Pop Live Coding Encounters: Reflections on Practice

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ABSTRACT

Live coding started as a grassroots computer music rebellion, and has predominantly grown around academic institutional interest and support. As a radical field, it has so far largely circumvented the trappings of the music and academic industries. However, its ever-increasing popularity leads inevitably to the question; what happens when live coding encounters pop music, and vice versa? We provide personal reflections as pop live coding practitioners, from our experiences mainly taking place across the United States and Europe. In doing so, this paper seeks to open up a discourse on pop live coding - live coding of popular music, for a general audience, onstage, in the studio, and online. We discuss the motivations for bringing these worlds together, and how our practices have developed over the years to work with the needs and expectations of non-academic, non-live coding audiences. We also reflect on the tensions and challenges that arise when communicating live coding aesthetics, idioms and values on a larger scale, particularly in social media. We hope that by sharing our experiences, others will be encouraged to push pop live coding further, engage with broader audiences around the world, and contribute to the much-needed discourse around this timely topic.

1 Introduction

Interest in live coding does not appear to have peaked. Anecdotally at least, our impression is that the number of people aware of live coding and participating in it one way or the other, has never been higher. While there might not be any live coders storming up the pop charts or record labels begging for their signatures just yet, we nevertheless feel that this is an important topic for the community to start discussing, and better to start sooner rather than later. Every musical genre and artistic movement that ended up being labeled as pop - from Blues to Trap - underwent significant transformations as a result of wider interest attracting new and different types of people, not to mention the commercial investment and exploitation that followed. Framing live coding as a values-based community and not simply a technological one, we believe it's important to ask: what could live coding gain from increased popularity, what might it stand to lose, and how can the community come together to emphasize the gains over the losses?

To our knowledge, this is the first paper in the live coding literature to address pop live coding directly, though we hope it is by no means the last. Rather than attempting to survey the field or theorize on the topic, we have chosen to work with the data that we have, and provide reflections based on our combined 15+ years of artistic practice. To complete our reflections, third author Gus Lobban (Kero Kero Bonito, Kane West) provides additional commentary from a pop producer perspective.

In the next section we attempt to describe what pop live coding is, with reference to live coding and pop music literature. We then describe motivations for pop live coding, from our own personal perspectives, and then from the perspectives of live coders and pop musicians. The subsequent three sections discuss pop live coding in performance, studio production, and on social media. Finally, we reflect on the themes that emerged out of this work, and outline areas of interest for future research.

2 What is Pop Live Coding

We acknowledge that, like the term "live coding" itself, "pop live coding" can have various interpretations and meanings. In this paper, we offer a working definition to provide a foundation for our discussion and to help frame the ideas presented. However, we actively encourage and embrace diverse perspectives on what pop live coding could entail, as these multiple viewpoints contribute to the richness and potential of this emerging practice.

Pop live coding is about connecting live coding to new audiences, specifically those with no coding background or interest in coding. It encourages using live coding to create music and performances that appeal to a wide audience, through musical taste and awareness of contemporary currents, through audience interaction centered around entertainment, surprise and

joy, through the accessibility of code as a medium, and through collaboration with non-live coding artists. We see play as a unifying concept that grounds pop live coding in outward social engagement, creative co-exploration, and light-hearted risk-taking. With respect to code as an art medium, play creates fluidity, dissolves boundaries, and loosens definitions and preconceptions. The message of pop live coding extends beyond "you can make music with code," "anyone can code," or "code can be creative" - simply, you can do anything with anything if you play.

2.1 Engaging With Pop Through Code

Engaging with live coding in a pop context requires being self-aware of how code is perceived by the general public. In popular media, the main references that are culturally associated with code are mostly negative: hackers and hacking, technosolutionism, tech bros and Silicon Valley, neoliberal capitalism, privacy invasion, surveillance, identity theft, and labor automation. These are both the first hurdles to overcome in communicating with code, and the factors to be aware of and sensitive to when bringing code into spaces where it may be perceived as insensitive or even threatening. These connotations are in stark contrast to those that the live coding community uplifts and celebrates: neurodivergence, community, open source, public commons, pedagogy, culture, craft and art. Also absent from the popular image of code is the long history of code art, aesthetics and poetry (Cox and McLean 2012).

We believe that in this differential of perception there lies a latent potential for pop live coding to bring powerful and liberatory ideas into the public imagination, also creating space for to explore alternative identities and reformulate ideas of personhood (Geffen 2020). At the same time, we must be aware of the shadow side of pop and its potential negative influence on live coding. After a century of recorded music, today's artists operate under increasing precarity, where a handful of artists make a majority of the revenue, and the few remaining conglomerate music groups leverage new technology such as generative AI to consolidate their power (Morreale 2021). However, as AI has also been making its way into more live coding practices and tools (Paz and Knotts 2024), we again see an opportunity for live coding to bring fresh ideas to the mainstream, and subvert entrenched power dynamics.

2.2 Process Versus Product

We agree with the authors of the recent book "Live Coding: A User's Manual" (Blackwell et al. 2022) that live coding can not and should not be rigidly defined, and pop live coding is no different. Nevertheless, their initial description of live coding will be familiar to anyone who has attended an Algorave[1]:

> Live coding has been described in terms such as writing software in real time, changing a program while it is running, projecting the screen for the audience to participate in, writing as an improvisatory practice, composing live using textual notation, changing rules while following them, conversational programming (conversing with the computer in its own native language), thinking in public, and creating and using bespoke systems tailored for on-the-fly or just-in-time performance. (ibid, p. 2).

