter concept into a discourse on practice, suggesting that 'the forms of things arise within fields of force and flows of material', where making is a practice of weaving within a mesh of material textures, in an 'ongoing generative movement that is at once itinerant, improvisatory and rhythmic' [83].

This thinking has resonated with many researchers who are seeking new methods for understanding the design and use of interactive systems. Much of this research explores non-hylomorphic practices of making [67], where hands-on material inquiries can be productive of alternative 'ways of knowing' [100], and where new forms are discovered through 'enabling material drift' [77]. Engagement with vital materialist theories in practice can help to 'support rather than abstract material qualities' [53] and methods of reading digital design practices *through* accounts of existing materialist processes may lead to new insights, highlighting detachments from the material conditions of the work, and encouraging altered design approaches that arise from a place of hands-on experience rather than symbolic understanding [97].

NIME has become a site of lively discourse around materiality in sonic interface design and practices. An engagement with entanglement and materialist theories have encouraged practices in which 'materially-situated knowledge meaning and making practices can manifest' [48]. Researchers have investigated the chaotic 'immanence' of 'hybrid resonant assemblages', where unfixed arrangements of feedback loops allow sounds to emerge without any further source [55]. Understandings have been shifted through a re-thinking of *structure* as *process*, or 'contingent co-presence of parts', where 'everything is at once together' [55]. Post-optimal approaches attend to material behaviour, however messy and chaotic, engaging in practices of 'curdling' [98] and 'ironing in the creases' [69], and creating messy 'ecologies of making, playing and listening' [56]. Through engaging with these theories, NIME researchers encourage attention to be paid to the ecologies and ecosystems of emergent work [98], and suggest a shift towards re-use, repair [91], and circular making practices [76].

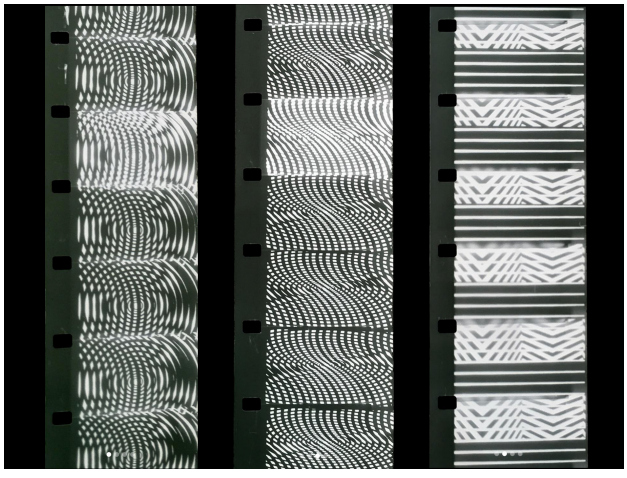


Figure 3: An image of optical sound filmstrips made by the first author, exposed frame by frame using a mobile phone and adapted enlarger

2.3 Materialism in Optical Sound

Optical Sound was the principal method for the recording and playback of soundtracks in 20th Century cinema, and is still in use in processes of making and screening photochemical films. Optical sound enables audio information to be recorded and read as a continuous graphic waveform along the edge of the film strip (see Figure 1 and Figure 2). This photochemical waveform modulates light reaching a photocell, creating fluctuations of voltage which are amplified and output as sound.

From the late 1920s, filmmakers and audio engineers have explored this technology as a way to *synthesise* as well as record sound, replacing optically recorded waveforms with graphic ornaments, and employing hand-drawn, cut up, resampling and physical modelling techniques to explore hitherto unknown sounds [59, 62, 68, 88, 107]. In the 1960s, filmmaker Peter Kubelka, 'rejecting the belief that film is a carrier of separable meanings and messages' [89], sought to create a film that exposed the 'brute facts' of the apparatus [73]. He limited himself to using only the raw materials of film: light, dark, sound and silence. This film, named *Arnulf Rainer*, became a much referenced cornerstone in structuralist composition. One of the first flicker works, it held to a non-illusionist, structuralist thinking, resulting in the de-mystification or attempted demystification of the film process' [2]. At a similar time, Stan Brakhage was exploring the concept of an innocence of, and adventure through, perception [32, 42], creating groundbreaking cameraless optical sound films like *mothlight*, by sticking and optically printing organic matter onto the filmstrip [36].

Since the advent of these works, collectives like BEEF the London Filmmaker's Co-op have been subverting the film apparatus by dismantling the boundary between the image and the printed soundtrack, using both cameraless and in-camera techniques. Exploring structural, materialist approaches to audiovisual synthesis, complex diffraction patterns in sound and image have been created photographically, through the use of patterned materials such as letracet [26, 31, 93], dot matrices [30], fly screen [33], buildings [27], stairs and railings [34, 34, 37]. Many musical instruments and audio synthesis processes have been inspired by both the technology of optical sound and practices that subvert it [11, 43, 49, 60, 61, 70, 78, 81, 84, 95, 102, 112, 113]. Influenced by encounters with these optical sound film works, the first author has developed both their own photochemical optical sound practice (see Figure 3), as well as an optical sound-inpsired digital musical instrument called the *pattern organ* [60, 61].

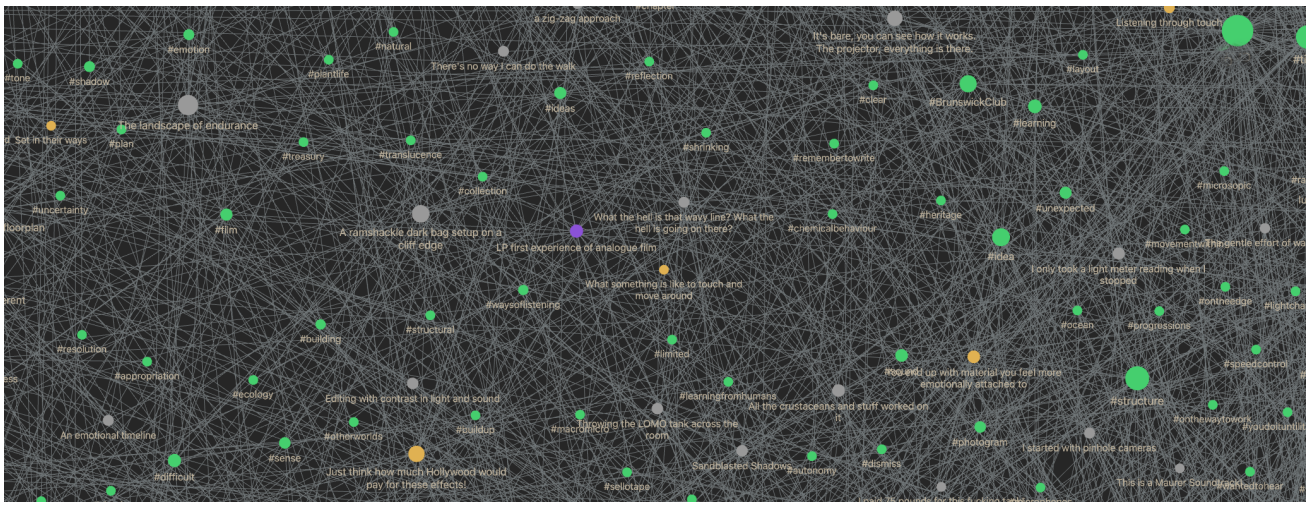
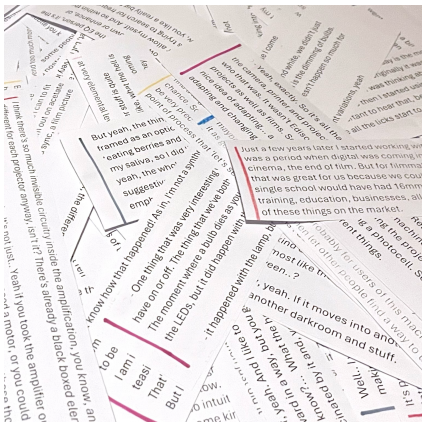
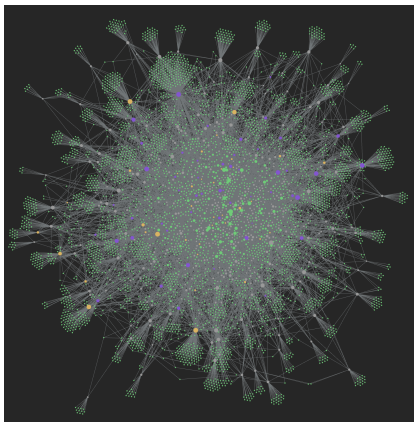


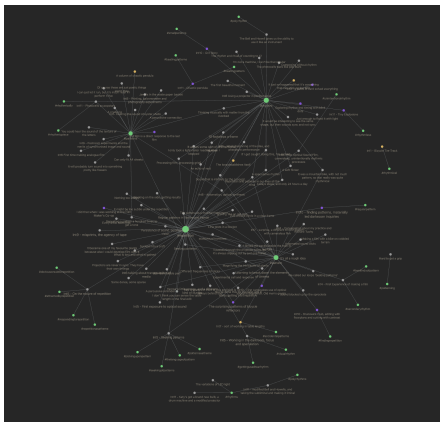
Figure 4: A screenshot of Obsidian graph view, displaying files and tags



(a) Transcripts were hand transcribed, printed, cut up, shuffled and then re-transcribed



(b) A zoomed out image of the Obsidian graph view, with tags and full as well as split transcripts



(c) A view of a filtered Obsidian graph view, of tags, split and full transcripts and tags

Figure 5: Three stages of data familiarisation

3 Method

3.1 Interviews

11 artists were interviewed for this study. Each of these interviewees had engaged with optical sound technology in their work, whether by making films or developing tools. The majority of the interviewees were local to the first author, and members of the Bristol Experimental Expanded Film (BEEF) Collective. Five of the Interviewees were based outside of Bristol, in Frome, London (UK), Zagreb (Croatia) and Boston MA (US). Interviewees who were not formerly known to the first author were found through online research, word of mouth and contacting film labs. Demographic information can be found in the appendix.

