

ROGUE TWO

REFLECTIONS ON THE CREATIVE AND TECHNOLOGICAL DEVELOPMENT OF THE AUDIOVISUAL DUO—THE REBEL SCUM

— FEATURE ARTICLE —

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ABSTRACT

This paper examines the development of the audiovisual duo Obi-Wan Codenobi and The Wookie (authors Shawn Lawson and Ryan Ross Smith respectively). The authors trace a now four-year trajectory of technological and artistic development, while highlighting the impact that a more recent physical displacement has had on the creative and collaborative aspects of the project. We seek to reflect upon the creative and technological journey through our collaboration, including Lawson's development of The Force, an OpenGL shader-based live-coding environment for generative visuals, while illuminating our experiences with, and takeaways from, live coding in practice and performance, EDM in general and algorave culture specifically.

KEYWORDS: live coding; collaboration; EDM; audiovisual; Star Wars

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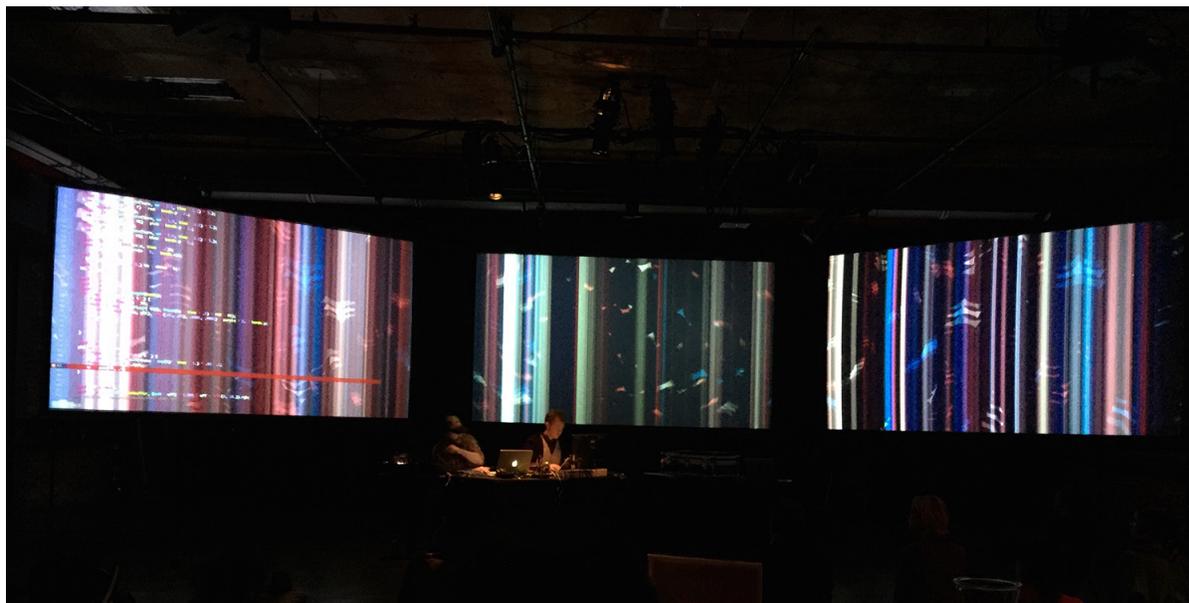


FIGURE 1. OBI-WAN CODENOBI AND THE WOOKIEE PERFORMING AT REFEST IN NEW YORK CITY (2015).

IN A GALAXY FAR FAR AWAY: 2014

Obi-Wan Codenobi and The Wookiee, AKA The Rebel Scum, AKA Shawn Lawson and Ryan Ross Smith, began as a parody wrapped in an enigma, with a more than passing interest in what was to us an exciting new field of performance practice: live coding. For those who may be unfamiliar with the term, Live Coding simply describes the editing of the source code or algorithm of a piece of software while that software is running. The practice of live coding has existed for some time, although a significant touchstone of sorts occurred in 1996 with the publication of *Supercollider* at the International Computer Music Conference (ICMC). This is followed by a coalescing of practices by Nick Collins et al. in 2003, Ge Wang and Perry Cook in 2004, Andrew Sorensen in 2005, the creation of Live Algorithm Programming and a Temporary Organization for its Promotion (TOPLAP) in 2004 and the accompanying book chapter with the same title in *Read_Me*: “In a new discipline of live coding or on-the-fly programming the control structures of the algorithms themselves are malleable at run-time. Such algorithmic fine detail is most naturally explored through a textual interpreted programming language” (Ward et al. 2004: 243). Eleven years after the publication in *Read_Me*, the first International Conference on Live Coding (ICLC) was held at the University of Leeds in 2015. ICLC and the related International Conference on Live Interfaces (ICLI), have been instrumental in our development as an audiovisual live coding duo, but our collaboration first started in a galaxy far, far away in Troy, NY.

In 2014, Smith was a graduate student at Rensselaer Polytechnic Institute researching Animated Notation, and Lawson, a Professor of Computer Visualization. After a couple years we floated the idea of an audiovisual collaboration based loosely on the Star Wars

metaverse. The first performance set we created, if it can be called that, was hastily thrown together for an evening of audiovisual performances held at the Electronic Media Performing Arts Center (EMPAC) in Troy, NY in April, 2014. Creating a system where Obi-Wan Codenobi could directly engage with his visual materials in real time was in large part the impetus for this project, and so in preparation, Obi-Wan Codenobi built The Force, a live-coding OpenGL shader environment that analyzed and reacted to the spectral content of The Wookie's sound.

Like live coding languages in general, The Force enables on the fly creation and manipulation of functions to elicit an (almost) immediate visual response. As Collins et al. note, "As long as the program has to be compiled in order to be able to run and to simulate a user interface, the time delay between creating the tool and using it seems to be very dominant" (2003: 327). Confronting this delay was an important consideration in the development of this project, and to that end, The Force auto-compiles and attempts to execute the shader code as the code is being written. Successful compiles are executed, unsuccessful compiles retain the previous successful compilation, and although there *is* a small delay time between typing, compilation and execution, the process feels nearly instantaneous.¹ This immediacy facilitates fast paced graphical changes in performance. The audiovisual synchronicity is based on the aforementioned spectral content from the sound. The Wookie's audio output is analyzed through a Fast Fourier Transform (FFT) process which is parsed into four bins. The four bin values are packed into a Vector4 data type for easy transmission to the graphics card and used to modulate properties of the imagery.

