UPLOrc: A Networked, Live Coding Laptop Orchestra based in South Africa

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Abstract

In this article I report on the current and emerging practices of *UPLOrc (University of Pretoria Laptop Orchestra)*, a networked live coding laptop orchestra based in Southern Africa. Since its establishment in 2019, the ensemble has performed live coded network music using the TidalCycles live coding environment at various conferences and live streamed events. The development of these practices is owed to, among other aspects, the fieldwork experience I obtained with the trans-continental network ensemble *SuperContinent*. I describe how this knowledge has been implemented into the activities of UPLOrc, alongside some of our own emerging practices. Particular problems that emerged during the performance preparation process is also highlighted, as well as the strategies that could be implemented to address some of these problems.

Keywords: Digital Humanities, Networked Communities, Network Music Performance, Laptop Orchestra Pedagogy, Live Coding

1   Introduction

Contemporary music performance, particularly network-based performance, has recently experienced an increase in popularity for a number of reasons. First, increased interaction has become commonplace for people who use technology to maintain relationships across long distances and "political borders" (Schrooten 2016), whether professional or personal in nature. These online relationships increased on an unprecedented scale after the outbreak of the Coronavirus pandemic in late 2019. Consequently, many collaborative activities were forced to move to online platforms, including the activities of some laptop orchestras (Fasciani 2020). Network music, a corollary to telematic music (Oliveros et al. 2009), is performed using an internet connection, where collaborators are often, but not always located in the same country or region (although it is also common to work collaboratively across continents) (Carôt et al. 2006). For example, collaborators of the trans-continental network ensemble SuperContinent are located, at minimum, 500 kilometers apart. The group performs regularly at various events and conferences (Betancur et al. 2021), and is a sub-project of ongoing research at McMaster University's collaborative research center the Networked Imagination Laboratory or NIL [1]. An opportunity to join SuperContinent in 2020 became available when my research supervisor could not participate due to other academic and creative commitments. I viewed this as an opportunity to gain experience as a performer, and to learn how others approach collaborative laptop ensemble performance. In the most general sense collaborative laptop ensemble performance involves the staging and performance of contemporary art forms through the use of computers, or more accurately, laptops. These contemporary art forms, and the technologies that make them possible, may vary widely depending on the context. For instance, some ensembles such as Princeton University's PLOrk (Princeton Laptop Orchestra) make use of self-contained stations consisting of a laptop and a hemispherical speaker (Trueman 2007), or in some cases Digital Musical Instruments (DMI's) (Ferguson & Wanderley 2010, Berdahl et al. 2018). However, due to the limitations of this type of setup, many ensembles make exclusive use of software to perform and improvise music collaboratively (Freeman & Troyer 2011). In some contexts, as is the case with SuperContinent and UPLOrc, software similar but not limited to Estuary [2], is further combined with networks to enable collaborators to perform together across long distances (Knotts 2015, Ogborn et al. 2017, Carôt et al. 2006).

My interactions on the Estuary platform included attending weekly SuperContinent rehearsals alongside NIL-related activities, both of which introduced me to new concepts, practices, and ways of performing music collaboratively. In particular, NIL hosted weekly *fromZero* workshops (Ogborn et al. 2015) which I was attending in addition to performing regularly with the members of SuperContinent [3]. Most of my time was spent observing and interacting with a number of new processes I had never experienced elsewhere, working with a wide variety of technology such as the intuitively-designed Estuary platform (Ogborn et al. 2017). SuperContinent is one of many ensembles that use Estuary to perform live coded (Collins et al. 2003, Ogborn 2016, Nilson 2007) network music, a performance practice which forms a central part of current pedagogical strategies in formal academic contexts, in particular STEM education [4] (Soon & Knotts 2018).

Through engagements with the members of Super-Continent, I was able to note the requirements involved with planning and coordinating the activities of a typical live coding laptop ensemble (Betancur et al. 2021). As the coordinator of the then newly established *University of Pretoria Laptop Orchestra* (UPLOrc), I was tasked with developing and facilitating ensemble activities. This article presents the process of using such techniques alongside the progress made by UPLOrc thus far. I begin with a brief background of how UPLOrc came to be and where we currently find ourselves as a group. I then attempt to address some of the questions surrounding collaborative musical creativity, an idea put forward by Bishop (2018), in the context of a network-based live coding ensemble. Further, I present the planning and coordination that went into three UPLOrc performance cycles in addition to the communication involved in network music performance. The article then concludes with a discussion detailing the current problems we have encountered, as well as the lessons we learned during the process.

