

# Looping slowly: Diffraction through the lens of nostalgia

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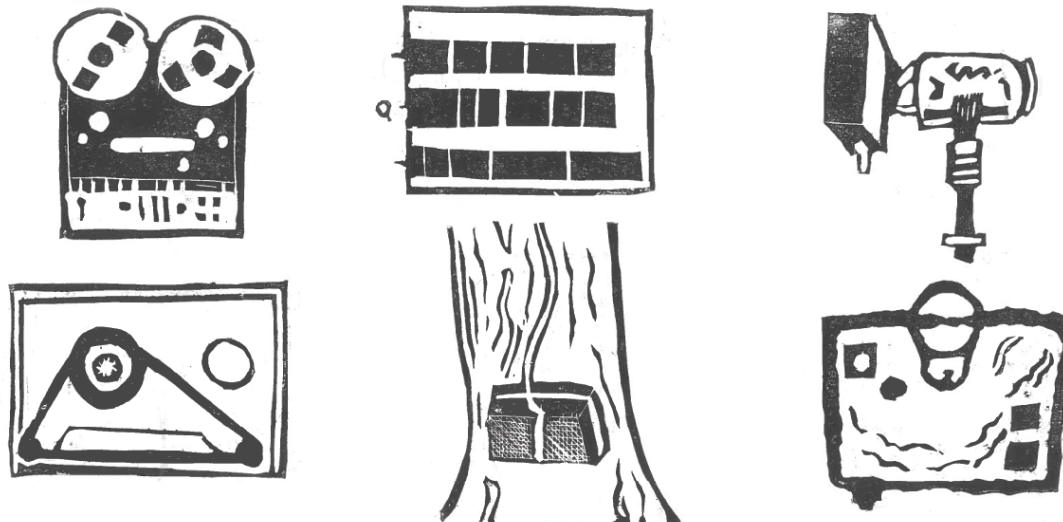
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**Figure 1:** In this paper we explore technologies and practice based on magnetic tape, showing linocut representations of some of the interfaces we examine.

## Abstract

This paper concerns magnetic tape and the nostalgia of media, finding new relevance in old technology, remaking and adapting practices to fit within a modern workflow. Pushing against the driving force of economic structures, which emphasises a continuous cycle of replacement, musicians and instrument designers are drawing on a shared history to create new pieces of art and machines. This can be read as reflecting NIME's Code of Practice and, more generally, the unfolding climate crisis.

For some, NIME may convey a focus on new musical instruments, but here, we focus on the notion of new through the diffracted lens of the old. Defined in recent NIME conferences by zooming in on the 'O' in NIME through the importance of reusing and repurposing old musical instruments and, in our case, old practices and processes. This paper considers magnetic tape and the machines that process it as the material and instrument.

Following a survey, we present a diffracted reading through an intra-related process of how musicians, producers, and others who work with audio integrate tape into their practice. Drawing on post-humanist theories, we explore how slowness, community, and the old can inform NIME as a methodology. It provides insight for NIME to continue moving forward while focusing, through its Code of Practice, on sustainability, connection with our past, our history, years of artistic practice, and workflows that are not simply optimised for efficiency or the new.

## Keywords

Tape, Nostalgia, Raw Data, Entanglement, DMI Design, Art, Agency, Ethnography, Design

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## 1 Introduction

Ingres is said to have created an artistic order out of rest; I should like to create an order from feeling and, going still further, from motion.

Paul Klee 1923

More than a decade ago, a close friend started a journey to enable them to manage personal grief; it would come to redefine their artistic practice and in many ways their world view, developing a practice diffracted through the lens of community, slowness, and contemplation. It's impossible to describe their artistic practice and output in this short introduction, rather instead what we focus on here, is that which draws us into their work. More than anything it is their interest and understanding of the old, often discarded, analogue technology that conjures a new way of working, pushing against the constant drive of ever 'better' technology. For them it is the visual image, for us it is magnetic tape that inspires questions into the material practice of music composition and production.

Even with all its 'progress', it's hard to find a truth in the idea that GenAI can or will fully replicate the warm, imperfect sound of cassette tapes, which creates a truly special listening experience. This paper is not about if GenAI can or cannot create



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**Figure 2: Some examples of different tape loops.**

interesting music, it's about noise, it's about artistic practice, it's about analogue tape and embracing its imperfections. Like what Dunning refers to as 'Ironing In The Creases' [13], where the artist searches for and reinforces a medium's faults. It's about our entanglement with the past and how it influences the music we make, the noises we create, what Fisher refers to as Hauntology [17]. This paper considers how and why the workflow and 'warm' sound of a very particular 20<sup>th</sup> century sound medium support and provide insight into the practice of NIME.

The crazy thing is it is not yet over. There are all those crazy people that are working with cassette.

*Lou Ottens (the inventor of the cassette tape) 2016*

According to a simple Youtube search the video [TAPE LOOP 101](#) has been watched more than eighty eight thousand times, which for a medium that was made obsolete, not to mention the niche application of making a 10sec tape loop, seems impressive. (A selection of different length tape loops are shown in Figure 2.) The use of tape to process and produce music reaches far beyond the doors of academia, contemporary musicians such as Ei Wada, Hainbach, Erland Cooper, Aaron Dilloway and others utilise the medium extensively in their practice [4, 12, 18, 21, 40, 52].