Smith had previously been working with a handful of standard fare software and hardware, including Max/MSP (visual programming/patching environment), Ableton Live, Pro Tools and Logic, modular and semi-modular synthesizers, amongst others. Smith's music traversed a wide range, from folk and pop to IDM and experimental, inspired by artists like Squarepusher and Aphex Twin from Warp Records, Venetian Snares and μ -Ziq from Planet-Mu, the Clicks & Cuts series from Mille Plateux, Telefon Tel Aviv, Autechre and many others. For those interested in digging, Smith had also collaborated on a remix of Public Enemy's "B Side Wins Again" with Jeff Snyder (aka Scattershot, the inventor of the incredible Manta controller). For The Wookie this project was a good excuse to return to some of the more beat and pattern-based music he had put on hold during graduate school.

With time being a significant factor, The Wookie assembled a fairly simple, tempo-based, sample-mangling patch in Max/MSP to process several earlier works of his in order to inject a sense of rhythmic regularity. Specifically, the Max/MSP patch randomly selected start and stop points within an audio file that adhered to some small, metered subdivision based on the predefined tempo and then looped these short sections. These sections were not necessarily defined by any significant transient content, but the repetitive nature of these micro-loops produced a sense of rhythm based on the tempo-dependent relationships between one another. In this case, The Wookie's musical selections for this performance leaned much more toward the *electronic music* side of things than *dance music*. Still, the musical characteristics of EDM had great appeal to us, and it is under this umbrella that The

Wookie's current music and many of the live coding musicians that populate the algorave scene operate within, including Mike Hodnick, Alex McLean, Renick Bell and many others.

Now, it must be noted that during our performance at EMPAC, nobody danced, and really, why should they? Smith had never DJ'd, but then again this certainly wasn't a DJ set, and the idea of bringing the party hadn't really crossed our minds. This was, first and foremost, a fun project by a visual artist and musician in a decidedly artsy space for engineering students who were hoping for Skrillex and Girl Talk mashups, at least until Smith's computer crashed. Still, we enjoyed the project and each other's company, and that was reason enough to reflect on our experience in order to determine a better and more artistically fulfilling path. The main culprit was the music. We felt that the relationship between the music and visuals did not read as cohesively as we had hoped, and in order to increase the likelihood of significant audiovisual correspondence over the course of a performance, a sonic palette containing more transient-rich and repetitive material would be built from the ground up, including slight changes to the audio interpreter in *The Force*.

In summation, this first collaborative attempt uncovered a wealth of flawed materials that were perfect for reflection, rebuilding and refinement and inspired a solid foundation of potential practice.

A NEW HOPE: 2015–2016

While our goals with *The Force* and *The Wookie's* sample-mangling at that first performance was to inject some rhythmic regularity, leave room for improvisation and generate cohesiveness between the audio and the visuals, the time constraints left us with little time to develop any compositional identity. And so, following our performance at EMPAC, and inspired by the audiovisual cohesiveness of groups and artists like Daft Punk and Squarepusher (specifically his face-melting performance at the Creators Project in San Francisco in 2012), which appeared more *fixed* than improvisatory, we created a more composed work: *Kessel Run* (2014). The visuals and audio for *Kessel Run* were developed in closer correspondence in order to produce a more cohesive audiovisual connection, and musically, leaned more heavily on strong rhythmic material and instrumentation more closely associated with EDM. *Kessel Run* led to a couple performances in Spain (Radical Db) and Portugal (ICLI). The *Kessel Run* video is linked here: [Kessel Run](#).

The performance in Portugal was particularly influential as it was our introduction to the algorave. An algorave describes an event in which performers deploy music generating algorithms of some sort (hence the "algo" prefix) in front of an audience, often controlled via live coding (Cheshire 2013). The performances frequently, but certainly not always, borrow heavily from various sub-genres under the EDM descriptor, from Gabba to Breakbeat (check out Neil C Smith's live-coding [AMEN \\$ Mother Function](#)) to more obtuse musical forms, although often replacing the visual pomp and circumstance associated with large-scale EDM events with the performers' projected code.

Inspired by our experiences in Spain and Portugal, and invigorated by the conceptual and social framework of the *algorave*, we created *Sarlacc* (2015) with the support of a residency at CultureHub. CultureHub is an Arts and Technology center in New York City with affiliations to La Mama also in New York City and The Seoul Institute of the Arts in South Korea. CultureHub provides residencies for artists, educational opportunities for youths and hosts festivals. During our time at CultureHub we used their multi-projector, multi-channel audio systems to increase the scale of our production and presentation.