Artists were interviewed using a semi-structured, conversational approach, guided by an interview guide (see Appendix B). Questions were themed around technical accounts of the materials, tools and processes used in the making of optical sound film, as well as broader accounts of practice, experiences of photochemical and darkroom working, and understandings of failure and intention.

Hrvoje Spudic [23], Laura Phillips [16], Graeme Hogge [22], Melanie Clifford [21], Guy Sherwin [34], Matt Davies [20], Kathy Hinde [15], Vicky Smith [46], Lynn Loo [6], Matthew McWilliams [44], James Holcombe [13].

The 11 artists interviewed for this study.

DIY Optical Sound Printer [41], soundtrack.optical [45], filmless [45], Katy's Got a Brand New Bulb, Tiny Explosions Up Close [10], Brunswick Light Ray Process [24], Grit, Brunswick [14], River Traces [9], Bicycle Tyre Track [96], Noisy Licking, Dribbling and Spitting [96], Agitations [7], Cycles [4], Musical Stairs [37], Railings [1], Washi [8], Vowels [5], Vowels and Consonants [3], Graphic Optical Camera [38], Modulations [47].

A list of some of the projects, tools or films discussed.

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BEEF [12] (Bristol, UK)
London Filmmaker's Co-op [18, 19] (London, UK)
Baltic Analog Lab [28] (Rīga, Latvia)
Klubvizija [90, 90] (Zagreb, Croatia)
Filmwerkplaats - WORM [25] (Rotterdam, Netherlands)
Not/Nowhere [39] (London, UK)
Erehwon Film [13] (Frome, UK)
Mono No Aware [35] (New York, US)
Curioso Lab [29] (Mexico City, Mexico)

A list of film labs and collectives discussed.

3.2 Method of Analysis

We have conducted this research from an entangled standpoint, believing that 'humans and their things are ontologically inseparable from the start' [75]. This view calls for a shift in the way in which data is understood and analysed. Pre-established tools of inquiry are not discarded, but instead reframed, involving a 'rethinking of how we use these tools, the different ways in which those tools might work, and the types of information they might reveal' [79]. In this study we explore a method of analysing interview transcripts by creating a *diffraction apparatus* through which to read 'the natural and the social together' [50]. This 'diffractive' form of analysis calls for data to be read *through* structure, where results are understood as a wider relational pattern rather than discrete thematic insights. Acknowledging a mutual dependency of information and material, diffractive approaches de-centre the human, shifting away from a sole focus on human experience and intention [52, 57, 87, 92, 94, 101, 104, 110, 111].

We investigate deep links between materials and practice, exploring this co-constitutive relationship by reading accounts through a structure defined by some of the core elements of the film apparatus. In this way, our inquiry folds inwards and takes on an immanent character. In our analysis, we have committed to an understanding of meaning as arising *within* ongoing material-discursive relations.

The main bulk of the analysis took place over several months. Each of the transcripts were split, printed, re-transcribed and tagged, using the Obsidian application [40] (see Figure 4, Figure 5a, Figure 5b, Figure 5c). After this process, a decision was made to look to the medium of film itself to provide a structure through which to make our readings. Inspired by Kubelka's thinking around the 'brute facts' of the film apparatus, we read and re-read the transcripts through five lenses, relating to five core elements of photochemical film:

- Transduction: the conversion of one material or form of energy into another.
- Frames: the units of measurement that structure and modulate sound and image.
- Difference: the many entangled and overlapping contrasts that make up a film
- Repetition: pattern found in both sound and image, creating resonances within noise.
- Chemicals: the photochemical nature of film, and the behaviour of emulsion.

We seek to understand these elements, or entangled, *brute facts* of the filmmaking apparatus through apertures large and small, paying attention to accounts of material behaviour in relation to wider patterns of practice. In addition to these five structuring elements, these readings were made through theories

Apertures of Agency: an collage of different parts of a film apparatus

of entanglement and materialism as well as the first author's own experiences of working with optical sound.

The analysis is presented in five sections. Additional titles and corresponding filmic illustrations are included, which have all been made through arranging scans of hand-processed film or found footage, made or found by the first author. In order to preserve the richness of these accounts, we have included an enumerated list of quotes for each section in the appendix. We recommend the following analysis to be read alongside these referenced quotes. The full transcripts can be found in the obsidian vault, available in the additional published materials.

4 Analysis

4.1 Transduction: *Apertures of Agency*

Within the apparatus of film, there is no one object that transforms light into sound, or photographic image into projection. The lens, the photocell, and the image and sound lamps all sit within distributed sites of transduction, and can be made up of many parts. Optical sound filmmakers often become interested in these sites of transduction quotes 1, 2 and 3, and, perhaps through understanding them as complex clusters of simple mechanisms 4 5, see the possibility for physical intervention. They engage in processes of modifying, interfering and derailing 6 7 8; processes that one filmmaker described as a form of 'exorcism' in de-industrialisation of machinery 9.

Some interviewees described the way in which their film practice began by exploring one part of the apparatus, or one stage of the filmmaking process, and gradually spread to incorporate other stages. An interest in film might begin by using a camera and sending film to a lab to be processed, or using a projector with found footage. Slowly, the filmmaker might begin to think more about the 'intermediate stages' of developing and printing 10 11, and in exploring these, become familiar with developers, fixing agents, developing tanks, sync blocks, and other darkroom apparatus. Soon, a filmmaker might harbour a deep understanding of the mechanisms involved in the many stages of making a film from film stock. Within these clusters of machinery and process, a seemingly insignificant part of the apparatus can have powerful influence 12. The size of a slit in a piece of card 13, or the chance sticking of a forgotten piece of tape 14 can drastically

alter results, achieving or obstructing an intended outcome and possibly suggesting a new process [15].

Aided by an interest in these transductive behaviours, filmmakers find ways to transform one kind of tool into another. The sound drum in a projector, designed to read an optical soundtrack, can be used to record one instead by modulating its light source and running film stock through it in the darkroom [16]. A camera can be used as a contact printer by 'bi-packing' it with a roll of both negative and raw film stock together and pointing it at the midday sun [17]. Hybrid digital/analogue systems are developed to create optical soundtracks, using programmed scripts, and printing lasercut forms or images from digital screens onto film [18 19].

These filmmaking tools, made or modified, are built in a bricolage process, fashioned out of what can be found to hand [20]. Often, word of mouth, or seeing another filmmaker performing can be enough to share blueprints of DIY tools or experimental processes [21]. a bricolage approach is necessary when working in a medium that one film-maker described as being in its 'afterlife' stage [22]. Engaging with and sharing with the community is an essential part of creative practice where the tools in use are no longer in production. These communities of filmmakers, through maintaining and storing both physical equipment and tacit knowledge of process, become immune to dissolution through loss of a collective space. Three of the film collectives interviewed in this study were in the process of re-building shared darkrooms and communal tools, despite temporary displacement due to evictions for housing and office development [23 24 25].