Why is this the case, why is tape still so popular in the age of digital 'perfection'? Jackson and Kang argue that the languages of post-humanism and material agency, '...specific(ly) contexts of technological breakdown, repair and repurposing...', have important things to offer questions of creativity and design in HCI today [25]. By extension we argue that within the context of NIME and more generally musical production and expression, the notion of technological breakdown and repair, finding new and emerging agency, through intra-activity of this technological breakdown, enables artists and instruments designers to explore a practice that is embedded in NIME's Code of Practice and Ethical Research [33].

One might wonder if tape's ghostly presence, along with other 'expired' technology, is of interest to us again in part, because of

digital overload, according to Negroponte: 'like air and drinking water, being digital will be noticed only by its absence, not its presence' [37]. As the 'tendrils of digital technology' reach us all, Cascone argues for a 'post-digital' understanding where the 'medium is no longer the message...: the tool has become the message' [10]. As musicians worked to understand the end of the 20th century and expand the range of the digitally infected music of techno, house, and other dance floor music, the emergence of glitch or microscopic music allowed artists to work beneath the previously 'impenetrable' veil of digital media [10]. Since the 'death' of tape was proclaimed in the 2000s [51], so aptly captured in Basiski's Disintegration Loops [3], and like the analogue synth resurgence observed in the domain of Eurorack [46], tape as a medium for producing, distributing, and listening to music can be heard from experimental ambient through to mainstream pop music. The sound of tape can be found echoed in J Dilla inspired LoFi HipHop and the haunting textures of Burial. These productions often do not use the physical medium of tape itself, but imply its nostalgic power through its warming compression, noise, and hiss.

Christopher Morris's film *A Year in a Field* surges forward through slowness, meditating on the impact of climate change [34]. It is more than simply an essay on climate crisis, rather a meditation on the natural world and human impact, so often mirrored in commodification of the next thing in digital technology. Travelling through technical developments, as much as political turmoil, at what seems like the speed of light, it is hard to find an anchor, difficult to find time to reflect, enquire, and enjoy the moments of community, the moments of dust settling, the moments of silence. Morris argues that the film is the 'antithesis' of the 'million-dollar dazzle' of the over produced, almost 'science fiction', nature documentaries. Arguably there is a close analogy with Morris's interpretation of the nature documentary and the slowness and processes of working with a medium such as tape, when compared to the sci-fi like powers of digital technology, as seen by the incredible leaps in the context of music making and Generative AI.

It is important to note that while simply pushing against our society's need to continually discard the old as part of the goal for 'growth', is itself an important stake in the sand, it can often cause the evaluation that new must be better, new must be more 'hi-fi' and old, as a natural conclusion, 'lo-fi'. However, it is possible that discarding the old for new is not just concerning from an environmental standpoint, but also, we are losing not only a connection with our past, our history, but also neglecting years of artistic practice with workflows that are not simply optimised for speed. As Schechner [49] explains the 'social actions' and 'cultural performances' are 'events' whose origins are not defined by the human, rather they are intra-acted via 'a feedback loop with the actions' of humans and non-humans.

Through the audio loop and the feedback loop emerges an intra-action between human and the tape (or tape machine). Bulter refers to this as a performance [8], one that is not simply different in degree, but in kind. As a 'feedback loop', individuals and objects, or individuals and events, produce phenomena [2]; they are the ontological inseparability of intra-acting agencies. Both the discrete instances and continuous processes are necessary for history to 'perform.'

In this paper we develop an argument through an analysis of theoretical, ethnographic and performance work. We begin by reviewing background work, including post-humanist theory in the humanities, NIME, and more generally HCI that argues

ID	Question	Type	IRQ
<b>General</b>			
Q1	How long have you been making music?	Num	N/A
Q2	Working with loops is an important element in your production process	Likert	9.5
Q3	My workflow tends towards the use of a DAW	Likert	5
Q4	I tend towards a 'hardware' (or DAWless) workflow	Likert	4
Q5	Tape is an integral part of your workflow (where tape is open to interpretation)	Likert	7
Q6	How do you feel about tape	Text	N/A
<b>Musically I use tape</b>			
Q7	I use tape for colouring the sound	Likert	11
Q8	I use tape as a delay effect	Likert	6
Q9	I use tape as a looper	Likert	7
Q10	Other uses of tape	Text	N/A
<b>Devices</b>			
Q11	Where do you get your devices?	Multi choice	N/A
Q12	I get my devices in good working order	Likert	6
<b>Reuse and modify</b>			
Q13	I am willing to extend or adapt	Likert	13
Q14	Obtain instruments/machines that may not be in full working order	Likert	8
Q15	Modify or repair instruments/machines you use for music production	Likert	11
<b>Workflow</b>			
Q16	I interact with the tape as it records or during playback	Likert	6.5
Q17	Tape loops beyond the recording or play back device are important	Likert	9
Q18	Working with tape contributes to an efficient workflow	Likert	6
Q19	The customisable aspect creates an emotional connection between me and the instrument	Likert	8
Q20	The unique results of working with tape in live performances and the associated risk of failure creates a special emotional experience for the audience	Likert	7
Q21	The hardware aspect of working with tape encourages me to experiment	Likert	11
Q22	I make better music when I have less stuff and the computer is like having too much stuff in a studio	Likert	0.5
Q23	When working with tape I find it hard to think musically. Compared to classical instruments as e.g. the guitar where I can predict the outcome	Likert	4
Q24	I am much more attached to something that I made myself	Likert	10
Q25	In some tape processes there is a non-immediate gap between the making and listening, compared to a digital workflow. This gap, and the slownature of working with tape affects the work you create	Likert	9
<b>Community</b>			
Q26	I read and/or contribute to online discussions around music	Likert	13
Q27	The closeness of the online community supports me as a musician	Likert	7
Q28	I purchase music through mediums other than Spotify, Youtube, or Apple Music	Yes/No	N/A
Q29	I release music on tape	Yes/No	N/A
Q30	I purchase music on tape	Yes/No	N/A
Q31	I release or share music with others through online sites such as Bandcamp or Soundcloud	Yes/No	N/A
Q32	I share music with others through the medium of tape	Yes/No	N/A