This quote highlights the heavily process-oriented nature of live coding to date; it is about coding, changing, projecting, writing, composing, thinking and creating. An immediate contrast can be made with pop music, where the product is the main focus. One definition of pop live coding could propose that live coding is process art and pop music is product art, and pop live coding is where these two worlds meet. This is a useful starting point, although it's worth briefly considering the ways in which it oversimplifies. The end product for an Algorave performance for example is in part to make people dance (or at least have a lot of fun trying). Likewise pop musicians and fans alike take great interest in the stories of how their favorite songs come to be.

In the context of pop live coding, pop puts an emphasis on the ability of the final product or performance to exist independently from the process by which it was created. Relative to live coding, this may mean the listener may be unaware of the live coded process entirely. With live code performance it may mean there is no visual setup present with the performer (discussed further in Section 4). With pop, there is no guarantee that the audience has a baseline understanding of the craft, whether listening or watching. Thus, concision is an imperative focus for pop live coding — relevant equally in duration and content. There is always an underlying emphasis on the process amongst live code artists and this bears no less significance with pop live coding, however pop live coding may take more time to reveal that process to their audience. Regardless of the indispensability of that process to the actual artist's work, pop live coding takes into account the knowledge of the audience and delivers a product respectively.

[1] https://algorave.com

3 Motivations for Pop Live Coding

Why has pop live coding only begun to emerge recently? Now that it is starting to emerge, who might be interested in pursuing it, and why?

3.1 The Slow Emergence of Pop Live Coding

The emergence of pop live coding as a distinct practice within the broader live coding community has been a gradual process, influenced by various factors. One significant reason for the delayed appearance of pop live coding is the diverse range of interests within the live coding community itself. Live coders have been exploring a wide array of fascinating avenues, such as poetry, weaving, dance, data visualization, and hacking, each attracting its own dedicated audiences. Additionally, personal motivations play a role, as some live coders may have little to no interest in creating music for a large audience, focusing instead on more experimental approaches that cater to their individual creative pursuits.

Another factor contributing to the slow rise of pop live coding is the historical gender imbalances within both the pop and live coding communities. As with many STEM-adjacent subjects, live coding has been predominantly male-dominated since its inception. In the music industry, women have often been urged into roles as vocalists, while men have been encouraged to become producers. Pop music also tends to include elements that are inherently humanizing and accessible, foregrounding vocals and catchy melodies, elements that have been somewhat antithetical to the foundations of computer music, which often emphasizes randomization and other experimental techniques. Thus, combining these opposing forces to create live coded pop music requires a deliberate effort. Unsurprisingly, progress in vocally-led live coding has primarily come from women, such as Emma Winston (Deerful)[2] and Melody Loveless[3], highlighting the importance of diverse perspectives in the development of pop live coding.

3.2 Why Pop Live Coding

What are the motivations for engaging with pop live coding? We offer four different perspectives for the reader to consider, first attending to live coders approaching pop music, and vice versa. We then supplement these with our own personal accounts.

3.2.1 Live Coders Approaching Pop Music

For live coders interested in pop music, we believe there are two basic questions regarding creativity or artistry: do you gain creative fulfillment from making and listening to pop music, and do you enjoy collaborating with artists who are potentially experts in their respective musical fields, but have no idea what live coding is? If the answer to both questions is yes, the next question is the financial one of whether you seek a living from making music, because pop is also of course an industry. Though a behemoth unto itself, the music industry can potentially provide live coders with a more direct form of income compared to academic grants/salaries, artist residencies and other forms of professional labor that do not revolve around musical artistry. Finally, we believe it's important to consider how through engaging with pop, the live coding community can expand its already noteworthy impact on sociotechnical discourse, and become sustainable for a more diverse range of artists.

Though there are 42 artist expositions in Blackwell et al. (2022), only three of them mention pop music, and one of those is the second author of this paper. Despite this, we know we are not the only ones interested in pop in this community. There are many upcoming pop live coders out there besides ourselves, and Appendix A is our attempt to provide names and links to pop live coding artists.

3.2.2 Pop Musicians Approaching Live Coding

For pop musicians interested in live coding, there are also some starter questions to consider: does code as musical notation and instrument appeal to your tastes, and do you desire to break through the artificial walls imposed by most music software, and have a more direct relationship with algorithms, computers and their history? Though novel to many, live coding is one of the oldest forms of computer music, with a dense trail of literature to engage with, that all relates heavily and consequently to the state of contemporary technology in society – a common theme in pop. As the proceedings of this conference[4] show, live coders are also at the forefront of creative exploration of artificial intelligence in music. Though we

[2] https://deerful.com
[3] https://www.melodyloveless.com
[4] https://iclc.toplap.org

enjoy pop performances that rely on playback of recordings, performing with code introduces risk and vulnerability that is refreshingly honest and potentially liberating.