4.2 Frames: *A Nest of Frames*

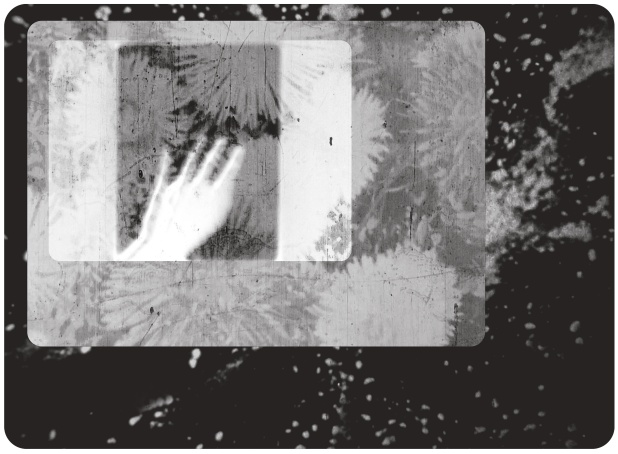
A frame
A window
An envelope
A hundred foot
A darkroom bench
A sweep of torchlight
A piece of A4 acetate
A building [1]
A river [2]
A beach
A day
2 years
A train journey [3]

A list of different units of measurement

. To the photochemical filmmaker, the frame might refer just as naturally to a round cornered rectangle of emulsion as it does to a fraction of a second. This interchangeability between material and time is baked into the practice [4]. And yet the filmic apparatus disrupts this simple relation, creating a tension between one part of the film strip and the other: the discrete frame and the continuous soundtrack. Two areas of the same film strip are read differently, one held still at intervals, frozen in the gate, the other, gliding smoothly and continuously over the sound drum [5].

In exploring this disruption, by spilling the image into the soundtrack area [3], shifting the soundtrack into the image area, or printing forms across the whole of the filmstrip, unexpected animations, modulations and relations are revealed [6 7]. Continuity and segmentation modulate one another in both sound and image.

Image frames that have been captured in-camera can be spilled into the soundtrack area either using contact printing techniques



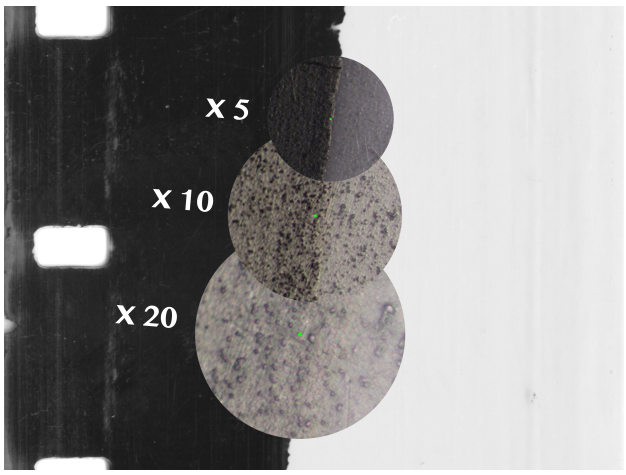
A Nest of Frames: A collage of scanned film

or by shooting with a widescreen (super 16mm) camera that has an enlarged gate. In-camera optical sound films are often characterised by a modulation where the frame line between images creates a pulse of light (or shadow, if a print is used). Using camera-less techniques, some filmmakers have chosen to work with materials that sit neatly within a single frame, suspended in the image gate, such as printed letters, blick dot stickers, punched holes, bees, and fun-snaps [8]. Where these forms might enter the soundtrack, their resulting sounds are phase locked with the frame rate. In a series of works, exploring the feminisation of film, a filmmaker used her own body parts as units of measurement as opposed to the conventional forty-frame 'foot', for example, making prints with her tongue that were roughly 6 frames long [9]. Another filmmaker created a 'heartbeat' with blick dots at regular frame intervals, filling out the soundtrack area with complex rhythms by cutting and sticking quarter dots along the edge of the filmstrip (often working on this intricate and laborious process while commuting to work) [10]. Where these change spacing, drifting across frame intervals, the film mechanism, projected image and amplified sound all move in phased counterpoint.

Thinking beyond the gate-defined frame, we find other spatiotemporal constraints modulating the signals exposed to film. Films are worked on in, and defined by, sections, whether the length of the darkroom table [11 12], defining how long a strip the filmmaker can work on at once, the paper size of the photocopier that is used to print graphics on acetate [13 14] or the sweep of the arm holding the torch, making a print by hand. Where, in one case, 100 feet of film was used to capture pebbles across 18 miles of beach, capturing one frame every 12 steps [15], the exposed film was modulated by waning daylight, abruptly brightening and loudening as the making process was resumed a second day [16]. These overlapping, nested 'frames' can make their way into the fabric of a film, and their edges can be felt both in the making and the playback.

4.3 Difference: *The Tideline Between Black and White*

The line between black and white on the photochemical film strip, even if sharp to the human eye, is a bleeding tide of chemicals, where gelatin, filled with metallic silver structures, meets an empty, translucent lattice where unexposed silver crystals



The Tideline Between Black and White: Microscopic images of an edge of exposed emulsion, Images courtesy of Dr Kathryn Lamb-Riddell, Health Technology Hub, UWE

have been washed away. In film, what looks like a sharp edge is rarely sharp when magnified. A closer look may reveal an almost geographical view of scalloped tidelines and salt blooms. In sound, the edge of a square wave, or the speed and shape of the transition between a positive voltage and a negative one, defines the character of its sound. When creating optical soundtracks, the qualities of a waveform can be defined by chemical and optical conditions [1] [2].

One interview concerned the creation of a black and white flicker film, exposed using a drum-machine-modulated light source. The filmmakers described their interest in the way different light sources decay when switched off. They had previously explored intricacies in the way a dying light shifted across the reflector at the back of a bulb, revealing its pattern, or the way that LED lights seemed to decay in steps, exposing several variations of grey [3] [4]. Contact printing their flicker experiments, they expected to listen to identical sounding negatives, but were surprised to hear new rhythms in them, as the non-linearity of exposed light created differently perceived patterns [5].

Contrasts in material and light, found in different environments have informed the structure of certain films. One filmmaker made physical 'crossfades' with material from different parts and depths of a river [6]. Another captured the gradual erosion of pebbles across a beach, 'starting in the East the size of potatoes, and moving Westwards to grit' [7]. In a film capturing patterns found in a working men's club turned DIY film lab, light sources and patterns in different rooms created different tones, and the filmmaker learned to cut the final edit in an order which emphasised this contrast, shifting attention from the 24Hz pulse of the frameline [8].

Particularly in the case of the optical sound films relating to location, the process of making presented a distinct contrast in the lives of the interviewees. In one case, a filmmaker engaged in a daily scramble to photocopy envelope security patterns onto acetate before their co-workers arrived, attempting to find beauty in the mundanity of their post room job [9]. In another, a filmmaker carried out a solo endurance mission over two days that helped them to process their grief [10] [11]. Engaging in slow processes in nature through the use of a portable darkroom allowed one filmmaker to step away from a frantic schedule [12], while another film documented the details of a beloved building prior to eviction, encouraging a similar excited attention to these details as felt on first being handed the keys [13].

4.4 Repetition: *Oscillations, Rhythms and Percussive Connections*

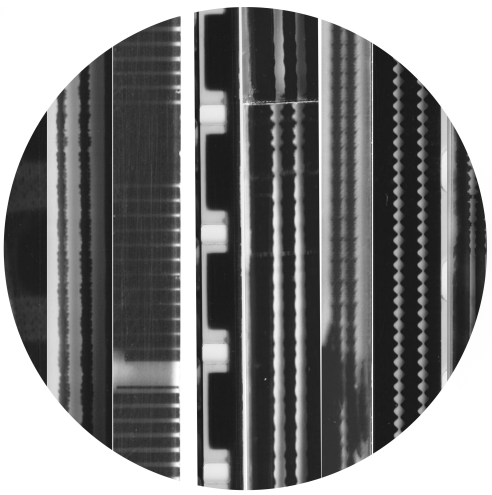
BRRRRRR [1]
grnt grnt grnt [2]
prrrrp [2]
n nn nn nn nn [3]
skgrrrrrrrr [3]
DUN DUN DUN DUN DUN [4]
duh-duh [5]
puh puh puh puh [6]
du-dum du-dum [7]
brrbrrbflrrrb! [8]

Noises described by the interviewees

Looking along the frames of a film made in-camera, you are faced with what looks like repetition. In a similar way, the held note of a flute in the soundtrack section may look like a steadily repeating waveform. With a closer look, there is always variation to be found. This imperfect repetition is often what constitutes a film, creating a perceptible moving image, a rhythm or a tone. Pattern tends to sort signal from noise, creating held resonances within constant change. In optical sound films, variations within resonance are seen and heard, as difference in exposure time across a filmstrip, leaves blowing across a set of steps, a shadow cast across the ground [9], the phasing of patterns from layers of washi tape [10] or phasing prints in multi-projector performances [11] (see **??**).

In optical sound films, percussive marks produce percussive sound; scratches, dots, prints of clustered matter and frame lines generate noisy clicks, crackles, pops and buzzing tones. Optical Sound experiments often involve a seeking out of patterns in materials that are close at hand [12] [13] [14]. Exposed regular patterns create humming, tonal drones, where soft sonic shifts can arise from small changes in light, unevenness in exposure or development [15], or bumps and folds in patterned material.