**Table 1: Survey questions, split into their corresponding sections. Likert questions were accessed with a 7-level scale (-3, +3). The inter quartile range (IQR) was used as a measure of clustering around the median (m). Items of very high cluster (IQR <= 2) or high spread (IQR >= 3) are of particular interest.**

for an expansive way of considering the relationship between humans and the objects around them (Section 2). This is followed by an exploration of current practices with tape, through a survey of musicians utilizing the medium in their artistic practice (Section 3). We believe that the findings hold design narratives for the NIME community, when working in the context of the old and 'forgotten' technologies that is central to our and other artists practice, both in music production and in the design of new musical instruments. Drawing on these findings we propose a design space for exploring 'a circular making practice' for building new musical interfaces (Section 4). Finally, we bring these ideas into focus with an autoethnographic [41] description of two works brought together as Looping slowly, which are

seen together within the context of tape (Section 5). Section 6 concludes with pointers to future work<sup>1</sup>.

## 2 Background

Post-humanist theories around entanglement, diffraction and relational space have long been adopted in the social sciences [2, 8, 22, 28]. Recent work has theorised a model of entanglement as a fourth wave for Human Computer Interaction (HCI) [19] and recently developed in the context of NIME [35], this paper further explores these notions through the lens of magnetic tape.

<sup>1</sup>The audio and videos referenced through the text can be found at <https://www.youtube.com/watch?v=Znhoz8XMeLc>.



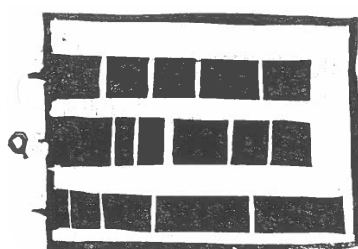
NIME and related settings has explored entanglement through the eye of the performer, see for example Reed et al [42], while the work of Renney et al considers the entangled nature of the digital instrument designer, within the context of their own musical practice [43, 44]. Nordmoen and McPherson explore an entangled material making practice with a diffractive reading of woodwork and building interactive systems [38].

Trends in Interaction Design education have often focused on visual feedback and touchscreen interactions, while the classes of Bak et al [1] were developed to provide foundations for design students to leverage the potential of non-visual modes of interaction and provide them with tools and skills to develop complex multimodal, embodied experiences. This notion sits well with tape's focus on the non-visual, is in tune with screen as a material, which often in the case of live musical performance, for example, is a distraction and disembodies the actor, i.e., the performer and musician, from the process at hand, that of producing a tapestry of sound. Fixed physical interfaces provide for haptic feedback, location information, and fine grain control even under the heat and pressure of a dark and 'sticky' venue. Rossmly and Wiethoff explore this notion through the 'outdated' technology of Modular [46], while Zheng et al consider this from a material perspective, studying how designers understand deformable sensor materials in the context of creative aesthetic design [53].

Repair and reuse feature highly in the use of outdated technology, such as tape, and Odom et al explore why we preserve some things and discard others in the context of interaction design [39]. Vail has looked extensively at the reasons tape has lived long beyond its sell-by-date [51]. The work by Jackson et al, within a post-humanist setting, considers the use of old and broken technology in the context of design and maker practice [24, 26]. Masu et al consider the 'O' in NIME, where they reflect on the importance of reusing and repurposing old Musical instruments [30]. The work of Bowers and their collaborators have long considered the notion of interaction design, simplicity, and reuse as an approach to probe NIME design and making [5, 6, 20, 27].

Finally, it would be amiss to not consider the provocative and 'warm' feeling that tape brings to both making music and in the listening process. Reading this through Fisher's version of hauntology, considers it as 'lost' futures [17]. Seen in this light the use of nostalgia—as per the title—intends to invoke the idea that old technology can be remade anew, adapting practices to fit within a modern workflow. Pushing against the driving force of economic structures in place for always using the new, musicians and instrument designers are drawing on a shared history to create new pieces of art and machines. This can be read as reflecting NIME's Code of Practice [33] and more generally the unfolding climate crisis, rather than wanting to return to a past that was somehow 'better' than now.

### 3 How do artists view tape?



To explore individual reasons as to why musicians utilize tape for production and musical performance, we invited participants to document their practice through an online questionnaire. Developing

this approach and methodology helped to further our understanding of where tape sits within musical practice.