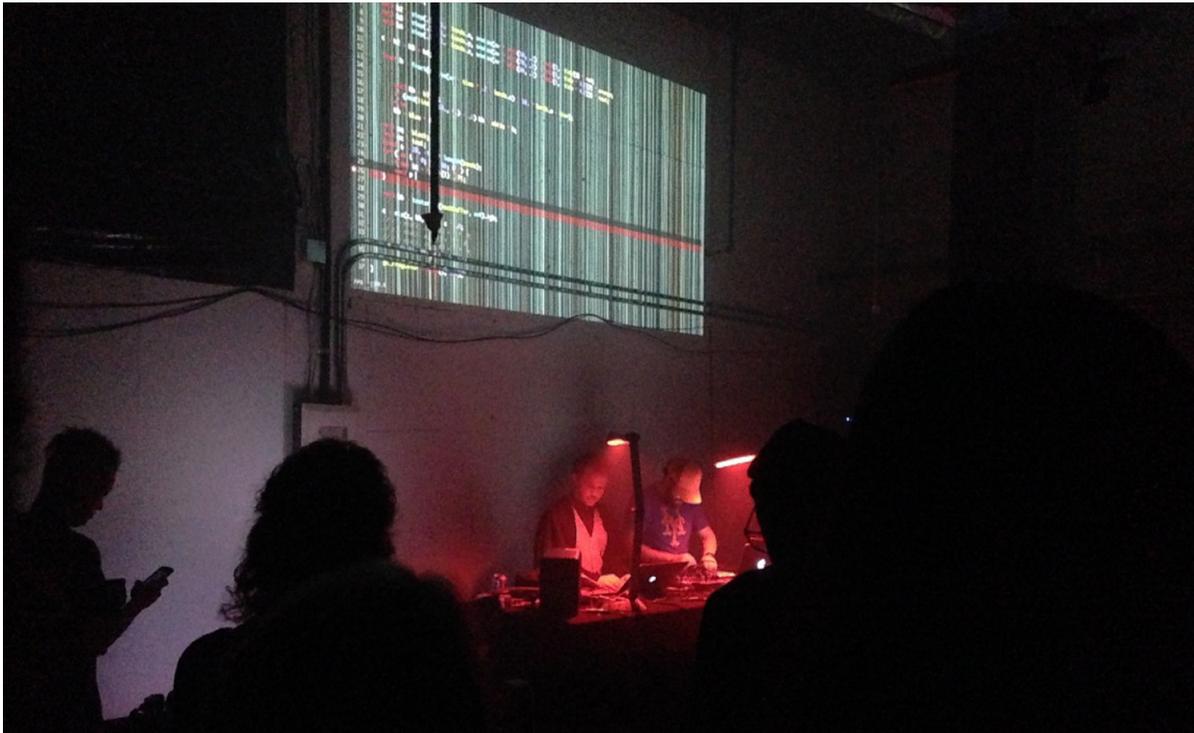


FIGURE 2. OBI-WAN CODENOBI AND THE WOOKIE PERFORMING AT ISEA IN VANCOUVER (2015).

At this point it is important to note that the audio components for *Kessel Run* and *Sarlacc* were not created and performed with code, but with Ableton Live. With Live, The Wookie retained improvisatory and structural control during performance while following a malleable set list of precomped fragments. In similar fashion, while the visuals were being live-coded by Obi-Wan Codenobi with The Force, he too followed a coding score so as to maintain a tight visual correspondence with the music and to hit structurally significant cue points throughout the set. We achieved the cohesiveness we had hoped for, but ended up feeling, well, a bit bored just playing the same stuff over and over. After rounding out our residency at CultureHub with a performance that included like-minded composer-performers Dataflow and Bevin Kelley (see Figure 1), we performed *Sarlacc* in Scotland (ACM CC), England (ICLC), Canada (ISEA), Germany (Generate!), the Netherlands (LPM) and several local US venues. The *Sarlacc* video is linked here: [Sarlacc](#).

EPISODE V: 2016

For our next project, *Owego System Trade Routes* (2016), (OSTR) The Wookiee began using the live coding language TidalCycles (McLean et al. n.d.) in conjunction with a modular synthesizer. The details of the modular rig are fuzzy as it has changed dramatically since that time, but the primary sound sources were the Make Noise DPO and Noise Engineering Basilimus Iteritas, sequenced by a Make Noise Rene, clocked by ALM's Pamela's Workout and modulated/modified by a series of function generators, LFOs and VCAs. The decidedly improvisatory nature of this work explicitly countered the fixed structure of *Kessel Run* and *Sarlacc*, while the TidalCycles elements retained the transient-rich, pattern-based rhythmic material. In this setup, the modular synth was not in any way synchronized with TidalCycles, but functioned as a standalone noise generator of sorts, influenced by, and influencing the behaviour of The Force. Video samples of *Owego System Trade Routes* album are linked here: [Owego System Trade Routes samples](#).

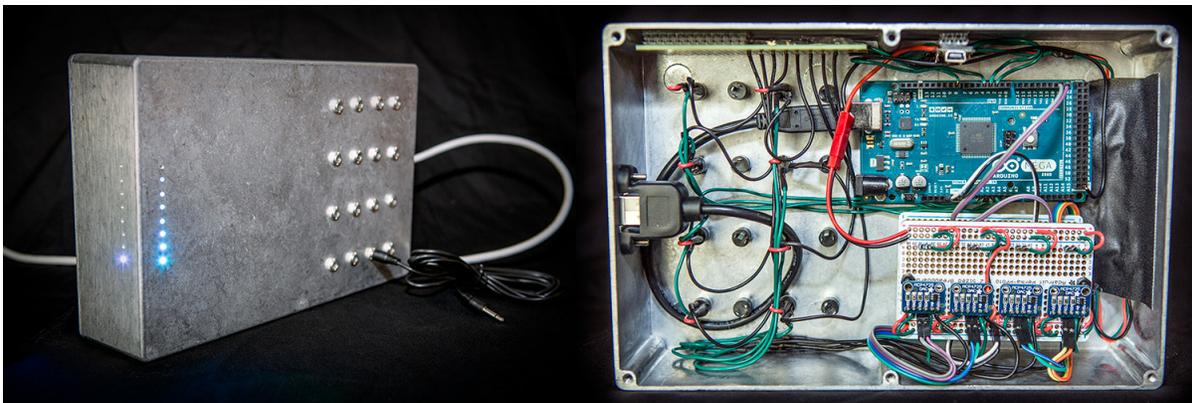


FIGURE 3. APPIOSC DEVICE OUTSIDE AND INSIDE (2016).

In an attempt to further counter the scored predictability of the previous works, and to add a new dimension to the interaction between the audio and visual components, we created the AppiOSC in collaboration with Frank Appio (Lawson, Smith and Appio 2016). The AppiOSC is a hardware device that converts text code into control voltage (CV) for use on the modular synthesizer, and can generate, modulate and sequence basic functions, including saw, square, triangle and sine waves. Open Sound Control (OSC) messages sent to the AppiOSC determined frequency, amplitude and function type, and assigned values could be static or set to be randomized per frequency period. The text-to-CV algorithm searched for letters, spacing, or keywords in The Force to attain sums that were further adjusted to fit within a range suitable for the AppiOSC. For example, if a block of code contains 15 “-” characters, that value 15 would be modded by a specified max, for example, let’s say 10 resulting in a value of 5. This 5 value is further scaled within that 10 maximum to return a float value between 0.0 and 1.0 resulting in .5. Mathematically this would look like the following:

$$\text{finalValue} = (\text{characterCount} \% \text{specifiedMax}) / \text{specifiedMax}$$

The final value and property to change are sent to the AppiOSC. As code is added or deleted, that final value might change, impacting the CV signals being sent from the AppiOSC to the modular synth.