Often, film experiments are turned into small loops, that can be played continually, making a short strip of film play for as long as



Oscillations, Rhythms and Percussive Connections: A collage of optical soundtracks

is wanted. A film loop can attune a film-maker to the possibility in a process, allowing them to sit with its audiovisual effect [16 17 18]. When played, a loop 'establishes itself' [19], where rhythms and resonances emerge and change as we perceptually tune into different patterns. In live performance, the loop creates space for attention in which even small changes become amplified. It also creates an opportunity for the performer to introduce change away from the projector, interfering with the film elsewhere in the room, using optical or audio effects [20 21].

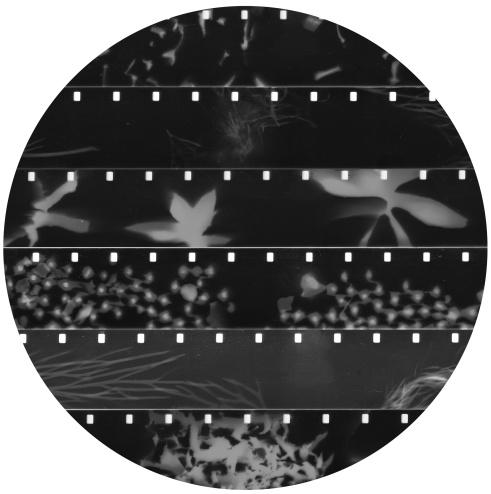
Practices of optical sound filmmaking are filled with moments of repeated effort: cutting, pulling, taping, exposing, developing, printing, lacing a projector. These gestures often occur in cycles, and their rhythms echo one another across stages of production. The filmstrip encodes movement of making and playback, whether it is the mechanisms of the camera and projector or the regulated movements of the film-maker [22 23]. One interviewee recalled a moment of acute awareness of these 'percussive connections' [24], where the resting point during the process of making a structural endurance film, where they stopped, drank water, and punctuated the film with 4 frames of the surrounding landscape (north, south, east, west) and one black frame (with palm against the lens), became a resting point during the process of making prints of the film [25].

These rhythmic and resonant practices extend beyond mechanisms and materials into ritualised making, where film makers enter into a dance of repeated movement or process. Some filmmakers describe repetition as both reassuring and productively uncertain, a framework that allows chance and randomness to emerge, which urges the practice on [26 27]. Through repetition in practice, ideas and communities are continually renewed [28].

4.5 Chemicals: *Kitchen Sink Synthesis*

Film stock is made up of a thin coat of silver halide crystals suspended in gelatin (emulsion) on a celluloid or polyester strip. Photons, reaching the emulsion, knock electrons loose, spreading catalysts for quickened transformation. When developed, certain grains become fully metal, scattering and absorbing light and appearing soot-black.

Emphasising the *photochemical* nature of their medium over the analogue, some interviewees described a form of 'ground materialism' in the 'wetness of working with the media' that naturally gives rise to serendipity [1 2 3]. Where DIY photochemical practices require direct, tactile engagement with chemical processes, a distinctly wet, chemical form of audio synthesis through image production can be found.



Kitchen Sink Synthesis: Photograms made with herbs and spices

Film emulsion recipes have been in continuous development for over a century [4], largely accelerated by research for military and surveillance uses. As manufacture of film stock has rapidly declined, filmmakers are increasingly looking for ways to bulk buy stock [5]. Due to one supplier relationship between a filmmaker in Somerset and ORWO in Germany, Bristol based filmmakers were able to buy and split reels of 'PF2' stock relatively affordably. This high contrast, fine grain, low noise stock has been developed for producing prints and crisp optical soundtracks. It can be worked with at a slower pace, outside of the camera using a range of light sources [6]. Its crystals are less volatile, and easier to process by hand, using recipes remembered by heart.

> CAFFENOL RECIPE
> 1/2 jar cheap coffee
> 1 litre water
> 24g/12 dessert spoons washing soda (not baking!)
> 3 dessert spoons vitamin C
> Develop for 20 mins/agitate frequently
>
> shared at a 2018 workshop at Brunswick Club, BEEF, Bristol

The majority of the interviewed filmmakers learnt to hand-process film in in-person workshops, run by DIY film-labs. Working in the dark in converted kitchens, toilets or pub cellars, the ramshackle nature of these often temporary labs served to emphasise the unpredictable nature of a process that can feel closer to cookery than an exact science [7 8]. Whether using developing tanks or buckets, learning to hand develop film and bypass the need for a commercial lab dissolves the notion of a necessary precision. DIY processing allows for quick iteration of ideas and experimental processes. A film can be solarised with a torch half way through development. Filmmakers can take a risk with expired film stocks that would be rejected by a commercial lab [9]. DIY developing also encourages the use of handmade eco-developers made from shop bought or foraged ingredients. Here, the immutable nature of the precisely engineered, highly toxic developing and fixing agents can give way to organic, multi-use materials. In one case, a filmmaker foraged plants along the riverside. They made plant photograms, and ate nettle soup while waiting for the film to be processed with a nettle developer. They would like, in future, to revisit this foraging spot, process a yarrow film with yarrow, and listen to its feathered leaves in the optical soundtrack [10, 11].

Using low sensitivity film stock allows artist filmmakers to lay film out, unspooled in the darkroom. They can use objects found to hand to create 'cameraless' films. Plants, funsnaps, washi tape, acetate prints, bike reflectors, bubbles, combs and chains can all be used to expose forms, sometimes patterned, onto film [12 13]. The repetitive nature of placing and exposing material onto the film stock in the dark leads to a deepened sense of touch that one interviewee described a having parallels with Deep Listening [14 15 16]. In some cases, where filmmakers pressed scorching fun snaps into the emulsion or spread wet river plants and sediment over

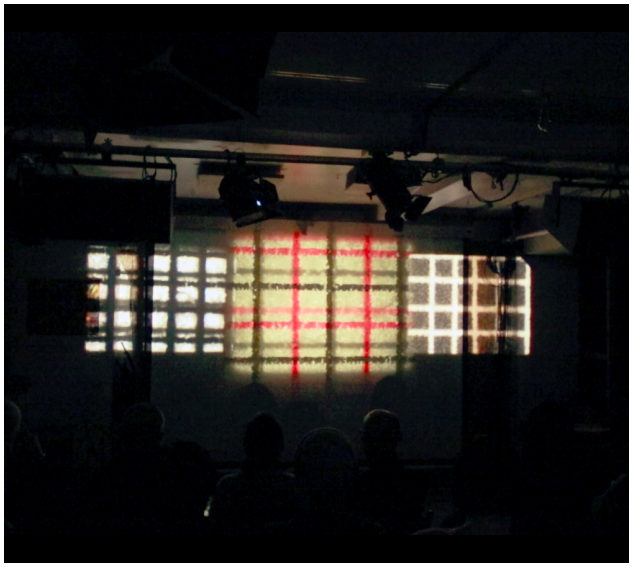


Figure 6: A photograph from a performance of *Washi MM* at Cafe Oto in 2022, Lynn Loo [17]

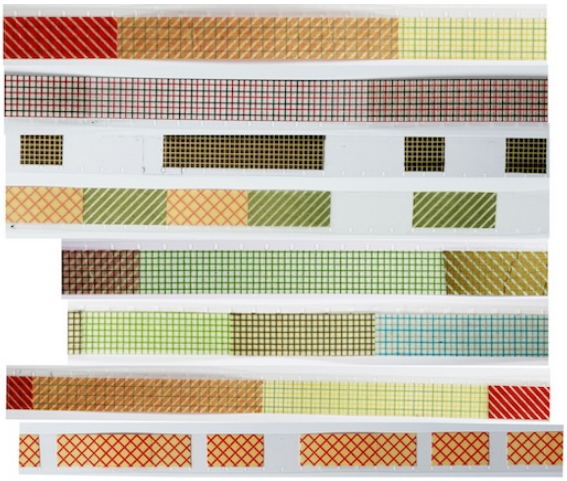


Figure 7: A photograph of Lynn Loo's *Washi MM* filmstrips

it (see Figure 8), materials were described as active agents in the process, colliding and reacting with the emulsion chemically as well as casting shadows [17 18]. Even when exposed *in-camera*, film works were described as 'invested with touch' [19], by their continual close contact with the apparatus of film, passing through the camera or projector gate, whether smoothly or otherwise [20].

5 Discussion

5.1 Found-to-Hand

Experimental film communities have become the custodians of equipment that, for the most part, is no longer in commercial use. Most of the machines described in this study are over forty years old, having passed from hand to hand and accrued rich material histories. Often discarded or abandoned, such equipment is recovered, shared, repaired; circulating according to use rather than ownership.

Though complex, mechanical and optical film apparatuses become familiar through repeated use, enabling optical sound filmmakers to learn to maintain and repair this equipment, as well as developing bricolage practices of modification in the process of filmmaking. As well as emerging through solo, tacit experience, technical knowledge circulates between filmmakers informally. This knowledge is often shared through care for equipment, where machines are viewed as distinct and characterful rather than as neutral, interchangeable tools. These practices are sustained by, and in turn sustain, local infrastructures: such as shared darkrooms and DIY cinema spaces.