3.2.3 DJ_Dave

My interest in pop music production preceded my introduction to live coding in 2019, but combining the two was what ultimately led me to discover a desire to pursue a music career. The structure that live coding brings to music production and performance revealed a way of creating that I did not know previously was possible — a type of analytical and methodical approach that is not always immediately associated with a creative process, and which is exciting for someone like myself who thrives in structured and organized environments. I also was excited by the prospect of entering a pop space within live coding that had not yet been widely explored. With the advent and popularization of so many new electronic music genres and modes of production, it seemed timely and appropriate for pop live coding to exist and be popularized. It almost seemed like electronic music producers were trying to mimic live coding techniques and outcomes in their live production, like the "show your code" concept, which seems to be reflected in more artists putting their process on the forefront of their live performances (Beaven, O'Dair, and Osborne 2018). Even the aesthetics of underground live shows seemed to mirror what live coding embodied organically, like the actual aesthetics of code and the visual element of having hardware on stage. The existence of live coding in these pop spaces seemed inevitable and already welcomed, and all of these obvious opportunities were extremely exciting to me as an aspiring musician and live coder.

3.2.4 Lil Data

Around 2012 I witnessed Alex McLean performing with TidalCycles, and was instantly convinced that this was the answer to my increasing frustration and boredom with the digital audio workstation (DAW) as a creative tool. By 2013 I was part of the pop community centered around the PC Music label and later evolving into the hyperpop genre, and my mission became to bring these two (at the time) obscure worlds together. Pop to me is an ideal vehicle for smuggling strange ideas into the public consciousness, and the TOPLAP Draft Manifesto[5] was full of wonderful ideas that I wanted to help disseminate. At the same time, I personally wanted to know what it would feel like to experience pop as code, and to explore how code's unique affordances could be applied creatively within the constraints of the pop formula.

4 Pop Live Coding in Performance

In live coding there are certain performance strategies that are commonplace, like projecting your code, collaborating with visual artists, and improvisation. In pop live coding, there is no assumption of a base knowledge amongst crowd members, and jumping into a performance without the initial steps to bring the audience up to speed can create a divide between the audience and artist. Explaining some aspects of the performance early on in a live show tends to make a performance more enjoyable for the audience, even when that explanation may only cover a part of the process. Even when taking extra care in this way, it is not uncommon for audience members to mistake the projected code for a 'visual', i.e. a pre-recorded video with only an aesthetic relation to the live music being heard. For these reasons, storytelling in pop live coding is extremely valuable across all areas of the creation and release of music, and it is especially important in live performance. In this section we share examples of how we have tailored our performances to general audiences witnessing live coding for the first time, not as recipes to copy (though we welcome this) but to convey an overall sense of care for the audience.

4.1 DJ_Dave

After early performances in my career, I enjoyed asking audience members and friends what they did and did not understand from my set and what their favorite parts were. I have since used this type of feedback to create introductions and dynamic sections of my sets where the main goal is to inform the audience, and I have also rewritten parts of code in the places people enjoyed the most so the connection between the code on display and the music they hear is more intelligible.

In my opening set for the JPEGMAFIA and Danny Brown tour from July to September of 2023[6], my main focus of my set was to explain how the code they were seeing on the screen translated to the music they were listening to. I began my set with an empty screen and wrote out the main function of the track live, starting with a short sample playing every whole note, then changing the rate, then writing a pattern for it to follow. This allowed the audience to easily read the screen, and understand that the sample, which was followed by "sleep 1", was in fact resting for one beat after every play.

[5] https://toplap.org/wiki/ManifestoDraft
[6] https://www.youtube.com/watch?v=oLW_oQJC6aM

```
live_loop :DJ_DAVE, sync: :met1 do
   f = 0.05
   16.times do
      sample sss, "texture_18", rate: 1, finish: f if pattern "x--x--x--x--x-x-"
      sleep 0.25
   end
   16.times do
      sample sss, "texture_18", rate: 1.5, finish: f if pattern "x--x--x--x--x-x-"
      sleep 0.25
   end
   32.times do
      sample sss, "texture_18", rate: 1.2, finish: f if pattern "x--x--x--x--x-x-"
      sleep 0.25
   end
end
```

Writing the code live allowed enough time for the audience to read and interpret as I added more elements. Once the main function was finished, I scrolled down in the file to reveal the rest of the song had already been coded — my goal here was to connect the simple code they had been brought to understand with the complexity of the tracks they were about to hear. After beginning with this type of comprehensive introduction, the vast majority of viewers that I had the chance to speak to were able to understand that the code on the screen was the source of the music they heard, thus enhancing their relationship with the live coded elements of the performance and my artist project as a whole.

4.2 Lil Data

The most important aspect of pop live coding from my perspective is also perhaps the most obvious, that the musical structure has to flow and change at the same pace as pop music does. Obvious though this may be, this goes directly against what we might call a traditional live coding set, where layers of music are improvised, tweaked and layered one at a time, at a pace constrained mainly by typing speed (i.e. much slower than regular pop music). While I have found that it is possible to do this kind of musical iterating within a piece momentarily (and I liken this to the solo or instrumental break in a pop song), if it happens too often, the energy will dissipate and the audience will be lost, and it's hard to win them back from there. This fundamental constraint influences all of my decision-making; set composition, song duration, code structure, algorithmic pattern writing, sample library curation, transitions and so on.