Table 1 outlines the survey, which comprised of six categories. A range of statements were collected for each category. Some statements were free form text entries, but most were judged using a 7-level Likert scale (ranging from 'strongly disagree' to 'strongly agree') [11].

#### 3.1 Study Subjects

42 people responded completing the survey in full, while another 4 partially completed. After some consideration we did not collect person information. We did, however, request how long they had been making music (Q1). Their experience in making music averages around 24 years (4 – 52 years). All participants agreed that their data is used anonymized for scientific publications (see Section 7).

#### 3.2 Analysis

Based on the responses of the participants a diverse array of perspectives and descriptions emerge when attempting to define how tape is used in their process of making music. Some participants emphasise the use of loops, with its long history with respect to slicing tape loops (Q2), while others used more as an effect or even end of line processing. More than 50% of participants said tape was integral to their workflow and preferred a 'hardware' or DAWless workflow, over working in the box (Q5, Q4).

Furthermore, participants highlighted the role of tape within a Digital Audio Workstation (DAW), implying that for some, at least digital replication of the analogue process was their default approach. The physical artifacts of tape machines can be large and hard to maintain, reflected by some participants:

A very interesting way to limit and spice the workflow. Would love to use it more often but the machinery is often heavy and as a student moving every now and then it can't follow me everywhere. (P28)

Participants also highlighted the role of tape as an effect and as a way of introducing the unknown and failure into their work. The following response from P14 captures this:

I find that tape is a hugely useful tool for introducing fallibility and the leitmotifs of failure into my music. I use it as a medium for sound manipulation—sending things out onto tape from a DAW or sampler, then back into the DAW or sampler via a manipulated version of that tape. (P14)

Tape is known for its warm compression, as noted by mastering engineer Stefan Betke<sup>2</sup>, and as highlighted by participant P16 sits solely at the end of the chain:

mostly used at the end of my process to record my piece. (P16)

Other participants were more interested in tape as a medium to access other people's music, continuing to purchase physical artifacts rather than simply streaming digitally:

I like tape. I buy tapes to listen to. Have worked with tape a lot in the past, creatively, but less so at present. (P23)

<sup>2</sup>The Art Of Mastering.