2 UPLOrc, so far

UPLOrc was established in May 2019 by my research supervisor and artistic director of UPLOrc, Dr. Miles Warrington [5]. Our debut showcase was held at the annual University of Pretoria Music Festival (UPMF) in 2019 [6] and although a wonderful experience and opportunity, I was only beginning to familiarise myself with collaborative laptop performance practices and felt that I had much to learn in this area. Since then I have spent time interacting with other network musicians and used various technologies, attempting to absorb as much information as possible. The knowledge I acquired during this time has therefore greatly impacted the development of UPLOrc activities.

In obtaining this knowledge my goal was to understand how other individuals were able to collaborate, particularly focusing on the ways in which others would approach performing live coded music in real-time (Collins et al. 2003). I would spend hours watching and deconstructing the content of TidalCycles video tutorials presented by its creator McLean (2014). I further observed the ways in which SuperContinent members approached live coding with MiniTidal, a version of TidalCycles available to use on Estuary. TidalCycles and Mini-Tidal, often referred to as Tidal to include both versions, is an audio programming language environment used to perform live coded music.

My initial objective entering into SuperContinent was to improve my own skills as a live coder, then incorporating this knowledge and performance experience as a reference point for developing the practices and objectives of UPLOrc. What I did not expect to experience, was the the complete musical freedom afforded to me by the other members of SuperContinent. I experienced new forms of interaction that would otherwise be impossible without the technology facilitating those interactions. Encountering the work of Bishop (2018) allowed me to identify a shift in within my own identity as a musician. She states that in order to understand this shift further research should be conducted into de-

termining how the individual's mind is constrained by their imagination, and whether they are able to transform their frame of reference to make room for new sonic structures (Boden 2004). Evidently, the tools used to express these musical ideas, in this case MiniTidal and Estuary, should be evaluated in further detail to determine whether these technologies either facilitate or constrain the individual's ability to express their individual musical ideas in a collaborative setting (Bishop 2018, Knotts & Collins 2014, Knotts 2015).

Experiencing this sort of musical freedom has enabled me to embrace a similar openness to the perspectives and tastes of others. It is my primary objective as the manager of UPLOrc activities to facilitate a similar kind of approach to collaborative performance. My duties as the manager involves, among other things, planning and presenting educational content focusing on the technical aspects and logistics of live coded network music. While I am responsible for presenting this information to the members of the ensemble, I acknowledge that it is crucial to maintain these relationships in a manner that encourages freedom of expression from all involved in this project. Moving forward, our collective aim is to develop a fundamental understanding of the ways in which musical ideas can be generated in collaboration with others, where the performer is often required to monitor multiple actions in real-time (Xambó et al. 2016, Xambó 2017). Learning how to live code, and observing others who do, has become a fundamental part of the process of drawing closer to developing my understanding of how UPLOrc is able express musical ideas as an ensemble.

2.1 The network orchestra

The initial months of coordinating UPLOrc included a great deal of experimentation until I was confident that I had developed an efficient approach to preparing myself and my fellow ensemble members for upcoming performances. We initially intended for UPLOrc to perform live concerts in halls and venues and, before the Covid-19 pandemic, we

had already decided that a portion of our activities would be held online. I had moved to another province in South Africa and was to travel to Pretoria when I needed to be there for UPLOrc events. Since that did not materialise we were forced to, like many other ensembles, make use of additional technological tools that would allow us to perform collaboratively from the safety of our homes.

UPLOrc currently has six members located in all corners of Southern Africa, including the Western Cape, Gauteng, the Free State, Mpumalanga and Namibia. Members comprise of undergraduate students, post-graduate students and University of Pretoria faculty, as is the case with many other laptop ensembles in higher education, for example SLOrk (Stanford Laptop Orchestra) (Wang et al. 2009). A new challenge presented itself to UPLOrc in 2020. In navigating our activities as a "new" network ensemble, we needed to explore other modes of communication. Communicating our ideas became possible using tools including, but not limited to, Estuary, MiniTidal, Slack [7] and Discord [8]. These have provided us with the most efficient, no-cost option for meeting twice a week to rehearse and attend workshops. Communications between ensemble members are discussed in further detail in section 3.3 below.