The second main constraint I pay the most attention to is context. I have always strived to learn as much as possible about the gig location, lineup, set times, and venue look and feel. This helps me to understand who the audience are and where they will be when I begin, and what opportunities I might have to connect with them. Context informs the energy peaks and troughs, the balance of surprise and continuity, when improvisation might be effective, and what the main sonic and emotional landmarks should be. Having a framework like this has been essential for me, even though experience has also taught me that it's the smaller details and the unexpected, that often become the most salient moments.

At most of my pop shows I have not had access to a projector, and I have to rely almost solely on the quality of my musical output instead of sharing the process. Sometimes though it can be useful to still try to convey to the audience that I'm performing live in an unusual way. This can be achieved by briefly improvising near the beginning. In TidalCycles this can be as simple as doing what I call a "`d1 bd solo`", which can end with e.g.:

```
d1 $ iter 4 $ striate "<2 3 4>" $ sound "bd*256" # pan (slow 2 $ sine) # gain sine
```

Already this demonstrates liveness sonically (and hypes the crowd up with crazy kick drums), since this pattern would not be part of a regular song, and also could not be improvised in real-time using familiar tools. In smaller venues, performing in the crowd can sometimes be an option that allows them to see your screen (though it's amusing how many people think you are able to chat with them while playing!). You can also (cabling beware) momentarily tilt or turn your laptop to face the crowd so they can briefly see what you're looking at.

There are other subtle ways of breaking the ice with a pop crowd using code/text. A classic is writing `bpm 100000000000000...` which is both highly legible to a general audience, and yet they can't predict what is going to happen, since most tools have a maximum tempo of 999, and almost no one has heard music that fast before. Similarly, high-level variables with familiar names also invite people in (e.g. `let mix = [1,1,1,0]` as a four track mixer at the top of a file). An idiom that many live coders do is to write comments in real-time for the audience to read, which is a fun way to do "crowd work" (I sometimes do a variation of this using text to speech synthesis via the say command on macOS). Code comments can include ASCII art, song lyrics, emojis, and all sorts that can resonate in various ways. Deliberately crashing your computer is another fun, somewhat risky way to engage a crowd.

4.3 The Live Code Edit as a Bridging Tool

We have found that having a pop audience relate to you musically is another important element of pop live coding, and one way we approach this is through live-coded edits and remixes. It may sound simple, but don't underestimate this powerful tool. By taking a song people are familiar with and adding live-coded elements and performance techniques, the audience has a constant that they can reference to when noticing the changes in the code, relative to the changes in the familiar song. One way DJ_Dave achieves this is by recreating a main melody from a song in Sonic Pi, so the melody is recognized but the synth used is slightly different, and creating a remix of the track around that[7]. Lil Data has a playlist of edits on their YouTube channel[8].

5 Pop Live Coding in Studio Production

5.1 DJ_Dave

My experience with collaborative pop studio production is constantly progressing, but in working with different pop vocalists, producers, and instrumentalists, I have developed some techniques to make these sessions flow smoothly and also encourage the best possible creative outcome given the unique and often unprecedented collaboration.

I have two main methods of approaching a session, the first being to approach a session with other artists the same as I would approach a session alone, and allow the sporadic nature of the creative process to inspire and inform our output. In these instances, the other artist(s) tend to adjust their ideation time (time to write melodies, lyrics, and additions to the production) versus creation time (actual recording those vocal or production ideas) according to the flow of my process, and we use their lack of familiarity with live coding to inspire each of our own creative output. When I work alone, I often use the variability and randomness of the code to guide me in different creative directions, and in sessions I employ the same type of process in an attempt to not only inspire my own next steps, but those of my collaborator(s) as well.

In other, more structured instances, I prepare myself before sessions to be able to follow the workflow of my collaborators, often starting with "skeleton" files that cut back on coding time in the session and allow for a more organic process (a complete example is given in Appendix B). These types of sessions are more labor intensive, given the amount of preparation and quick coding that must happen to make them run smoothly. Some benefits to this process are often a more authentic and truly creative output from the other artist, which comes from prioritizing elements of their most comfortable creative environment, as well as a more singularly focused session, because the spasmodic coding workflow has already been reduced to its most basic necessities. This workflow also often changes the source of inspiration from the code and coding process to live instruments, DAW production, the artist's writing process, etc, which are often more familiar processes for other collaborators.

5.2 Lil Data

Most of my experience in music production with live coding has been as a solo artist, producing my own music. As described in Section 3.3.2, I initially wanted to leave DAWs behind, but I eventually came back for three reasons. First, I found composing at a high-level with code overwhelming due to the lack of a timeline or equivalent abstractions. Second, I wanted to make use of audio post-production tools (effects, mixing, and mastering) to polish the product. And third, it was a gateway back into collaboration with non-live coders. However, my early attempts to combine live coding with music production were also overwhelming, due to the tension between the tantalizing possibilities for going backwards and forwards between coding and producing, and the inevitable loss that occurs going from one to the other, along with the additional workflow friction introduced.

Eventually I realized I was never going to land on one specific workflow, and learned to soften around the idea of each piece of music having a different process. Puzzling away at these tensions eventually led to my debut album Folder Dot Zip (FDZ), released on PC Music in February 2019, which I think of as collected sketches exploring the different ways of combining live coding and music production. Along the way, I had also started picking up credits for 'Additional Production' (there's no live coder credit yet!), most notably on Track 10 by Charli XCX[9]. I found sound design to be the lowest hanging fruit for what I could contribute to pop sessions. Focusing on sound design bypassed the high-level composition issues mentioned above, and it was easy for me to use Tidal and SuperDirt to make sound-patterns that music producers had not heard before, which was exciting for them.