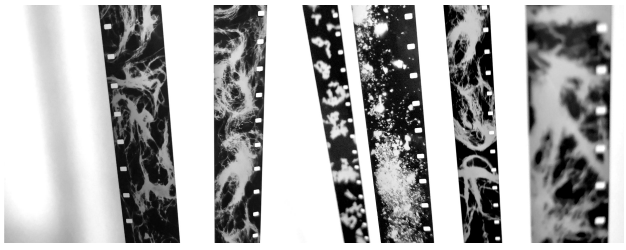


Figure 8: A photograph of 16mm photograms, made with river sediment, from *River Traces, Kathy Hinde* [80]

Optical Sound films are often made using materials that have been found to hand, selected less for their symbolic value than their ability to work within the filmic apparatus. When selecting materials, filmmakers attend to qualities such as pattern, translucence, stickiness, or size, which each suggest a productive, audiovisual possibility when coupled with the apparatus. At the same time, these pragmatic choices often intersect with site-specific or personal resonances, folding environments and everyday encounters directly into the film, and shaping and sustaining future practice.

Through their entanglement with the optical sound system, every day materials are transformed, generating unexpected visual rhythms and sonic effects. In this way, found materials are not symbolic, or illustrative, but operative, their properties deeply interwoven through both process and outcome. Even when experienced as 'crude' or 'raw', the sonic effects of these optical sound films bear a deep connection to material practice; as one filmmaker described it, they are *intrinsic to the concept*, this *concept* emerging in an immanent sense, within and out of the encounter between filmmaker, place, material, and apparatus.

5.2 Not a Closed Loop

The film apparatus is such that it is permeable to interference (human or non-human) at every stage in the making process. It is this openness to both deliberate and accidental material exposure that emphasizes the agency of these materials, offering a kind of serendipity that holds a potent capacity to sustain practice. The system is able to 'fail' at multiple points; to become derailed, to fog, to solarise, to jam and melt in the gate. In this study, many incidents and accidents have offered inspiration, suggesting pathways for future work. From an immanent perspective, dust sparkle, scratches, and hair in the gate are part of the signal, not noisy interference. Careful process can lean into certain material interferences, as much as they can seek to filter them out to make space for others.

When this material system 'fails', there remains a material result. One filmmaker said that failure, to them, is when the film is all black, or completely clear (and so silent), but that 'everything in between that is a series of discoveries that can either be discarded because they're not useful, or they can be filed away at the back of the mind'. 'Discarded' film is rarely if ever thrown out. It can be recycled as 'leader', scratched into, painted onto, or inter-spliced with another film to make an audiovisual collage. This unavoidable material result can encourage a circular making practice, where the outcome remains to be passed on, as an optical sound 'film', or as raw material for another project.

The global standardisation of the film apparatus has helped small, long distance communities of practice to flourish. An idea or process, seen in one place, can be explored in another. Communities can come together online to design and share blueprints for DIY optical sound film tools. Despite this standardisation, when filmmakers allow for material drift, and explore the minutia in vibrant points of interplay within the apparatus, situational differences will yield situational outcomes.

Once set in motion, a practice may connect the filmmaker to a place, the peculiarities of a material, or the inner workings of the apparatus itself. These practices unfold differently for each filmmaker, in the shape of harsh endurance, quiet investigations of matter in nature, or repetitive, processual engagement in the darkroom. The filmmaker can pay patient attention to subtle material and sonic differences, the effects of which may sustain specific material investigation over weeks, months, or even years. At the same time, these filmmakers accept that works transform with each screening and performance, due to differences of space, equipment, and even weather and time of day. Filmmakers engage in a sustained focus on and *from within* an apparatus and process that is never static but, to use Deleuze's description of immanence, is 'made, remade and unmade along a moving horizon' [65, 108], shifting and differentiating itself through repetition.

6 Conclusion

Through this form of deep engagement with the apparatus of audiovisual synthesis, ideas, knowledge and equipment are shared and distributed informally, through in-person communities. These practices foster care for, and maintenance of, discarded equipment. Ideas proliferate as material processes through a form of recipe sharing. Never static and rarely hidden, these processes are continuously picked up and differentiated through shifting situations and apparatus.

Considering these accounts, and following on from our analysis, we suggest a list of potential attributes that may make up a form of immanent practice. We do this not with any dogmatic aim, but as a way of prompting further consideration of materialist practices of <design-use> in the NIME community.

Immanent practice:

turns focus inwards, to the apparatus of making itself

attends to what an apparatus does, not what it is for

is situational, holding that a work embodies the material conditions of its making

is often patient, engaging in sustained attention within a particular apparatus

decentres the human, driven by an interest in vibrant material behaviours

cultivates intimate, tacit knowledge of equipment

engages in processes of maintenance, repair, modification and subversion

shares work that in some way demystifies the process of its making, passing on recipes for process and assemblage

At a time when many media practices are becoming increasingly abstracted from their material histories, these accounts of optical sound filmmaking offer a counterpoint, in the form of insights into situated making practices. These immanent forms of practice are sustained through careful attention to the behaviours and effects of material systems, where differences (whether minute or stark) unfold through intentional or accidental shifts in process, and the agency of materials is foregrounded in the making and sharing of works.

7 Supplementary Materials

Full interview transcripts can be found here:
https://github.com/gguueesstt/OpticalSoundInterviews
They can either be navigated as nested markdown files or as an obsidian vault.

8 Statement of Ethics

This work was ethically approved by our university's Faculty Research Ethics Committee. All participants were provided with an information pack and gave consent for their names and work to be referenced, and for anonymised transcripts to be shared.

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A Research Methods - Quotes

A.1 Transduction

(1) *Even from the very earliest soot recordings on paper. Which could never be played back until they worked out a way of scanning it and being able to play it back. The idea of that transmutation of, you know, bio-mechanical energy from the lungs and projection of speech into a mechanical physical machine of some kind that can then encode it. Yeah, I don't know... I can't quite put my finger on it. I think there's a number of things happening simultaneously. But it still feels to me like a radically important and potent physical fact. It's still exciting to me. None of its luster is diminished.*

(2) *It's a fascinating thing to talk about. It has this transparent glass inside, which are put out of focus. So when half of this glass is inside this light foam let's call it, then it just mixes and puts, you know... the output is like a percentage of this. It's also mechanical and it works. You just have to get one and open it, and... 'ok'*

(3) *this is utterly incredible that a tiny beam of light, a couple of millimeters wide can capture, you know, X, Y, Z. Although it's obviously extremely compressed and very, very limited.*

(4) *When you see something that's quite dynamic and then placed around the space, and then it can be explained very simply right in front of you... This is stuck on this, it's on the long thing, it goes through the light, it goes through there, and tada! Wow!*

(5) *Film clusters around the basic... It's a potential network at any one time.*

(6) *it was the crudest optical sound you can make, because optical sound is all about tiny detail entering the photocell, and that variant of light creates a different sound, or frequency. This was just bombardment of light, so it was treating the photocells at a very crude, almost early prototype of optical sound level, so it was a really basic optical sound bombardment.*

(7) *I think that in everything that I do, I somehow want to understand how things work and why they work. Why people made them in the way they made them. And by really understanding this mechanic, the mechanics behind this process, this allows me to play with the essence of that. So, yeah, I think with this optical sound I also thought about the sound reader and realised that if this works like this then it should be obvious that you could repurpose it to become a recorder, but then, you know, you have to make like a lot of experiments, failed attempts and, you know, read the results and somehow move on from there.*

(8) *I was kind of getting hold of it while it was playing and I was kind of derailing it. So then it becomes into the image area. So I was just holding the film, manipulating the film away from its proper path, into a different position...*

(9) *...To give the apparatus agency somehow or to push the apparatus somehow and see what's possible with it. Which I've always seen as being an exorcism as well as exercising the equipment, you know, like the de-industrialisation process of the Steenbeck, or the Auricon, of the Bolex, of the projector, of the optical printer and all the rest of it...*

(10) *So, you know, you might start, your engagement with it might be just as a filmmaker with a camera, you might just have a camera and then you're making and sending stuff off, and then you engage with the projector and do projector performances. And then you realise that there are these intermediate stages where you're printing it and doing all kinds of other things. And then, the more you zoom out, the more you realise there's all these machines in all these different relationships. And then you can kind of more or less draw a line around the whole thing. You can just draw a circle around the whole thing and say, it was through all these different types of material processes and machines that this whole structure of cinema was based on. It was the use of all those tools. And the ideas change the tools sometimes and then the tools change the ideas. It's this dynamic system.*

(11) *I don't think I'd ever do a film where I've not developed the film myself... It is a difficult and slow process, so it's kind of a bit like, I'm invested in this now, I'm going to stick with it. I could write a grant application and try and get a film made and send it all off to CineLab or Gauge or somewhere and just get them to scan it and process it and things, but it's something about taking the long road. Cause I'll learn a bit more.*