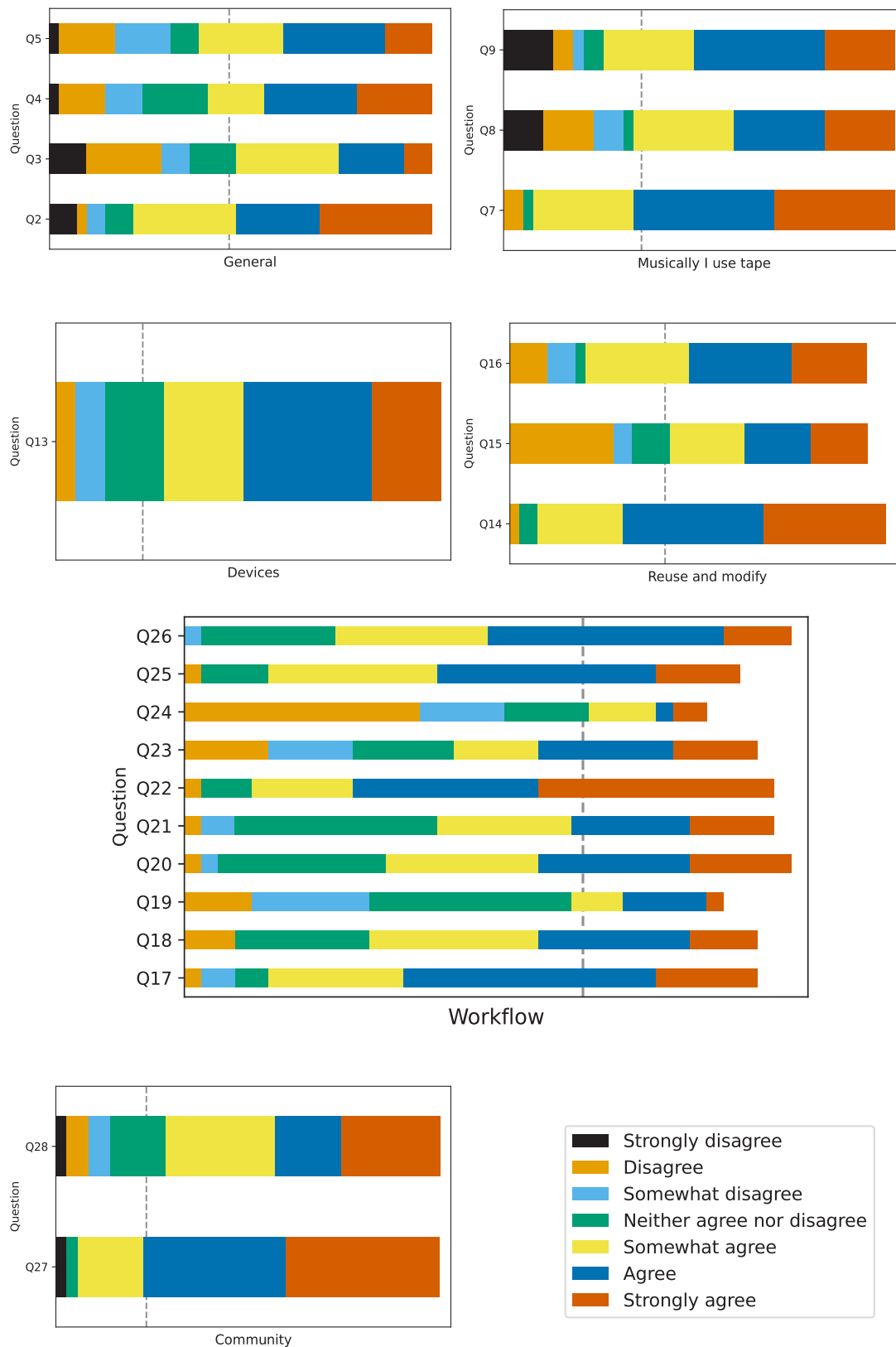


Figure 3: Survey Likert results



**Figure 4: Tape an example of circular making.**

Participants commonly used tape for saturation and compression, but also exploring texture and other effects caused by direct manipulation:

I saturate with tape mostly, but I also use tape to slow down or speed up sounds to add a different texture to them before restoring them to their original tempo within the DAW/sampler. (P14)

Playback of pre-recorded audio, speed manipulation, live sampling (recording and playback of self and others during performance), playback of tape glued to a record with a separate tape head. (P23)

There was a general consensus of participants getting used devices from sites such as Reverb, with a few highlighting thrift stores and parents lofts:

Parents old equipment, thrift shop, one professional reel to reel that I had to chance to get for free in the caves of my former school. (P28)

2nd-hand shops. (P20)

Many participants were happy or at least willing to fix, modify and extend devices (Q13, Q15), while it was often that old machines would not be in good working order (Q14).

A common thread was participant's use and access to online communities, such as forums and other online groups, for example, those found on Discord. It should be noted that as most participants were recruited via an online call, it does not seem unreasonable to assume that this would be the case (Q26, Q27). Most participants purchased and listened to music from means other than Spotify or mainstream streaming services (Q28). Based on the responses of the participants a diverse array of perspectives and descriptions emerge when considering how as artists they release music, but most had or would release music via tape or other physical mediums and not simply via digital streaming services (Q31, Q32).

### 3.3 Discussion

The analysis in this paper presents initial findings, constructing narratives that focus on distinct aspects of how musicians approach working with tape. While alone these ideas are insightful, when viewed together and within the context of existing work, we can develop further insights into how the old can be remade

anew, and begin to form hypotheses from observations that can be explored in future work.

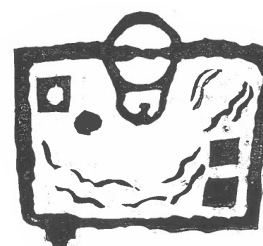
Perspectives from participants suggest an interplay between a fixed and limited workflow. They are inspired by materials and problem solving, fixing old machines, all to reach an end goal. We see this described by P28, who says:

I use tape to limit myself to a number of channels using a loop of tape on a reel to reel. When I do this, the stereo becomes a kind of dual mono. The tape cannot overdub (workaround aside) and it creates those sound collage with very sharp delimitation. I sometimes replicate this workflow on my daw, also it doesn't have the same grainy texture coherence, it still leads to new-to-me structures and ideas (P28)

Finally, we observe that participants across the study heavily emphasised their interest in the processing of loops with tape for sound generation. Due to the clear interest in electronic music production, this observation is not surprising; it is affirming to see that through observational findings, this shared focus across research and practice is well aligned and motivates continued exploration in this area. Through old analogue machines, musicians seek to create more expressive instruments, which we suggest reinforces a design space to NIME practitioners that can support a more sustainable maker practice that we introduce as 'circular making' in Section 4.

## 4 A circular making practice for musical instruments

In conjunction with the ideas considered in this paper and significantly inspired by the use of tape, we have begun to outline an approach to our practice, which we currently present as a 'circular maker practice', which positions our work alongside other work at NIME on sustainability and the environment [29, 32]. The perspective of viewing technology through an approach that embraces slowness and constraints, requiring adaptability and improvisation, creates a lens to consider



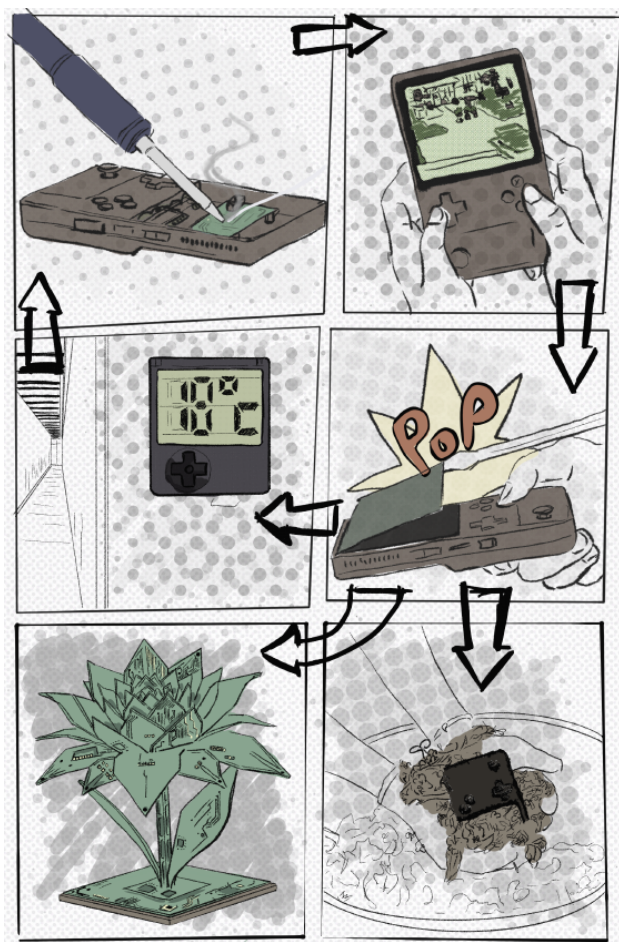


Figure 5: A circular making practice.