These CV signals could be applied to various modules within the synthesizer to affect LFO and function speed, pitch/tuning, filter cutoff and resonance and any other parameter that accepts CV. The CV coming from the AppiOSC could be quite erratic at times, which introduced a fantastic source of uncertainty. CV from the modular could also be sent back into the AppiOSC, where it would be converted into streams of numbers available for use in *The Force*. Unfortunately, our use of this device was under-explored due to the eventual long distance nature of our collaboration. Simply put, we didn't have enough time with the AppiOSC, and this lack of experience inherently and repeatedly pushed us towards a surprisingly consistent sonic texture. Well, that and the conversion algorithm computing the text of the fragment shader into the values of the control voltage. Golan Levin postulated a similar scenario as: "... the premise that any information can be algorithmically sonified or visualized is the starting point for a conceptual transformation and/or aesthetic experience. Such projects may or may not reveal the origin of their input data in any obvious way" (2010: 273–4). Levin further reveals the potential fault by highlighting the relationship between raw data and the artistic content it may produce:

Most commonly, the transmutability of data per se is not itself the primary subject of a work, but is rather used as a means to an end, in enabling some data stream of interest to be understood, experienced, or made perceptible in a new way (2010: 274).

Moreover, due to OSTR's heavy reliance on spectral analysis for communication from audio to visual, we inadvertently supported the argument that visuals are secondary to the audio, not unlike the iTunes visualizer (Alexander and Collins 2007: 134).

Despite its shortcomings, the concept of the AppiOSC in and of itself was an intriguing one: integrate a complex control voltage scenario with the relevant *leftovers* of contextually-irrelevant live-coding. Still, in revisiting our means-to-an-end we found that Obi-Wan Codenobi's live-coding text to sonic conversions were simply repetitive and frequently disappeared into the overall sonic texture. Perhaps we had been seduced by the potential of some perceptible relationship, confusing the randomness of the text-to-CV conversion with what was little more than an imperceptible 1:1 relationship. A stronger path may have been to explore how the raw text data could have been mapped onto a more musically-significant structure. Another solution would have been to apply a global scale and/or quantizer to the data stream as it leaves the AppiOSC. This type of control, a conductor of sorts, could oversee the text-to-CV/CV-to-text conversion at the low-level while applying a high-level structure to compartmentalize the data into more usable or perceptible bursts of information rather than slower changes to a stream of continuous values. The OSTR audiovisual album was published on the Spanish label naucleshg, and we had the opportunity to bring this work and the AppiOSC to Canada (ICLC), England (ICLI) and Australia (NIME).

As mentioned above, once our collaboration turned long-distance we were unable to continue exploring the possibilities that the AppiOSC may have afforded us. But this was a bit of a blessing, and in the spirit of healthy self-deprecation, we felt that we had let the intriguing possibilities of the hardware lead our project down an aesthetic path that had little positive impact for us or anyone who saw us perform.

Recognizing this failing, we wanted to again integrate the audiovisuals and show the artist's hand in the work. The *artist's hand* in the visual arts refers to mark making, as in the quality and personality of the line, brushstroke, etching and so on. It also implies that the work itself feels divorced from the artist, meaning that artist her/himself does not seem present in the work. Or, this may indicate that something is too *slick* or *refined*, hence a machine-made copy. For us it meant to lose the AppiOSC's *black boxness* and get everything up on the screen.

LUKE'S SIDE QUEST TO DAGOBAH (AS IN, SO, WHAT ARE WE REALLY DOING?): 2016

Before developing a solution to both our long-distance collaboration and our desire to remove the black box, we took a moment to consider what it was we were doing, and how the algorave *scene* in general, might fit into a broader artistic and historical narrative. Furthermore, and influenced in part by the massive interest in contemporary EDM, we found ourselves looking a bit closer to try and gain a better understanding.

While exploring the visual components found in some EDM performances we found ourselves traveling through an ancestral tree of methods and technologies including color organs, animation (artistic and commercial), film, video arts, performance, theater, music, light shows, expanded cinema, music videos, live cinema, *Gesamtkunstwerk*, psychedelia and synesthesia with the most closely generalizable precedent being the Video Jockey (VJ) (Spinrad 2005; Crevits 2006; Eskander 2006; Shaughnessy 2006; Alexander and Collins 2007; Alexander 2010). More specifically, within the VJ category there are sub-categorizations for scratch video, clip-based work, video synths and code-based procedures to mention a few (Watz 2006; Alexander and Collins 2007). Most revealing was the frequent, emergent thoughts regarding a subservience the VJ had to the audio:

[F]or many, vjing [sic] is a dirty word, artists view it as eye candy for the clubbing generation, musicians view it as a secondary accompaniment to their music at best, vjing [sic] is regarded as audio-visual wallpaper, not worthy of serious consideration. [Y]et to my eyes, the best vjs are creating a new, fluid interface between sound and image—one that is genuinely mould-breaking and aesthetically invigorating, and one that deserves to be recognized as a 21st century art form (Faulkner 2006: 9).

This mirrors Marius Watz's experience of being a VJ:

Still VJ Culture is in its nascent stage and the VJ rarely becomes a full-fledged member of the band, typically remaining a visual commentator. . . . However, any visual artists and audio-visual collaborative projects seek to reach new levels of integration between sound and image (2006: 5).

Taking a moment to consider the integrated aspect of audiovisuals, there has been much discussion about the connection between EDM with visuals and their synesthetic affects (Crevits 2006; Eskander 2006; Watz 2006; Alexander and Collins 2007). Crevits goes so far as to state that if the EDM drug culture had been different then VJs may not have existed:

The VJing at house parties reproduces this [synesthetic] experience. Whereas ecstasy does create a 'spiritual' symbiosis of sensation, it doesn't evoke many concrete visual hallucinations compared to LSD. One could say that if LSD had been the drug of the house scene there would have been little or no need to compensate for the lack of performance or low visual character of a DJ set. There would be no VJing (2006: 15).