[7] https://youtu.be/NbSLQbikFyo?t=1302 (starting at 21:40)
[8] https://www.youtube.com/LilData
[9] https://www.youtube.com/watch?v=2DLGZHo4Ygo

Composing live in the pop music session with other artists remains an underexplored area in my practice. I see it as a form of performance, one that I find much more intimidating than being onstage. I still long for live coding systems that either integrate better with DAWs, or replicate some of their functionality for composing with visual abstractions of time, with bi-directional editing between text and graphics. That would take the technical stress out of the equation, and allow me to focus on the social and musical aspects.

6 Live Coding from a Pop Producer Perspective

To complemenet our personal reflections and broaden the perspective of this paper, we invited pop music producer Gus Lobban (Kero Kero Bonito, Kane West) to comment regarding performance and studio practices. Gus graduated from Music at Goldsmiths University having taken special interest in computer music topics, and has been aware of live coding for some time, having witnessed one of Lil Data's first pop live coding performances in 2014. The rest of this section is Gus' words.

There is rich potential for live coding in pop music. Live coding is a pathway to realtime sound manipulation, a valuable tool in the areas DJ_Dave and Lil Data highlight and beyond. Modern pop (particularly electronic) music performance is still reliant on direct audio playback and lacks responsive performance options in comparison to traditional instrumental musics; live coding's low level manipulability clearly embodies this responsiveness. In pop songwriting and production, where creative reactivity and communication is expected to be notoriously fast (especially at the corporate commercial level), live coding represents a tantalising alternative to DAW-based editing and improvisation; perhaps one day TidalCycles' instant processing will be as commonplace in songwriting camps as obstructive audio comping tasks or vague vocal jamming are now.

Both DJ_Dave and Lil Data describe how live coding's tropes variously inspire excitement and confusion in audiences. While I wonder if live coding's most popularly recognised trademarks - projected blocks of code, performers focusing on laptop screens, iterative drum patterns - risk losing their novelty in pop music's fickle aesthetic churn, the fundamental process of live coding remains innovative, and it is not hard to see how live coding could be implemented further in pop music. Coding's inherent interoperability opens the door to technologies that are highly desirable in pop music performance, like remote networking and I/O formats such as MIDI and timecode. There are major areas in pop music where live coding's presence could be expanded; DJ'ing is one example, where the deceptively complex computation required to satisfactorily implement audio processes like "master tempo" (preserved pitch) changes, logical music theory and famously expensive equipment could all be taken advantage of by live coding's accessibility, speed and low level control.

Live coding's presence in pop music feels like it may still sit at a primitive stage. However, such is coding's nature that it will only take enthusiasts with computers and reference manuals to advance the field, potentially changing music in the process and redefining our conception of programming's uses. DJ_Dave and Lil Data have already set out on the path.

7 Pop Live Coding in Social Media

Here we focus on two platforms in particular; Lil Data relates their experience of Twitter (X), and DJ_Dave offers an account of TikTok. We also describe our approaches to integrating live coding aesthetics into music videos on YouTube.

7.1 Lil Data on Twitter (X)

Twitter (X)'s troubled history and current death throes aside (important topics that we don't have room for here), there are two main what I would call 'pop live coding moments' that I've had on Twitter (X) that I think are worth discussing, and they are both screen capture videos of live coding. The first is an edit of Vroom Vroom by Charli XCX[10], and the second is a partial cover of Avril 14 by Aphex Twin[11] (full code listings available in Appendix B). These two posts have received the most engagement of anything I have posted on the platform, and I think there are some key reasons why.

The first post was an edit (see Section 4.3) that I wrote for a gig, but afterwards I realized it brought together many things I'd been chipping away at for years, and recorded a single take of the track to post online. I cut the most iconic samples out of the original and composed a new hook from the bassline, and the rest of the track simply supported these hooks in a straightforward build and drop format. In the drop, multiple layers change simultaneously, and I achieved this via the multiple cursors feature of my text editor. After the drop, I do an improvised "code solo" working on the vocal layer. As far as achieving pop in code form, this remains the closest I have come. It clearly resonated with hyperpop fans too due to the popularity of the original, I think also because I'd managed to pull off an edit of it apparently without ruining it!

[10] https://twitter.com/lildata/status/1142238053861396480
[11] https://twitter.com/lildata/status/1250158507367817216

Among Aphex Twin fans, April 14th is known as "Aphex Day" after the song Avril 14, and people post covers of the track which vary widely in their level of completion and seriousness. I transcribed the main hook into Tidal through trial and error, but recorded myself writing it from scratch as if for the first time, i.e. performing the code-listen-code loop of learning how to play the song. This is something I wanted to share, to illustrate one of the most enjoyable aspects of live coding, which is the conversation between you and the code. I wanted to capture a part of the live coding process that doesn't usually make it into the final product. This required editing the video in a particular way to fast forward some typing but keeping the audio continuous, something that could not be achieved in real-time. Apart from offering a fresh take on the meme itself, I believe the performative act of learning by writing supported by a continuous musical edit, was what allowed this post to resonate.