our wider practice as creative technologists. It affords a chance to consider how we might reconcile our practice and approach with broader social goals and ideologies, entangling the way we create with the environment, our understanding and our broader social roles. At this current stage, we consider how our practice can integrate sustainability and reuse as a motivating and inspiring constraint that allows us to practice the creation of new technology in a more environmentally conscious way, perhaps not in a way that will make a significant distinction to the climate crisis and other environmental problems. Rather in a way that may demonstrate its importance, share ideas and develop solutions, and inspire approaches to creation that allow for production and limits [23, 36, 45], at the core of circular degrowth, to co-exist. An ethos inspired, in part, by computing within maker practice, we aim to factor in three main priorities when creating technology:

- to prepare for the full lifecycle from inception to disposal;
- to plan for maintainability and longevity; and
- to consider the sustainability and impact of the processes employed and the other technologies upon which we build.

To consider the full lifecycle of a piece of technology from the outset calls for preparation for dissolution through ideas such as unmaking [48, 50], planning for the reuse of components or repurposing/recontextualising, for example, by conversion from technological artefact to art. In planning for longevity, practices

such as stable, modular design offer more multifaceted technology, which motivates its maintenance and increases its value by sharing its role across projects. We also consider our practice around processes and the reach of the tools and technology on which we base our work, for example, considering if using systems such as generative artificial intelligence are appropriate in achieving the project's goals and are ethically and sustainably in line with our goals.

As we develop these ideas, we present and document them, storyboarding a narrative representation in Figure 5 showing the creation of a new device, its use and then its dissolution or unmaking, where some components are recovered for reuse, some are composted, and some are creatively leveraged for art.

In presenting these ideas, we want to make it clear that we do not suppose circular maker practice is a far-reaching solution in tackling climate change or if that individual action such as this can truly address these issues, but rather to acknowledge our need for awareness and action toward constructive solutions that address the topic. By integrating these ideas, we aim to develop and embody a set of rules that may be important in exploring the practicality of minimising the impact of what we create in a wider design context and providing mechanisms for reconciling them with our use of technology. We include this section to provide a trail of how these ideas evolve and to allow us to connect with the reflective, techno-artistic context from which they originated.

Figure 4 shows an example of this process in action. Tape is musical controller reflective of 'circular' making, constructed from a process of recycling found cardboard, cast in the form of a cassette, recycled components from our lab, and a Raspberry Pi Pico reclaimed from an earlier project. At the end of life Tape can be unmade, composting the cast components, the silicon mold itself is cut up as filler for new mold making, and the components reused in future projects!

The following link is an example recording made with Tape and a MaxMSP noise patch inspired by tape hiss. The patch includes a selection of LFOs and wave-folding techniques to extend beyond the simple static noise, common of tape.

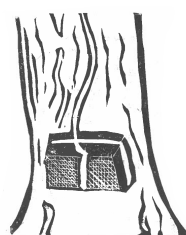
#### ► Performance 1

## 5 Looping Slowly

Inspired by these findings and building on the theoretical foundations laid out above, we choose two snapshots of work from our own artistic practice that is entangled with tape practices in some way for musical creation and research. With the aim of again exploring and developing these ethnographic insights with two reimaginings, through the lens of tape.

These insights and findings are documented in the following subsections as autoethnographic [41] presentations of work by the first and third authors.

### 5.1 16-bars: tape loops in the woods



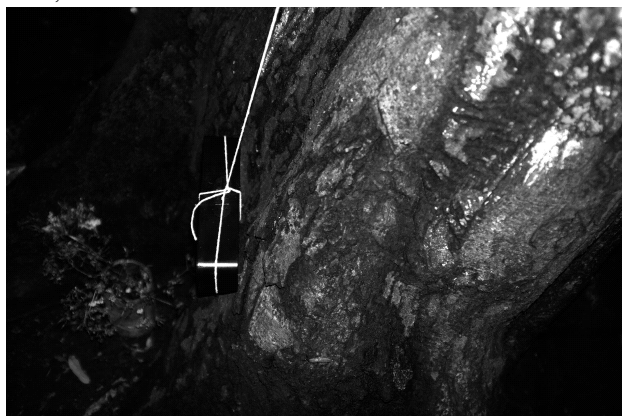
In this section we consider the first author's use of tape and its inspired intra-action as part of developing a sound collage for listening in the woods. With sound artist *t l h*, the first author was commissioned to produce a tape inspired work that explored songlines within city

woodlands. The final work, 16-bars, was part of a larger piece by



artist Esther May Campbell, for her *Anything Moving and What Remains* work at the MayK festival [31]. An intimate guided trail in the wonderful nook that is Nightingale Woods<sup>3</sup>.