Even if we disregard the hubris of this statement we can't overlook the multiple references to real or perceived synesthetic effects of audiovisual performances. We have encountered performance attendees who reported having some degree of synesthesia; however, Obi-Wan Codenobi and The Wookiee neither claim to be synesthetes nor have aspired to intentionally create synaesthetic work, and believe this speaks more to the integrative collaborative approach, direct mappings, or *learnt* synesthesia (Alexander and Collins 2007: 137). A contemporary synesthetic *condition* could also be a result of the post-digital human condition as per Watz, "one could just as easily claim that the thirst for synaesthetic experiences is a response to our multimedia-saturated world, where instant sensory gratification is the order of the day" (2006: 6). Large-scale audiovisual EDM spectacles may simply quench that thirst.

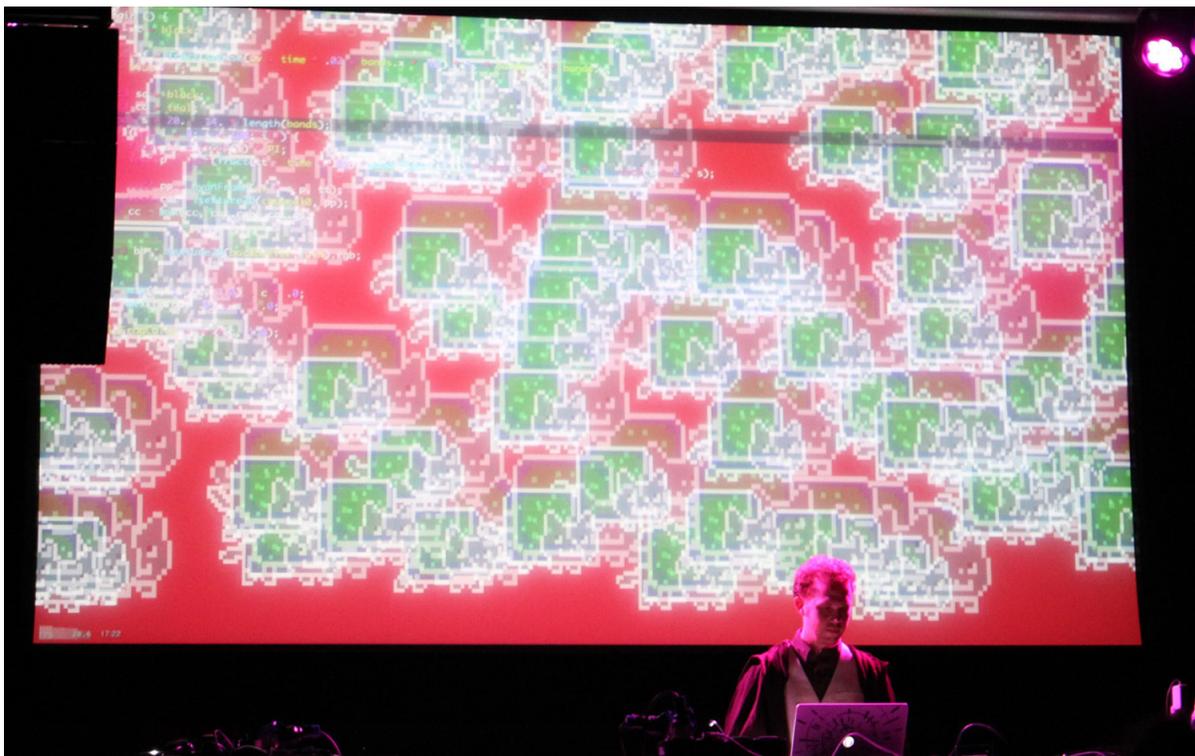


FIGURE 4. OBI-WAN CODENOBI PERFORMING AT ACM CC IN GLASGOW (2015).

In addition to our desire for more structural and audiovisual cohesiveness, we were beginning to identify more and more with Alexander's comments on the fluidity between VJs and live cinema artists (2010: 202), and as laptop performers, we have sought to expand the narrative aspects of our performance by perpetuating our loose narrative around the Star Wars metaverse.² But beyond our naming conventions and Obi-Wan Kenobi's jedi stage attire, we did not intend to create strict, Star Wars-based textual, storyboard, or compositional narrative for audiovisuals, as that would reduce the potential for artistic flexibility and improvisation. Rather, it gave a couple Star Wars fans reason to find inspiration in more obscure references, like R5-D4 or Dannik Jerriko, nevermind the inherent value in inspiring conversations regarding the merits of the original tentacle-less sarlacc. Still, however insignificant this conceptual basis might be, it is worth noting the in-between space of VJing and live cinema:

A third, and lesser-known type of audiovisual performance practice operates within a performing arts context while also drawing from conceptual, performance art, and new media art practices. In the absence of a commonly agreed-upon name for this practice, we can refer to it here as 'conceptual audiovisual performance' (Alexander and Collins 2006: 135–6).

Given the relative infancy of live coding practices in historical terms, it seems appropriate to consider the algorave as a conceptual audiovisual performance environment, but not one that need adhere to any specific *type* of performance. And so, the Star Wars concept disappears, easily outweighed by the far more interesting and broader concept of live coding.

LUKE'S RETURN TO DAGOBAH (ARE WE SURE ABOUT WHAT ARE WE REALLY DOING?): 2016

From the musical perspective, we have been considering EDM as a high-level container for any and all music that is A) largely created and/or performed by/with electronic means and B) contains the musical attributes (beats and patterns) and, in some cases, the live social contexts of EDM's 70s and 80s prototypes. Yet, it is also the case that EDM as a musical, cultural and capitalist phenomenon, that Simon Reynolds refers to as nothing more than a "rebranding coup", *may* represent a more contemporary set of micro-genres that preclude one's understanding of their history (Reynolds 2012). Naturally, artists working within genres are not necessarily keen to embrace whatever label is placed upon them, and as Collins notes: "Genre is a contentious area at the best of times, but an especial minefield in electronic dance music, where producers, journalists and consumers are always eager to promote new micro-genres" (2012: 1). In-line with Collins, Gresham-Lancaster notes that within the major online (streaming and download) distributors:

. . . the history that I have experienced over the last four decades is not represented at all. 'Electronic Music' - in the various forms offered by the pull-down menus of these apps - refers to a form of dance music from the late 1990s on and bears little resemblance to the 'electronic music' that has been such an important part of my own musical life (2017: 76).