7.2 DJ_Dave on TikTok

During the COVID-19 pandemic, social media was for me the most available and reasonable approach to finding a community and engaging with other artists. At the time, I took to TikTok and began posting videos of me coding in Sonic Pi on my laptop[12]. Quickly, I found social media to not only be a streamlined way to connect with listeners, but also a validating experience as an artist entering uncharted sonic territory. I began using the hashtags #sonicpi, #algorave, and #livecoding on all of my videos, and soon became synonymous on TikTok with live coding, simply because I was the first live code artist most of these viewers had ever encountered.

Once live shows resumed, I began posting videos showing what an "Algorave" looks like, which is where mixed reviews started coming in[13]. On one hand, people were excited to see such a unique and unexpected craft be enjoyed in New York City venues nonetheless, and on the other hand people who were frustrated at the complexity of the performance were quick to judge and wrote the experience off as "soulless," and "the least enjoyable show [they had] ever seen". Contrarily, the majority of feedback was much more positive, calling the performances "fascinating" and expressing a great interest in seeing the process live.

It comes as no surprise that social media platforms allow space for ridicule, so I looked at most negative comments as their true meaning, which is that the storytelling in my content was lacking for this new, "pop" audience. On each video, I would take feedback, presented both negatively and positively, and use it to inform not only my storytelling on other TikTok videos, but also in performances, songs, artwork, and my general presence online. Taking from other friends' approach to online feedback, I made sure to consider only the helpful elements of negative comments and never take personally the tone, or any comments that were altogether unhelpful. TikTok has changed drastically in the past year, however, and I believe it has become a toxic incubator for new artists because of the inevitable and singular aim of virality. As with any social media, I believe it is important that artists use them to their benefit and disregard elements that can cause detriment to their work ethic, interest in their craft, moral interests, and community.

Social media should be a tool for artists to share their work in the way they intend their work to be shared, and oftentimes even the smallest update or edit to a social media platform can have great effects on an artist's ability to share their work authentically. Creating spaces in real life (IRL) for us to make and share art is more important now than ever, and I plan on continuing to use social media as a method of communication that will always come second to the art itself — which seems obvious, but an idea that is becoming less and less common in the music industry.

7.3 Pop Live Coding Music Videos

Another pop tradition that we have both engaged with is the music video. Here are some brief notes about two examples that use code in their aesthetics, differently to how they are usually presented in live coding performance.

7.3.1 Lil Data - Burnnn (2019)

In this video[14] directed and animated by SCOTTY2HOTTY69, code is first introduced in the form of a caret appearing as a Kubrick-like monolith in the middle of a retro racing game styled landscape. The code of the track is then printed line by line, choreographed in sync with the vocal sample that leads the track, almost to appear as if it's being sung. The idea of singing the code was in reference to the lyric video, which was becoming more commonplace at that time.

[12] https://www.tiktok.com/t/ZT8gHWYm5/
[13] https://www.tiktok.com/t/ZT8brc8Ur/
[14] https://www.youtube.com/watch?v=qrTMkgpBia8

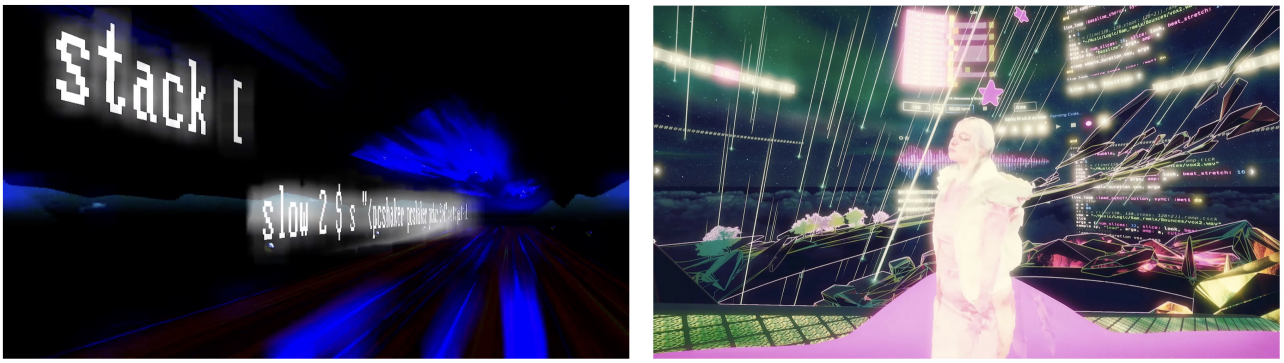

Figure 1: Stills from two music videos by the artists. Left: Lil Data - Burnnn (2019). Right: DJ_Dave - Array (2023).

7.3.2 DJ_Dave - Array (2023)

In collaboration with visual artists Char Stiles and Andy Rolfes, the Array music video[15] was imagined to visually embody different aspects of live code production, performance, and peripheral mediums. The setting, which was created in Unreal Engine by Rolfes and edited in glsl (GPU code) by Stiles (among other contributions), features my Sonic Pi Ruby code in the sky taken from the original track, and performance shots overlaid by code as well. The concept was to literally insert myself into this digital world, which we achieved with volumetric capture, courtesy of scatter's DepthKit. The video places lifelike footage in contrast to lifelike 3D renders throughout the video, painting a vivid image of what it might be like to step inside the sonic sphere of the song itself.