(12) (On learning to use a LOMO developing tank) *It was an hour a week, for two weeks in the evening as I remember it... And I must remember thinking, you know, I've completely wasted my money. And then I just worked out, I just turn that that way. And all of a sudden, the magic happened.*

(13) *That was the first beautiful moment, that you could hear the rhythm of the sound that I put in this device, but I realised that I couldn't get the high frequencies. And I realised that this was because the line of light was too thick. And then we started talking about it, and then I kind of started to go through my recollections of the errors and what could be the problem and then like a week later I got the 'Aha' moment and I realised that all I needed to do was make the line of light thinner and you can do this by adding like, slits. Slits, like a cardboard with thin slit between the LED and the sound lamp.*

(14) *But yeah, as part of that, I think there was a bit of tape at the end of one of the pieces, and so it got stuck at the end, and it stuck in the gate and the film kept running over it. And so at the end of it, it was two cormorants, but they look like dinosaurs. Like ghost dinosaurs. So yeah, I was like, okay, this is quite interesting. But I need to spend a bit more time on it in terms of what it does to sound...*

(15) (later, describing intentional exploration of the tape sticking effect)... *But with my machine, with the Bell and Howell and with the little Hollywood Junior, if you tape a frame in the gate and then the film passes over it, you get this kind of elongated smearing of the image. But weirdly, it doesn't register. It's not focused. It's really strange. I don't quite understand what's going on. It's a bit of a mystery. So when there's a mystery like that, I find that quite fascinating and I try to sort of wrap my head around it a little bit.*

(16) *So you use the 16mm projector as a machine to pull the film and to expose the soundtrack. And you do it by threading the unexposed film in the darkroom through the projector, and when you turn on the projector it pulls the film at the specific speed that it needs, at the 24fps speed. But the interesting part is with the light exposure. So, what I did was, I pulled out this, what do you call it... sound lamp?.. Exciter, that's the word. And I put my own like LED on top of the sound lens.. And it was just an led, a 5mm LED which I attached to a sound amplifier with some sort of modifications to make the LED brighter and dimmer instead of the speaker going in and out.*

(17) *They showed me 'bipacking' in a Bolex to make very simple, quick DIY prints. So that's where you have your neg, and then you sandwiched it in a daylight spool, and then put it through a camera without a lens and just aim it at the midday sun to make quick, easy prints.*

(18) *It was the kind of thing where, you know, we just wanted to make films with what we had. We found this acetate that was very acceptable, image-wise, to print on. And I think as I was writing the software that generated the imagery and generated the SVGs to cut the images out of the acetate... The audio it produces is, I'd say sub telephonic. It's very rough, just because you're limited by the physical properties of the medium.*

(19) *I drafted this software in Processing called Soundtrack.Optical, which, for me just laid out the fundamentals of, okay, this is how image relates to sound, and this is how sound relates to image, and allowed me to generate what should be roughly visually accurate soundtracks from audio.*

(20) *There's very much a hacktivist mentality of like, oh, this doesn't fit, so I'm going to go in my workshop and try and make... Because this stuff is no longer made or accessible. There's a bit of like, knowing the means of your production in regards to creating and disseminating the work.*

(21) *It's so simple, and every film lab in the world has one 16mm projector, and with this device you can record sound, which nobody does because these machines are, you know, hard to get. The value in this, to put it out to film labs to use like a tool, only as a tool to record sound on film.*

(22) *Cinema is in its afterlife mode in a way. Which I think is just really interesting.*

(23) *So this film lab that I mentioned before called Klubvizija, where I discovered all this stuff and where I was at this sound workshop in the first place, it got kicked out of the venue, and it was kind of without a space for I think 4 years or something. And a few of us that were still interested in this started to get more involved in this, and we kind of wanted to revive it. So this is what's happening now in Zagreb, so a couple of us are reviving this film lab.*

(24) *I did that at the time I was working in the workshop at the Film-Makers' Co-op. And funnily enough, later on today, I'm going to the rejuvenated Film-Makers' Co-op, which is now called Not/Nowhere, just two streets away from where I live…*

(25) *BEEF was like, jumping from lilypad to lilypad, cause we kept losing our buildings.*

A.2 Frames

(1) *So it's kind of like a very logical journey through the building. I wanted to take away some of the editing decisions.*

(2) *So I wanted to sort of trace this, the whole of the river, as it came from its rural location into Bristol and then underground and then joining the river Avon.*

(3) *I was teaching up in Wolverhampton by then, so I was sitting on trains a lot. I filmed the tracks beside the train in sunlight, from the moving train. And where they sort of shift, you know, when they move apart and then come together, or they go through a tunnel and then other tracks appear… I just wanted to hear what those things sounded like. So that was the basis for Soundtrack, just one shot.*

(4) *Even if it's just addressed as duration, like in wavelength or something like that, or William Reagen's 'Bungee', you know where he just drops the camera and the film takes the time that the camera drops. So those are ways of structuring the time-based aspect of the media in ways that aren't arbitrary. And I like that sort of fit, in a way. And what I realised, and it was clarified by what Robert Breer had said, which is that, he would start in the middle and structure outwards. And I suddenly thought, yeah, I nearly always thought of film as a container that needed to be filled. Somewhere in my head, I had this notion that it was a long thin thing, that, even if it wasn't filled with story or a beginning middle and end, that one needed to think through, beyond the immediate shot.*

(5) *But there is an impression of continuity, you don't see the shutter closed. So if there is an impression of continuity at the visual level, and an impression of continuity at the sound level, does it really matter in terms of audience experience that they are produced in different ways and that one actually is intermittent?*

(6) *One frame of film, we know it's only 24th of a second, but you do get changes within that. So we know that there's changes, hundreds of changes, maybe thousands happening within one frame. And I guess what that change is is the frequency of sound, it's the cycles of sound.*

(7) *When I was working with yarrow, it has all these tiny little regular prongs. And just putting it on in long strips, because of the way the frame rate repeats, you end up having these animations of this thing just moving, but it isn't, It's just laid out. And I love that sort of strangeness of the way that it turns into a different kind of illusion when you watch it on a projector. I kind of really enjoy that shift from this linear length of film to what happens when you watch it frame by frame.*

(8) *But I think it was informed by Vicky Smith's 'not a part' element, where she was also saying the Bumblebee, or the bee is the same width as the film strip. It's the same size as a 16mm single frame. And it was like the fun snap was the equivalent of the bee, in that sense of just pushing it to the filmstock.*

(9) *The basic unit of printing was my tongue, which is about 6 frames, whereas my foot was 33 frames, so these all became alternatives. I was thinking about the standardised measurement of film being 40 frames a foot, and that's obviously based on the male body, whereas mine is only 33, so I was thinking about measurements, measurements of the female body in relation to a male dominated film system.*

(10) *Yeah, it's called Cycles. It's got an interesting history that film, because it went through various stages. And I was doing that, but at the same time I was cutting little tiny quarters of dots, Blick dots, they're called, and sticking them along the side,*

very carefully, when my eyesight was much better than it is now. And I had various ideas about rhythm and timing. I set up a regular beat, like a heartbeat, about a second. And then I gradually filled in the gaps. Sometimes there would be a sound that connected with a dot, and sometimes there wasn't. It took a long time. I remember doing it on the tube going to work! So I ended up with about two minutes of material.

(11) *We had amazing benches which were like 2 meters long, you could actually lay a long strip, and I was working with loops anyway, and placing objects on.*

(12) *I could only really work with about one meter 50 at a time based on my table, and I was doing it in the back of my van. So I had a limitation on how much I could work on in one time. So I had to kind of work in strips really... It was impossible to kind of get that join in a way that I would have liked.*

(13) *I have a printer that can only fit A4 size sheets. So I get A4 size acetate, using Photoshop, map a 16mm strip as long as I can to fit into A4 sheet. I place the Os into this strip frame by frame, then I print them out on acetate... It is strenuous for the eyes to try to find where the O's are. So I put the unexposed film under this printed clear acetate and try to place the O's in between the perf. So it's quite a laborious process... trying to fit the O into the frame in between the sprockets. Once I think I got the place, I just flash the light.*

(14) *I would get into work early and photocopy them using the photocopy machine onto strips of clear film that I'd glued onto pieces of A4. And then I worked out, I ran them through the projector spliced all together, you could hear the sound of the texture of the letters. And so that was, that was probably the first time I sort of experimented with abstract graphical optical sound... So sneaking into the office an hour before anyone else got in, with my pre-made pieces of A4 paper with like clear leader strip stuck on them like this and taped at the top... and I'd load the photocopier and I'd be like, if I get caught doing this and this jams in this machine, I'm fucked. I'm sacked.*