Still, the immense growth of this musical culture has brought electronic music to a massive audience, and despite this kind of commercial success, it is fair to say that a lot of this music is decidedly experimental in nature. From Juan Atkins and Frankie Knuckles, Kraftwerk, to the wonderfully pornographic performance practice of Anklepants and many others, the performative act is a necessarily visceral and/or tangible one, and the methods by which these sounds were made possible were always changing. In Michaelangelo Matos' extensive tome on the rise of EDM through the multiple lenses of the artists, party promoters and attendees, he suggests that the liveness these artists brought to the stage were of exceptional importance. For instance, Moby's use of DAT tapes on stage became a flashpoint of sorts, as, "... party flyers around the U.S. were promising "live PAs" from artists. Being able to *bring it* onstage with a bunch of gear and no traditional instrumentation was starting to matter" (Matos 2015: 149). Moby's response questioned the value structures associated with dance culture with the eye of a historical musicologist:

... people who make an issue out of 'is it live?' techno are dangerously reminiscent of people who can describe eric clapton's [sic] guitar solos in depth and who dismissed punk, techno, hip-hop (and jazz and rock and roll for that matter) as not being valid because you didn't need a masters degree in music theory to appreciate them (Matos 2015: 153).

Yet this separation of process and presentation is necessary when considering the logistical nightmare and massive expectations of large-scale performance events. A computer-based (or *anything*-based for that matter) live performance that is largely improvisatory is likely ill-advised if the spectacle requires perfection in its execution (think about the cost of a stadium concert).

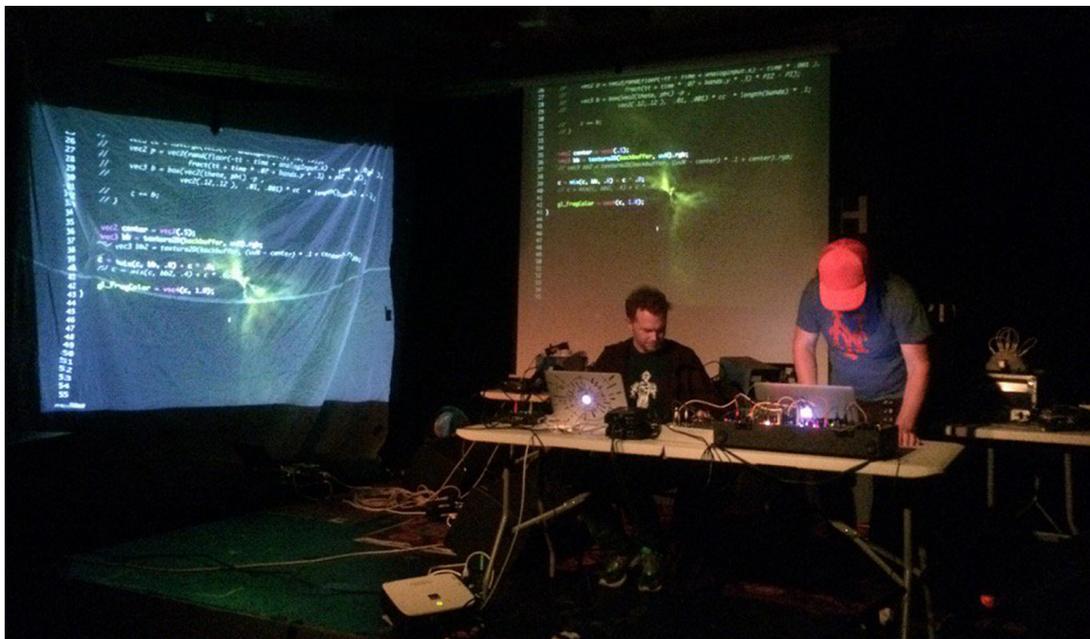


FIGURE 5. OBI-WAN CODENOBI AND THE WOOKIE PERFORMING AT ICLi IN BRIGHTON (2016).

Our experiences at several algoraves, festivals and conferences imparted a fantastic feeling of social engagement, community and experimentation. And while not all participants in each situation may have veered toward some form of EDM (although many did, including inspired performances by Mike Hodnick, the AlgoBabez, Alex McLean, Charlie Roberts and Renick Bell to name a few), the very context of a bar, club or concert setting and the transparency of the projected code, enabled a wide range of forms to not just coexist, but to encourage communal engagement. The ubiquitousness of EDM in the popular sphere presented a uniquely fertile opportunity to bring it back underground—academically, ironically or otherwise.

At an algorave, people not only care how you make something, but want to *see* the code you are using to make it in real time. In some ways, this is not unlike a DJ, turntablist or finger drummer, and we certainly aspired to connect more directly with our equipment from the musical, visual and physical perspectives by sharing this process and our screens with the audience, as is the *common practice* of live coding (Ward et al. 2004). Amy Alexander notes that “Laptop performers are now beginning to address the question of performativity” (2010: 204). The algorave has, in some sense, become a beacon for the integration of populist aesthetics (here EDM musical attributes and visuals that reflect upon them) with good old-fashioned laptop performance and the somewhat pedagogically-inclined practice of live coding.

And so, our approach, like many others, to EDM-inspired live coding practices in the context of the algorave environment supplants preprogrammed perfection with a direct engagement with the possibility of failure (crashes, performance anxiety, lack of good ideas, etc.) while retaining what we consider to be the most salient and generalizable visual and musical qualities of EDM: repetitive, *danceable* rhythms and correspondent visuals, even if those visuals may sometimes be just code.