8 Final Reflections

In this paper, we have explored the multifaceted world of pop live coding, uncovering a rich tapestry of themes and considerations that underpin this emerging field. At the heart of our exploration lies the enduring tension between process and product, where live coding's focus on transparency often contrasts with the product-focused nature of pop music, where perceptions and expectations are deliberately manipulated as part of the art. This tension challenges us to rethink how we engage with our audience, leading us into the realms of storytelling and implicit pedagogy, crucial tools for making the complex world of live coding accessible and engaging. As we criss-cross this landscape, pop's hauntology (Fisher 2014) reveals the hauntological aspects of live coding—a practice that simultaneously feels anachronistic in its remediation (Bolter and Grusin 2000) of early human-computer interaction methods, and yet profoundly relevant in our rapidly evolving musical culture. This duality prompts us to question assumed future trajectories of music and culture, where live coding's aversion to frontierism meets pop's perpetual quest for the now and new. Within live coding's novelty factor lies opportunities for audiences to playfully reflect on their relationship with technology, and gain exposure to alternative and historical algorithmic cultural practices, as the Hybrid Live Coding Interfaces (HLCI) workshops[16] and Algorithmic Pattern Salon[17] have recently facilitated so well.

Our journey through live coding in pop contexts has revealed a delicate balance between the realities of our craft and the fantasies often portrayed in pop culture, particularly through music videos and other visual media. Pop live coding requires artists to materially engage with the cultural symbology around code, and employ fiction and magic to escape from its brutal pragmatism (Andersen 2017). This allows artistic identities in this space to extend beyond code and music, encompassing visual aesthetics, social media interactions, and broader narratives weaved around the art. At the same time, engaging with pop audiences brings its own set of challenges and opportunities, particularly in managing the complexity of performances to make them accessible and enjoyable. Literature in user experience (UX) design around progressive disclosure and in new musical instruments about complexity management (Pardue, McPherson, and Overholt 2018) and audience perception (Bin, Bryan-Kinns, and McPherson 2016) may benefit practitioners and live coding systems designers in addressing these issues. This experience is familiar to all live coders, as we are all frequently sharing our practice with those who are unfamiliar with it. In such scenarios its important to remember that we become ambassadors of this community, sharing a responsibility to not only represent live coding authentically (without being dogmatic) but also to consider the welfare and growth of the community.

Looking towards the future, pop live coding artists must consider how to effectively share their practices with one another, fostering a community that thrives on open collaboration and mutual support. We advocate for maintaining live coding's

[15] https://www.youtube.com/watch?v=w2s1DK1w3WI
[16] https://hybrid-livecode.pubpub.org
[17] https://salon.algorithmicpattern.org

"resistance to hierarchical control" (Blackwell et al. 2022), even as we navigate the complexities of broader industry engagement. This could manifest in exploration of new avenues of pop culture integration where live coding provides much needed subversive influences. The future of releasing pop live code is also an area to explore, or rather revisit, as live coding's rich history of code labels and USB/URL releases meets new audiences (an article on this topic is long overdue). Moreover, the increasing maturity of real-time browser-based interaction and DAW integrations points to exciting possibilities for pop live code collaborations. A crucial aspect of our journey forward involves considering how the community can grow and evolve from the prioritization of a pop audience, in ways it hasn't yet been able to. When navigating novel income streams for professional live coders, caution should be taken in regard to unsustainable commodification and exploitation.

In terms of research, the field of social media studies offers perspectives for understanding the nuances of sharing live coding across platforms like YouTube, Twitter, and TikTok. The idiomatic format of platforms like TikTok presents unique challenges, especially in terms of live coding embodiment (Baalman 2015; Salazar and Armitage 2018) and the limitations of screen recordings in conveying the essence of live coding. A deeper familiarization of pop musicology (Zagorski-Thomas 2014) could provide valuable insights into the artistic and cultural dimensions of pop live coding. In addition, fan studies[18] could reveal much about pop audiences' perceptions of live coding through their limited knowledge of the process, and their appreciation of aspects that are not inherently related to live coding. Finally, designers of live coding tools and systems have many opportunities to find new ways of communicating with ever-larger audiences.

9 Conclusion

This paper has drawn upon our personal experiences as practitioners predominantly in the United States and Europe, and has sought to unravel the complexities that emerge when the worlds of pop and live coding collide. We have offered an initial working definition that pop live coding is about connecting live coding to new audiences, specifically those with no coding background or interest in coding. We have shared insights into how live coding can bring fresh perspectives to pop music and vice versa, both onstage and in the studio, and how it can engage with audiences in meaningful ways online. We discussed the delicate balance between the process-oriented nature of live coding and the product-focused ethos of pop music, and how this interplay offers unique opportunities for artistic expression and audience engagement. The role of storytelling and pedagogy emerged as vital in bridging the gap between these two worlds, making the intricate process of live coding comprehensible and appealing to a general audience. We call upon fellow practitioners and enthusiasts to push the boundaries of pop live coding further. By embracing the challenges and opportunities presented by this intersection, we can engage with broader audiences worldwide and contribute to the discourse around live electronic music performance, and technology in society more broadly. We encourage reflection on how as live coders we project or settle for limited visions of what kinds of artistry can be achieved via code; by rigidly defining what live coding is and who it is for, we limit its potential and miss the chance to connect our ideas and practices to new audiences. In other words, by embracing play, we can go crazy and then pop, if that's what we want to do[19].