(15) *So the rules were that you have 100ft length of film, or 120ft film, as much as you can cram into the camera. So what's that, it's like 4000 frames? So I divided 4000 into 18 miles. How long is a footstep... So I'd kind of done the maths of, ok, so it's 10 footsteps for a frame. So if I photographed the ground every ten steps, that would fill up a whole can of film, basically.*

(16) *So, there's a moment in the film, two thirds of the way in where it goes dark. And that's cause I kept shooting. I still had to keep shooting when there was no light to shoot, until I got to the official stop point sort of thing. And then it goes dark for a sustained amount of time, and then it comes back in and it's the next Tuesday.*

A.3 Difference

(1) *I realised that when it's at certain exposures, It's a really sharp clear disc, but at other exposures, it almost looks like a ball because you've exposed it too much and as the light is bled out around the image, it blurs at the edge and it looks more like a sphere... And then I suppose for the sound, could you approach the soundtrack in the same way?*

(2) *So in flicker, for instance, there's a rate of change, but also a degree of change. So if you change between bright white and black, that's very noticeable if there's a flicker. But if you're changing between, say, 15 percent gray and 18 percent gray at the same rate, it's much softer.*

(3) *But slowing down and speeding up, I was seeing a lot of, like, with a broken slo-mo camera, I was filming a lightbulb being switched on and being switched off. That decay of the light... Trying to experience that in a different time.*

(4) *One thing that was very interesting was that we didn't have just black and white, we didn't just have on or off. The thing that we've both been interested in for years, which is the dimming of bulbs. The moment where a bulb dies as you take energy away from it... We would get these grey variations, so we would get sort of deep blacks, and then coming into greys, and then white.*

(5) *We're using the negs. So we've got negative beats! So that ended up being a whole kind of line of inquiry as well... Rhythmically they are very different.*

(6) *I'd start doing one that had particles and introduced little bits of plants, so I was kind of making crossfades in a way, but like literally with material...*

(7) *There's a beach where my dad lived, it's a 20 mile, 18 mile stretch, where the stones gradually change size. So it starts in the East, the size of potatoes, and move Westwards to grit, basically*

(8) *So it's kind of like a very logical journey through the building. I wanted to take away some of the editing decisions, cause I had this wealth of information, which was like, how the fuck to you edit all this? There were so many versions. Do you go really musical or do you keep it quite structural, and take that approach? And also, I think I was struggling as well, cause the super16 method of creating optical sound, is the 'puh puh puh puh' which is the bracketing of the frame lines, which*

sort of put it in a very particular, distinctive sort of frequency range. Cause you've got 25 lines a second. I can remember actually writing to Guy Sherwin, saying, I've done this film, but how did you get around this? Did you go into the darkroom and somehow try and bleach out the lines? Or? And he was like, no, just edit it, and use a strong, different sound against a lighter sound, so that those changes and seams will be punctuated.

(9) *It was like mission impossible. A really shit, really sort of abstract film mission impossible. It's like, can I make a film using very mundane tools of production in an office environment. You know... can beauty or artistry be found in this most arid of deserts?*

(10) *There's situations where I've made it really difficult for myself. But it's really interesting, the energy.*

(11) *So it then became... Ok maybe this walk I could make a film for my dad, and the walk could be about trying to connect with him, or trying to give time for grief, cause up to that point I didn't give any time for it, I was just busy getting on with things. So, it was a chance at having this long duration of doing this one task. Of doing this for him.*

(12) *It's really good for me because I end up being over busy and I end up doing things too fast. And doing something that has to make me slow down is really, really good. And I think I do do that on purpose when I can, so that I do build this into my life... At the moment I'm doing a project all around soundscapes and listening, so I have to spend a lot of time out field recording in a beautiful place. So that's really good for me. And it's also creating a piece.*

(13) *There was this fascination of running around and picking up objects, or looking at the wallpaper, cause we moved a bench away, and we were like 'God, look at that!'. So the film was very much when we started to move out of the building, we were pulling things away again, so you started to see all of this amazing stuff reappear, where you became acclimatised to it before. And in the last few days of that, it was like, shit, we've got to!*

A.4 Repetition

(1) *I thought I would use printing ink, so it was really quite blocky and dark.* So, very loud? *Yeah, loud. Although that's relative isn't it, to how much you boost the signal. But yeah, strong black and white forms, and you know how it is, it was mostly like, "BRRRRRR".*

(2) *They are quite bodily sounds at times! They are quite grunt-y, like an old man. They make these kind of abstract noises, which is amazing because cinema has taken this really simple thing of modulated light, and refined it in such a way that you get speech and you get atmosphere, and you get a recreation off of a situation, but when you do it in the darkroom you get 'grnt grnt grnt'. And it's like, how did it get to such... You can understand how you can get a grunt, but to understand how you can do birdsong or something sophisticated is incredible. But you do it in the darkroom and it's like (makes fart noises).*

(3) *I kind of struggle with it over the years when I'm performing this piece with that sensor. Because you can't control it... Sometimes it picks up radio signals. So when I have a torch light, you can hear the nn nn nn nn nn, but then it goes 'Skgrrrrrrr'...*

(4) *There's so many classic works of flicker that, you get in the Avant-garde, like Tony Conrad films and Peter Koubelka and stuff, where you've always got this sort of on off sort of methodology where it's black and white. It's like 'DUN DUN DUN DUN DUN', you know, sort of in your face.'*

(5) *It's the cue for the people on stage... I use junk film, and often I'll use double perf film. So that duh-duh sound that is often recognisable in our gigs*

(6) *The super16 method of creating optical sound, is the 'puh puh puh puh' which is the bracketing of the frame lines, which sort of put it in a very particular, distinctive sort of frequency range.*

(7) *It might be too subtle you know, cause it's so repetitive isn't it, the du-dum du-dum you know*

(8) *With photograms, you do a photogram and it looks incredible when it's hanging on a mic stand, and you've got this really detailed thing. But as soon as it's projected, it's like 'brrbrrbflrrrb'!*

(9) *So the body, well, again, it's unintentional, it's an accidental thing. Cause I wasn't looking down the lens, it was just held on my stomach, pointing down to the ground, to a fixed point. My body became like a sundial almost, so the shadow would stroke the soundtrack, and all these other random things... But again, the 'puh puh puh' was quite regular as well. Which kind of had this ferocious, you know, sort of almost, weirdly, coincidentally, this sound of wind on a microphone. It has this kind of ferocious, like... being on a windy beach.*

(10) *And then once I make a loop, and I thought, oh this sounds interesting, and this looks really interesting. What if I just extend it... So I have no clue what's going to happen. It's just... I keep going... And then at some point, I'll try to study the artist, how she draws. It looks like a three dimensional effect, like she's expanding... How do I try and use that idea onto film? Of course, you won't see that idea on screen, but it helps me think, oh, why don't I put*

washi on the other side as well? And then once I do that, it's very, how do you say, regimental? It's like ok, four frames here, pause ten frames... So that's a rhythm thing. But then I also do some chance thing on the other side. I don't know how it's going to sound, how it's going to look. I just stuck it on rhythmically and then see what happens.

(11) *A few years later I was working at the Film-Makers Co-op and I put it through a printing machine and made several copies. I also altered the light levels. So that created something like a secondary rhythm that was happening behind the dots that are coming and going.*

(12) *So yeah, quite a lot of my work embraces the accidental, so to lay things on the film strip and to allow things to enter the soundtrack of the film strip and not know what they're going to do. And then learn, and work out, ok, so, a very minute repetitive thing is going to be high pitched, and a very fat, broad strokes thing is going to be low. And the darker, the louder, the lighter, the more white noise you get.*

(13) *There is a lot of pattern in my work. There's a kind of seeking of patterns.*

(14) *You knew repetition was an important factor, and you needed a strong regular pattern, and that building provided that.*

(15) *So if you've shot something a bit over exposed, or under exposed, there's going to be a broader stroke, so it's going to be a louder or a fatter sound. So even though it's still 25 lines in that second, it has a distinctive tone to itself.*

(16) *So, it's like, oh, maybe let's try this, see how it happens. And then once I make a loop, I thought, oh this sounds interesting, and this looks really interesting.*

(17) *One of the most important things is intentionally not knowing what the outcome would be. I would just start with that. Then I would think, ok what should I do next, and so on. I try things out, adding, subtracting, taking risks. Making decisions along the way in the process. Most of the time I keep the chances and random decisions I made.*

(18) *And this thing of, no matter what it is, being projected, because it's a loop, it becomes accepted, and it becomes normal, and then it changes over time. So, in a sense I was just looking for something else, I was just playing. I was just allowing myself to be in the darkroom, just laying things and asking questions like 'what does this do?', 'What does this do?, and then it started becoming... 'shit, what does this sound like?" If I put bubbles on the film stock, what does this do?', 'What's that sound?'. And so it was very much a direct call and response in a sense.*