RETURN OF THE JEDI: 2017

As mentioned earlier, we eventually found ourselves looking into our own personal sarlacc: long-distance collaboration. With The Wookie moving from Troy to the mountains, a new approach was required. To this end, Obi-Wan Codenobi created a new live coding environment, The Dark Side (Lawson 2017). This new IDE is browser-based, telematic and supports both TidalCycles and OpenGL shader languages in a single text buffer (Lawson and Smith 2017). Performers use the familiar The Force interface and are presented with a text editing experience similar to the collaborative functionality of Google Docs: multiple performers edit the code simultaneously from any internet connection while all text edits, text cursor movements and window scrolls are recorded with timestamps to a small JSON formatted file.³ Audio and visuals are rendered client side, meaning that each performer receives the highest quality possible audio and visuals that their hardware permits. Furthermore, the recorded text file can be played back with the highest possible quality audio and visuals available to the end receiver.⁴ With The Dark Side we were able to continue collaborating in real-time from our respective homes while retaining full audiovisual resolution.

With *The Dark Side* supporting our new approach to rehearsing telematically we completed a new work, *EV9D9* (2017). The *EV9D9* video is linked here: [EV9D9 from GENERATE! Festival](#). *The Dark Side* has also enabled performances in which one or both of Obi-Wan Codenobi and The Wookiee perform remotely, and in one scenario our text recording was *performed* by a third computer.⁵

Other performances included The Center for New Music in San Francisco (one performer remote), Sample Music Festival in Berlin (one performer remote), Generate! in Tübingen (both performers local) and ICLC in Morelia (one performer remote).⁶



FIGURE 6. OBI-WAN CODENOBI AND THE WOOKIEE (REMOTE) PERFORMING AT ICLC IN MORELIA (2017).

Moving to the audio side of things, with sample-based live coding languages, including McLean's *TidalCycles* (the audio live-coding language used alongside *The Force* or in *The Dark Side*), the performer is limited not only by what functions are available, but by what sample material the composer/performer has made available to themselves and how this material is exploited in performance. When developing the materials for *EV9D9* we created raw materials that represented the musical space we sought to occupy, while building in

room to discover alternative compositional spaces that might signify alternative genres in part or in whole. No big tricks here, just a compositional practice informed by EDM, assembled/manipulated with live-coding.⁷

EV9D9 contains five separate pieces that can be performed in whole or part. A performance containing all five pieces will last approximately 30 minutes, although each section can be compressed or extended depending on set duration. Each piece contains a sample set including standard percussion elements (kick, snare, hi-hat), intro and/or outro and bass, melodic and harmonic material. The sample set for each piece was generated using Pro Tools, Ableton Live and Maschine. Since TidalCycles reads samples from folders, each piece contains a series of folders with descriptive labels. For instance, the 2nd piece, EV123, contains folders for kick, snare and hihat (evk123, evs123 and evh123), folders for intro and outro material (evint123 and evout123), folders for verse and chorus (evv123 and evc123) and folders for a filtergate sample and an arpeggio sample (evfg123 and evarp123). In some folders there is only one sample, but in others, specifically chorus, there may be numerous samples in order to inject some variety into certain sections. The “ev” at the beginning of each folder name refers to the “EV” in *EV9D9*. The letter(s) following “ev” refer to the content of that folder (“k” refers to kick, “fg” refers to filtergate, etc.), and the number “123” refers to BPM.

In a performance of *EV9D9* the elements of each piece are coded and executed in order, although there is a lot of room for flexibility. For instance, there is no set beat/pattern for each piece, and patterns developed for one piece can often be carried over to the next piece. One of the more interesting problems to solve when performing *EV9D9* in its entirety are the transitions between different tempi, due in part to the use of longer samples that are not tempo-dependent. Beyond these structural or skeletal elements and their tempo-dependence, each piece is wide open for improvisation using a wide range of samples selected for the project.

It isn't really in the scope of this article to go into depth about the full functionality of TidalCycles (look to the website for more informations: [TidalCycles](#)), or any of the many other live coding languages in use. Still, the similarities between making beat and/or pattern-based music with TidalCycles and other off-the-shelf products is worth noting. As written on the TidalCycles home page, “Tidal allows you to express music with very flexible timing, providing a little language for describing patterns as step sequences” (McLean et al.: n.d.). This statement is similar to any number of products, from the Korg Volca series to Ableton to modular sequencers, with the exception of the word *language*. With TidalCycles you are representing the sonic output you want with code; no fancy interface, no visual representation of the audio, just the computer's blank screen that you populate over the course of a performance. Yet, it is the very non-flashiness of this environment that requires a different mode of thinking, and creates a performative and creative situation far removed from other electronic music models. For example, to create a simple beat, one might type:

```
d1 $ s “[bd*4, [~ sn]*2, hh*4]”
```

In this example, the bd (bass drum) and hh (hi-hat) are playing on every quarter-note, while the snare drum plays on the offbeats. Once compiled this pattern will continue until it is changed or silenced using the aptly named function “hush”. Far more interesting is to take advantage of scheduling and random functions. In the following example, the “sometimes” function is used to occasionally reverse the sound and/or slow the pattern down to half speed. The samples used are segments from the Amen break in 8th notes (although occasionally removed due to the “?”) and a Gabba kick on the 1 and 3. Lastly, samples are chosen randomly from the two folders called “amencutup” and “gabba” respectively in order to impart even more variation.

```
d1 $ sometimes (# speed “-1”) $ rarely (slow 2) $ s “[amencutup*8?, gabba*2]” # n (irand 16)
```

A slightly more verbose example pulled from the *EV9D9* set (below) demonstrates additional functionality including pitch-shifting, scheduled solos, sequenced modifiers, weighted randomness and local and global speed malleability. A code block like this has a generative quality to it, producing a variety of sonic results over time while retaining the musical foundations of this particular section.

```
d1 $ every 11 (const (s “[evk110*16?, [~ evs110]*4, evh110*16, notes*8?]” # n (irand 5))) $
  slowspread ($) [id,rev,(|+| accelerate “-1 1”),stut 8 0.8 0.125,slow 2,chop 4,slow 1] $
  stack [
    every 7 (striate 4) $ sometimes (|+| accelerate “-1”) $ s “<subroc3d*16 space*16 h1*16>”
    # n (irand 6) # end “0.1” # up (sine*16),
    sometimes (|+| up (choose [2,4,6,8,10])) $ every 11 (striate 2) $ every 9 (slow 0.5) $
    every 7 (slow 2) $ every 5 (|+| accelerate “-1 1”) $ every 6 (stut 8 0.8 0.125) $ s
    “[evk152*4?, [~ evh152*2]*2, [~ evs152]*2]”,
    sometimes (jux (iter 4)) $ s “s13*8?” # n (irand 12) # cut “1”,
    randcat [
      s “k1*8 speed*8?” # n (irand 12) # end “0.1”,
      s “gabba*8 stab*4?” # n (irand 12) # end “0.1”,
      s “numbers*8” # end “0.05” # up (sine*8),
      s “~ notes*4” # end “0.1”,
      s “<s1*8 k1*8>” # n (irand 10) # up (sine*32)
    ]
  ]
```