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11 Appendices

11.1 Pop Live Coders

How this table was compiled: either we know these artists personally and verified with them, otherwise we found the term 'pop' in their own descriptions. There are probably many more artists that identify as or with the term 'pop' in different ways, a surveying task we leave to future musicologists. Artists are ordered alphabetically.

[18] https://fanstudies.org/fan-studies-journals

[19] https://www.youtube.com/watch?v=KXdRl6Ml37I

Artist	Location	Link
Algobabez	UK	https://algorave.com/algobabez/
Alsoknownasrox	US	https://alsoknownasrox.com/
Celeste	US/CO	https://www.celestebetancur.com/
Deerful	UK	https://deerful.com/
Mico Rex	MX	https://algorave.com/micorex/
R Tyler	US	https://linktr.ee/rtyl3r/
v10101a	US	https://violand.xyz/

11.2 Code Excerpts

11.2.1 Sonic Pi 'skeleton' file

See Section 5.1.

```
use_bpm 140

live_loop :met1 do
  sleep 1
end

cmaster1 = 130
cmaster2 = 130

samp = "~/Desktop/dj_dave/samples/samples/**"
splice = "~/Splice/**"

define :pattern do |pattern|
  return pattern.ring.tick == "x"
end

live_loop :kick, sync: :met1 do
##| stop
  sample :bd_tek, amp: 2, cutoff: cmaster1
  sleep 1
end

live_loop :clap, sync: :met1 do
##| stop
  sleep 1
  sample splice, "BB", amp: 0.5, cutoff: cmaster1
  sleep 1
end

live_loop :hhc, sync: :met1 do
##| stop
  sample splice, "PMLB", amp: 0.4, cutoff: cmaster2
  sleep 0.25
end

with_fx :reverb, damp: 0.5, mix: 0.2 do
  live_loop :hho, sync: :met1 do
##| stop
    sleep 0.5
    sample samp, "hho_analog", amp: 0.5, cutoff: cmaster2
    sleep 0.5
  end
end
```

```
live_loop :arp, seed: 1, sync: :met1 do
##| stop
  use_synth :beep
  tick
  notes = (scale :a6, :major_pentatonic).shuffle
  play notes.look, amp: 1 release: 0.25, cutoff: 80, pan: [-0.5, 0.5].choose
  sleep 0.5
end

live_loop :sampleslicer, sync: :met1 do
##| stop
  slice = rand_i(8*2*2*2)
  slice_size = 0.125/2/2/2
  s = slice * slice_size
  f = s + slice_size
  sample samp, "vox", start: s, finish: f, amp: 1, cutoff: 130, pan: [-0.5, 0.5].choose
  sleep 0.5
end
```

11.2.2 Charli XCX - Vroom Vroom (Lil Data Edit)

See Section 6.1.

```
do
  let t = "cxvv"
  let build = loopAt 2 $ n "0" # s "cutcxvv"
      drive = loopAt 1 $ n "1" # s "cutcxvv"
  bpm 180
  let mx = [0,0,0,0]
  p (t++"vx")
    -- . fa 2
    $ drive # glo' (mx!!0) 1 0 # shape 0.4
    -- # ac (-1)
  p (t++"syn") . jux (# ac 0.03)
    $ build # glo' (mx!!1) 1 1
  p (t++"pc") . fa 1
    $ stack [
       -- struct "[t ~] [~ t _ [t? ~]]" $ n 2 # s "bddnb",
       -- jux (# ac 0.2) . struct "[~ t]*4" $ n 20 # s "ch2hh" # shape 0.5,
       -- fa "<1 [1 [1 4]]>" . struct "[~ t]*2" $ n 13 # s "pcmsn",
       -- struct "t*4" $ n 13 # s "pcmcp"
      ] # glo' (mx!!2) 1 2
  p (t++"bs")
    -- . struct "[t ~] [~ t _ [t? ~]]"
    . struct "t*4"
    $ n (sl 4 $ "[0 2]" + 2)
    -- $ n (sl 16 $ "[0 2]!2 [0 1 4 [3 2 1]] [2 2 2 [3 2 1]*2]" + 2)
    # s "cutcxvv" # glo' (mx!!3) 1 3 # rvb "0.3:0.3"
```

11.2.3 Aphex Twin - Avril 14 (Lil Data Cover)

See Section 6.1.

```
happy avril 14th :)))))))))))))))))))))))))))))))))))))))))))))
```

```
do
  let bars = 4
```

```
    key = "8"
    righthand = "[[4 -3] [0 _ _ _ _ _ 0]] [[-3, -8] [7 5 4 0]]"
    lefthand = "[0 9 12 16] [4 12 16 19] [5 12 17 19] [2 12 17 16]"
d1 $ slow bars
  $ stack [
    n (righthand + key + "<24 36>/2"),
    n (lefthand + key)
  ]
  # s "midi"
  # octave "3"
  # velocity "0.3 0.5 0.8 0.9"
  # sustain "[2 0.7]*4"
```

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