*Anything Moving and What Remains* was a close encounter with the ‘Anything Moving’ trilogy of short films made by kids and animals, that invited artists to wander through ‘what remains’ of a month long Mayfest residency in the trees. Each situation explored children’s play and interaction in the woods and 16-bars explored the looping sounds of Nightingale Valley, a community woodland that supports a large variety of wildlife, especially birds, hidden in Bristol’s St Annes area.



**Figure 6: Tape loop speaker Yellow (1 of 3) swinging in the woods.**

The original recordings were made during an afternoon in the woods, where a group of eleven young people told stories, played with analogue cameras, and made field recordings of wood banging and other noises materialized onto tape, as they spoke and performed as part of the sound making process. These loops were arranged into a set of three 16-bar loops by *t l h* and later processed through tape by the first author. Each loop was converted to an MP3, written to SD card, which was then installed in a small battery powered speaker.

The closing night of Mayfest, the last weekend of May 2024, saw *Anything Moving and What Remains* invite the public to enter Nightingale woods, as the sun set, for a night of films, musing and 16-bar sound collages hanging from trees. Participants explored sounds and moving images as the woods shifted focus to the night, torches reflected ghosts, as sounds shifted from the recorded to the ethereal and back. As seen in Figures 6 and 7. New friendships were fostered, connections and emotional resilience was entangled as ghosts of earlier times in the woods bounced in and out of focus.

The following audio links are the final 16-bar loops, one for each of the 3 speakers, that were placed around Nightingale woods, as seen in Figure 6.

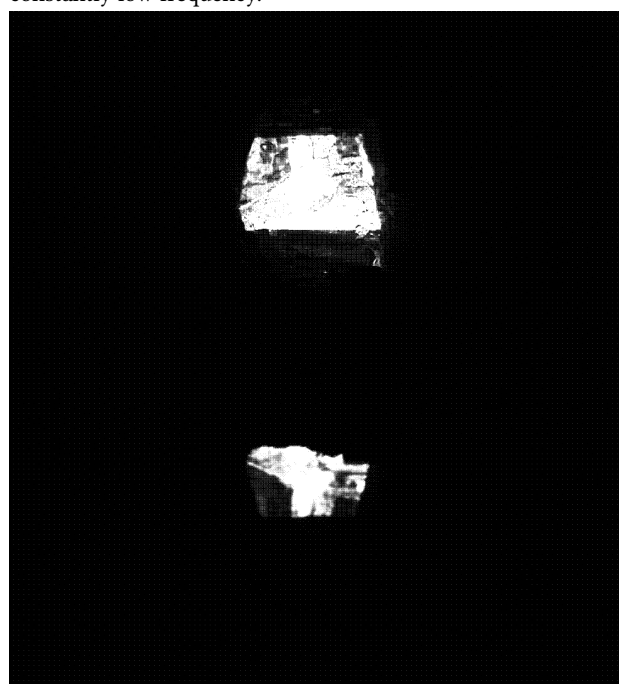
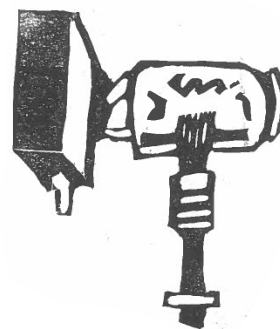
- ▶ [Nightingale Green](#)
- ▶ [Nightingale Yellow](#)
- ▶ [Nightingale Blue](#)

The linked [video](#) was a short piece made from the 16-bar speaker recordings, a selection of tape loops, and SOMA LABORATORY’s Pulsar 23, recorded directly to tape for prosperity.

## 5.2 Charcoal tape loop

In this section we consider the third author’s autoethnographic study inspired by the use of disintegration in tape loop practices. Arguably the most infamous example being William Basinski’s *Disintegration* loops [3].

This study made use of charcoal, a paper loop, a paint brush, a can attached to a motor, and a visual-to-audio wavetable synthesiser called the pattern organ [9]. The Pattern organ runs on Pure Data on a Raspberry Pi. It takes information from a camera, averages luminance fluctuations along the x axis and reads these values into a wavetable. For this study, the wavetable was scanned at a constantly low frequency.



**Figure 7: 16 bars projection in the woods.**

The circumference of a can was measured, and a paper strip was divided into four sections. These were further divided and marked with pencil, both horizontally and vertically. The paper was slipped over a can that had been salvaged from a communal recycling bin and washed.

The markings on the paper loop were used to draw a bold charcoal pattern onto the strip. The pattern was simple but aimed to have some repeating motifs, where there were areas of finer striped detail, and simple diamonds, creating movement between different areas of harmonic complexity.

A brush was placed against the can and the paper strip, so that when the motor was turned on, the pattern would revolve underneath a camera, creating a repeating pattern of shifting harmonics. While revolving, the brush would slowly remove or displace the charcoal. This is captured visually in Figure 8.

The motor turned and the pattern organ synthesised sound for over 40 minutes. During this time my ears were tuned into very detailed patterns in the sound between loops, but not necessarily

<sup>3</sup>Nightingale Woods is an inner city woodland in the centre of Bristol UK.

able to pick up longer gradual changes over the course of the study.