(19) *If you play it long enough, a loop, it makes sense, it forms itself, it establishes itself.*

(20) *So one of the photograms was, yeah, the direct exploding fun snap onto the film stock... So that fomed a 30ft loop in the space, so it hangs from the ceiling and goes down amd gets played multiple times. But because there are so many exposions on there, you get to see and hear these different explosions at different times.*

(21) *There's a looped film, and loop film means I can play it as long or as short as I want, and performance is always different every time, because you can sense, right, 'ok, I'm going too long now or I'm going to stop now.' But working with different musicians, it brings a different life to the piece... We had a trumpeter and saxophonist. We played with a throat singer, a rapper, even one with a meditation bowl... So we would look at it so differently every time, and that was really enjoyable...*

(22) *It allows some sort of unintentional rhythm. I think it's also intuition, like, okay, that's about the length I have pulled and that's when you have some kind of rhythm doing it. And so the other part goes into the film bin, the process repeats. Once I have exposed a reel of it, I made copies... So I have like, a hundred foot. Developed it. And then I go through the process of printing using the synchroniser, to make my copies.*

(23) *I love it. I mean, I think it's any kind of art making where you get sucked into it. I think you hear it from any kind of craft making. When you're so focused on something. For me it's usually at night. Yeah, with the music on and you just keep going.*

(24) *If it's something that's materialistic, where I draw onto film or stick onto film, there's a kind of, understanding, there's a percussive connection, a direct connection to optical sound.*

(25) *So those moments, those intersections of the body needing rest, were really resting points in the contact printer as well. So I could use it as a stop, an edit point... So not only was it a rest for the body, during making the film, but it was also a rest to reset the apparatus in the darkroom as well.*

(26) *Even like in commercial, narrative film, there's always a repeat, there's always a reminder. So I think that's an innate kind of nature for us. If something comes back, it's kind of a percussive kind of thing. And any sort of small modification makes it really interesting.*

(27) *Why am I so attracted to repetition? Why do I enjoy watching it and why do I respond to it?... I think repetition is reassuring. And also, technically, when I do a repetition, it never comes out the same way,*

because I allow chance.

(28) *I give it out. I do tell, I do show people, you can do this yourself, but, you know, knowing that you can't replicate it anyway, you know, you can't do the same thing.*

A.5 Chemicals

(1) *There's something unique or exciting about photochemical culture that's not so much about a lament for obsolescence, but there's a real ground materialism that maybe people like, Karel Doing, or Kim Knowles talk about or write about in regards to when you make up chemistry from scratch. It's the wetness of working with media that isn't maybe translated when you're doing hacktivist things with module building... It's just different.*

(2) *this serendipity aspect of chance. It's like the universe is kind of... playing. You're leaving it to the unknown processes, which can be quite exciting as a person who makes film.*

(3) *You could be like, oh, I really want this shot of a... Chicken! And you just do a straight shot of a chicken, but then if something goes wrong, artists love it when it gets abstracted or changed in a way that's unknown to them, and I think that's the unknown exciting bit... Because you've accidentally solarised the chicken. Oh, look at that! The chicken's now got a glow!*

(4) *It's not like we're working with the same stuff that was made in the 1860s, right? Or the early 19th century, right? It's not the same material in any way, shape or form.*

(5) *I think as filmmakers, certainly as artist filmmakers, we are used to having to sort of like scratch around like chickens in the dirt, try to dig up some stock, cheap stock to shoot with.*

(6) *So we were taking an American documentary about the natural world, optical sound, colour. Cutting it up into strips of about, you know, sort of two foot long or scenes. Running it once through the Hollywood Jr onto PF2 print stock and then rewinding the stock and then putting another strip on and running it again. So you get double exposed, because it double exposes the sound. So we were getting overlapping optical sound, double exposure, muffled but perfectly audible.*

(7) *We turned the toilet into a dark room, the sink where the chips are going to be cooked later, and potatoes are peeled is where we're processing. Like, nothing about this really is actually very good in terms of health and safety. You know, this is not an exact science. So therefore, expect the unexpected!*

(8) *He called me into the darkroom and he explained it to me like it was cooking, and it was like... You don't have to be that precise, you don't have to be that careful about temperatures and this stuff.*

(9) *But all of a sudden, here was the LOMO tank, I can shoot on this roll of gaff, whatever it is. Process it, I might get something, I might not get anything, you know. Again, even in the sort of stuff that came up like a gloopy mess and the emulsion was sliding off the strip, it's like, oh, quick, let's dry it because actually it's quite interesting.*

(10) *We did nettle developing and we also made nettle soup, which we ate while it was developing.*

(11) *I like Yarrow. Yarrow makes a really nice photogram. So I wanted to experiment with Yarrow to see if I can develop a Yarrow film with Yarrow.*

(12) *I was just allowing myself to be in the darkroom, just laying things and asking questions like 'what does this do?', 'what does this do?, and then it started becoming... 'shit, what does this sound like?', 'If I put bubbles on the film stock, what does this do?', 'What's that sound?'.*

(13) *Photogramming on black and white print stock was a lovely way to explore optical sound, especially, the comb makes a lovely noise on optical sound. So yeah, looking at things like Man Ray, but then patterns and stuff, very simple, crude, sort of like using a comb to make a repeated riff on the film. Yeah, combs and chains. Or grids...*

(14) *Contact printing... It's about contact, it's about intimacy.*

(15) *It was beautifully abstract, but also it kind of had a quality of what the particles felt like.*

(16) *I found the dark room in some ways had parallels with deep listening, in terms of very detailed, slow ways of working in contact with the material.*

(17) *It's really instantaneous. To push it against the film strip, it's so close as well, it doesn't fog the film, it actually creates this exploding universe in really minute detail. But to have that ability just to push... I can remember doing it... I went to the toy shop and bought like 3 or 4 boxes, and we were like 'pop, pop, pop, pop!*

(18) *It was already wet and so I knew it was going to kind of start reacting with the film when I put it on.*

(19) *so it is going through the mechanism so many more times, so I think of it again as being very invested with touch, on the film itself, even if it's not directly through my own fingers.*

(20) *And I turn the power on, the bulb on, I watched in real time as every frame kind of melted as it ran through the projector. Everything just liquefied and melted and burnt and smoke came out of it. And my love just like doubled, because I was like, not only are the colours extraordinary, but this thing is multidimentional. And then you just go to rewind and the projector just rewinds it and it's like nothing bad's happened.*

B Interview Guide

Draw to analogue film
- Can you tell me about the first experiences you had of exploring analogue film?
- Did you have someone who taught you or did you learn on your own?
- What was it that you found interesting about it?

"" Draw to optical sound
- Can you tell me about the first experiences you had of exploring optical sound?
- what was it that you found interesting about it?

Darkroom working
- How do you feel when you're working in the darkroom?
- Does working alone and in the dark influence your practice?

Audience and Venue
- Would you still be making films without an audience?
- Do the places that your work is screened have an affect on the creation of the work?

Raw Data
- You could say that optical Sound is a very rough and simple form of synthesis, where the input isn't treated, filtered or used to control something out - but is outputting 'raw data'. Is this sort of rawness - and directness important in your work?

Conception of time
- Has working with analogue film changed the way that you think about or understands time? If so, can you tell me a bit about that?

Beginning a work
- Can you tell me about a recent work you have created that incorporates optical sound
- Do you remember how the kernel of the idea started?
- Can you describe the way you developed on that idea to create the piece?

Intention / Agency
- Do you have clear intentions when you set out to make a piece? Or does this evolve?
- What factors change and guide the work?

Materials
- In terms of what you are capturing on the film strip - is there a particular type of material theme that runs through your work?
- Why do you choose to work with certain materials? Do they have some significant meaning to you?

Tools + modification
- What equipment are you using at the moment in the darkroom?
- Does your film-making apparatus change from piece to piece?
- If so can you describe an time when you modified it between pieces?

Constraints
- Can you tell me about a time where a particular limitation of equipment or material has shaped the outcome of your work?
- How would you say that limitations, or constraints affect or form a part of your creative process?

Experiment into piece
- What differentiates an experiment from a finished 'piece'?
- What do you see as the defining factors of a finished piece?
- Is there a point when your focus shifts from working on the film strip itself, to the projected image?

'Ending' a work /feedback
- Does finishing a work get something 'out of your system'?
- Are there any works you have made that have logically followed on from each other?

"Slow technology"
- There is a forbidden gap between the making and the viewing.. How does this gap, and the slow nature of analogue film processing affect the work you create?

Integrated image+sound
- How do you approach making sound from your images?
- Are you searching for a sound from an image? Or do youthey work with the image first and the sound is secondary?
- Do you see sound/image in these binary terms?

Pattern Making / Algorithmic Thinking
- How do you make use of patterns in your work? (Or lack of them - randomness/noise?)
- Can you tell me about a work that has a particular repetetive process?
- How do you understand the perceptual outcome of the approach?