As is hopefully obvious, this is not even scratching the surface. The variety of methods for handling sample and cycle manipulation is deep, and as the introduction of new technologies or exploitation of existing technologies have often made significant impacts on compositional and performative directions, different live coding languages enable different musical outcomes. Similarly, EDM has evolved in parallel with technological development and adoption, from turntables and the TB-303, to the introduction of MIDI, sampling, the wide range of DJ software, controllers and everything else. The long-term impact of live

coding languages as a fairly new musical technology can't possibly be predicted, but it is fair to say that the introduction of EDM-inspired musical practices into this micro-micro-sub-genre of live coding will continue to inspire new ideas that straddle that weird space between popular music and scholarly enquiry.

EPILOGUE: 2018 AND BEYOND

Much of this paper focuses on the technological and compositional path we have moved along over the last several years in order to highlight our process more objectively, but at its roots the writing of this paper has been an opportunity for us to subjectively and aesthetically evaluate the processes and results of a collaboration that has been very meaningful to us and continues to challenge our creativity.

In closing, it seems apt to share Alex McLean's recollection of a 2011 car ride published in *Wired*:

We [Alex McLean and Nick Collins] tuned into a pirate station playing happy hardcore, and we thought it would be good to [computer] program some rave music . . . It's kind of changing the way people think about computer music . . . And also breaking the limits of what electronic music can be (Cheshire 2013).

Indeed. Thank you for reading and may the Force be with us.

NOTES

- 1 The delay time is 200ms set on a keypress timer callback. Each time a key is pressed the timer is refreshed back to 200ms. If no other keys are pressed in that amount of time, the callback sends the code to be compiled and executed if successful.
- 2 Our Star Wars obsession is the impetus for many aspects of this collaborative endeavor. This includes stage names, titles of audiovisual works, titles of written papers, titles of software and performance attire with robe and lightsaber. Some of the more esoteric titles are listed in the references under *Wookieepedia*. A few titles are fan-fiction generated, which not surprisingly have been less successful.
Repurposing Star Wars, speaks to a digital-postmodern condition and opening the door to a nostalgic futurism, where authenticity and originality are more ambiguous. This is in-line with EDM genres, where samples are often appropriated, and a sense of futurism and science fiction is often pervasive. Our extended-metaphor-parody provides both a geeky entry point as well as a secondary narrative of conceptual context.
- 3 JSON is the acronym for JavaScript Object Notation, and its data structure is that of an unordered set of key/value pairs. This format is usually saved or transmitted as text, not binary, for human readability.
- 4 Compression algorithms for audio and video use lossy data algorithms to make files smaller, typically compromising the information. With the text recording files, *The Dark Side* plays

back the text edits in real-time, thereby re-creating a simulacra of the original performance with 60fps, pixel-perfect video and uncompressed audio. We use the term simulacra because each time the text file is played any random numbers are regenerated, so the playback is incredibly similar to the original but never exactly the same, although it may be possible to regenerate exactly the same piece by seeding the random number generators. In our observations an hour long performance would result in a 10-15MB text recording, while a screen-recording of equal length could be >100GB and already data lossy.

- 5 A performance at the New York Electroacoustic Music Festival in 2017 at the Abrons Art Center.
- 6 The Dark Side has not only been crucial to our continued collaboration, but has enabled several presentations that would have been logistically improbable if not impossible. For example, we used The Dark Side at the Sample Music Festival in Berlin during a lecture Smith gave on creating pattern-based music with TidalCycles. It was determined well in advance of the lecture that Lawson would not physically attend, but would be present within The Dark Side. In another case, a series of events left Smith stranded in Newark, NJ and unable to join Lawson in Morelia for ICLC. This necessitated Smith's virtual presence at the formal paper presentation of The Dark Side. We were able to *prove* that the system works, making Smith's travel woes and Lawson's inability to be in Berlin incentives. The performance of *EV9D9* scheduled for the last day of ICLC in Morelia clearly highlighted the fact that one half of The Rebel Scum was *missing* from a performance standpoint, but served as another proof of the project, and left us wondering what other possibilities there were beyond using The Dark Side as a method for rehearsals, lecture-demos and as a safeguard against debilitating flight delays. An additional demonstration of The Dark Side backend went un-announced at Morelia ICLC performance. Since many algoraves and clubs have notoriously bad or non-existent wifi connections, The Dark Side was designed to be low-bandwidth, such that only the code edits are transmitted. Because only minimal data needs to be transmitted, an international phone data-plan is more than sufficient, and in fact, is what we used in Morelia.
- 7 It may of interest to note that computer-based audio content analysis (Anderson and Eigenfeldt 2011; Collins 2012; Panteli, Bogaards and Honingh 2014) and generative systems based on ear-based content analysis (Anderson, Eigenfeldt and Pasquier 2013; Eigenfeldt and Pasquier 2013) do exist, and provide valuable insight into certain sonic characteristics that may elude our ears during a causal listen (e.g., the specific offset in milliseconds of a swing pattern from the $\frac{1}{4}$ or $\frac{1}{8}$ note divisions). As Anderson et al. writes regarding their GEDMAS system, "The compositions are based on a corpus of transcribed musical data collected through a process of detailed human transcription," and it is this kind of familiarity with the corpus (computer-guided or based entirely on one's own personal understanding of a style) that may help aid in the creation of musical material reminiscent of whatever genre one seeks to emulate (2013: 5).

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