Peculiarities in the sound drew my attention to material phenomena that I hadn't noticed. The brush wore away at the charcoal pattern, and the louder patterned harmonics took around 5 minutes to decay to a lower amplitude that felt like it had stabilised.

I left the machine running long after the study felt like it could have been over. The charcoal pattern had stained the paper, so there was a ghost image that stayed for the duration of the study, and an audible faint rhythmic harmonic pattern remained. During the last 35 minutes of the study, slower, more emergent qualities of the loop were observed.

I gradually noticed a dip in the sound followed by a quick harmonic swell. Looking at the visual pattern, I realised that the charcoal was gathering at the lipped join of the paper loop. This created a strip of black that made a dip in the signal. At the time this felt very noticeable, but re-listening to the clip subsequently the dip in sound does not sound so pronounced. Perhaps this is because at the time I had stayed with the loop for 30 plus minutes so I was more attuned to small details in the sound.

*... The join is often a point of sonic interest in the tape loop. It is a point of material break, often made with a sellotape splice, where the signal behaves and is read differently. This join is not a straightforward gap. It creates sonic peculiarities at its borders, and is often the loudest point in a tape loop as the magnetic material is stuck down where at other points it flakes away.*

Another noticeable behaviour of the charcoal loop is the additional harmonics created by the quality of the brush. The brush had seen better days, and was picked up from a communal area of a shared studio. The quality of the bristles were not noticed at first, but as the study progressed, I became aware that the brush was wearing away at some parts of the pattern more than others, creating a striped fluctuation of erasure that resulted in an emergence of high harmonics in the output signal. Erasing a signal doesn't always mean taking something away. In this instance a new feature was added to the signal. The charcoal was displaced, not erased, and a new pattern emerged.

The following audio captures the first five minutes of the charcoal can loop and a section from around 38 minutes, respectively.

- ▶ Charcoal first 5 minutes
- ▶ Charcoal approx 38 minutes in

The linked [video](#) captures the process visually and sonically.

## 6 Conclusion

The study and artistic work presented in this paper explores how the use and ideas, found in old and obsolete technology, in magnetic tape, are being utilized to develop musical practice and create an array of new sounds. These notions support and strengthen the NIME community's interests and suggest there is a great deal of opportunity to invest in deepening our understanding of how musicians and designers approach old technology and remake it anew.

More generally, through considering the entangled nature of musical practice and working with materials, such as magnetic tape, we can presume that work shared through communities such as NIME is a key focus in the practice of digital lutherie and the design of new instruments, that merits continued investigation and development. Opinionated design can be seen as a core philosophy in the design of DMI, but also can lay groundwork

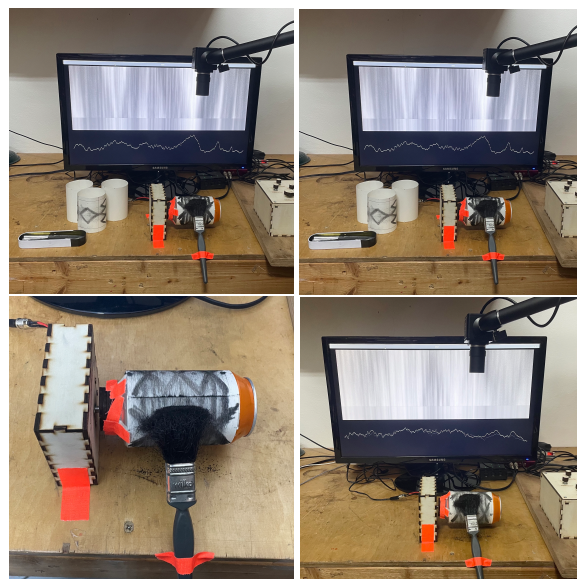


Figure 8: 'Charcoal pattern' slowly disintegrating.

for a more ethical approach to instrument design and building, that aligns directly with NIME's Code of Practice.

Drawing on our findings we have outlined a design space for exploring 'a circular making practice' for building new musical interfaces. This is an exciting area of future research that tightly integrates sustainability into the creation of digital technology in general and more specifically digital musical instruments. Inspired by how musicians work with tape and more generally by the maker/hacker movement, this practice emphasises utilising technology in a minimalistic way that serves the intended function whilst also factoring in other social priorities. We aim to prioritise democratising technology creation without increasing environmental impact by requiring approaches to include composability/ recyclability that can be achieved at home, not through commercial processes, for example. These sparks connect closely with the emerging area of unmaking [48, 50] and we expect to find threads that can be woven between NIME design and that of circular making.

Finally, building on this work more detailed study of how musicians use tape as part of their musical practice seems needed. We are planning to interview a range of musicians about their practice, along with a performative approach of collecting (im)perfect pictures through the process of Snaplogs [7]. Participants will be provided with prompts asking for them to capture pictures that reflect some part of their workflow, along with a short textural response.

An important area of future work, one that we have not followed within this work, is how mediums such as tape fit within the landscape of media preservation and obsolete formats [14–16, 47].

## 7 Ethical Standards

This work was ethically approved by our university's Faculty Research Ethics Committee. Participants volunteered to take part following a call on forums, direct email correspondence and referral of peers and community members. All participants were provided an information pack detailing the study and the use



of any data generated before participating and signed a consent form to take part. Participants had the right to withdraw at any time throughout the study and were also given a period to review their transcripts and redact any information before its publication.

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