3 Hardware and software tools

Between the members of UPLOrc we have three MacBooks and three Windows laptops. Since Estuary requires no installation of additional software, all members of UPLOrc require is a computer that is able to run the Google Chrome browser. It is safe to assume that most university-attending individuals have some computing device enabling them to attend online academic-related events, therefore having the ability to at least access Estuary (Feerrar 2019, Ogborn et al. 2017). Making efficient use of Estuary may be a challenge for some however, especially if their device does not meet minimum system requirements needed to run Estuary. I elaborate on the relationship between our laptops and navigating a rehearsal or performance in Estuary in section

3 below. Our current devices are, for the most part, entry-level devices which most would agree are best used for long-term administrative use. We have been fortunate to have access to at least two devices that could easily stream a live performance on YouTube, as has been common practice for some SuperContinent events. Software, as opposed to hardware, is our primary form of technology that we use to perform. Our laptops are currently the only form of hardware we interact with, meaning that any musical gesture we generate originates solely from typing code (Salazar 2017). For UPLOrc, the benefit of making exclusive use of software for performance means a low entry-level if a participant is not able to purchase additional equipment. More so if that software is completely free to use, and optimised in such a way that anyone with little to no live coding experience will be able to perform simple, yet interesting, musical ideas with a few lines of code (Ogborn 2012).

3.1 Estuary

The Estuary platform is a browser-based and multi-lingual live coding platform, providing instant access to a collaborative gathering space for novices and experienced programmers through the browser (Ogborn et al. 2017). According to Estuary's GitHub repository [9], it is recommended that users access Estuary using either Google Chrome or any browser that is based on the Chromium browser project [10]. Attempting to access Estuary from browsers such as Safari and Firefox, whose architecture does not use Chromium, is not currently permitted. The majority of UPLOrc'ers (the name we use to refer to our members) have had the best experience with Estuary using Microsoft Edge, another browser platform that uses Chromium. Some experienced Edge as performing better than Chrome on their older devices. When one member recommended I use Edge on my 2011 MacBook Pro, I immediately noticed a significant difference in the way Estuary was performing.

Getting to know the platform is simple, even for those who are not so comfortable using technol-

ogy. The overall layout and design of Estuary assists workshop instructors like myself in customising some features of the platform. For example, adjusting what is displayed on screen, adding and removing an ensemble, and adjusting tempo is among a long list of available commands. Most of these features, called terminal view commands, can be performed using one-word commands which are accessible by clicking on the question mark in the top right corner of the Estuary screen (see Number 3: Figure 1: Estuary login screen). When accessing Estuary for the first time, the user is presented with *solo mode* and *collaborate mode* (number 1 and 2 on Figure 1: Estuary login screen). Collaborating in an ensemble requires that collaborate mode is used. The following screen displays a list of all the current ensembles active on the platform. Once the correct ensemble is selected, the user is prompted to provide their username, and optionally, their location. The ensemble password is entered, taking the participant to a final screen where they are then able to collaborate with the entire ensemble (see Figure 2: UPLOrc screen layout).

Other useful tools include a terminal chat window (Number 2: Figure 2) used to communicate during activities, space to enter your name and your code (Number 1: Figure 2), a list of participants letting everyone else know who has logged in (Number 3: Figure 2), and a useful information bar used to monitor CPU usage or what is loosely referred to as "glitching" [11]. "Glitching" has become a regular term used among the members of UPLOrc, and is used to describe the point at which one of our laptops cannot process the current code running on Estuary, presenting us with a glitching effect of the audio. While glitching can be interesting at times, it can severely affect the audio at times where the glitching becomes a hindrance to the performance.

3.2 MiniTidal

MiniTidal is among an extensive list of audio and visual programming languages available to use use on Estuary [12]. Some of its features excludes some TidalCycles functionality, although new ones are

constantly being added by researchers and developers at NIL. Developed by McLean (2014) in collaboration with a growing community of developers and users, TidalCycles is currently one of the most prevalent live coding environments and music programming languages being used for live coded performance. This is true in individual and collaborative settings, but also for teaching live coding in a variety of educational contexts (Ogborn et al. 2021, Soon & Knotts 2018) across the globe. TidalCycles is a programming language written in Haskell, and is specifically designed for live coded music performance. SuperContinent mainly performs with MiniTidal and Punctual (Betancur et al. 2021), an audio and visual live coding language developed by David Ogborn [13]. Presently, UPLOrc is live coding exclusively with MiniTidal, due to the ease with which novice live coders are able to participate in coding exercises. Before moving online UPLOrc was using SuperCollider to run TidalCycles using the Atom IDE [14]. Various problems would emerge when installing software on some devices and it became challenging to assist newcomers with the installation of these tools. The simplicity of logging into a platform that is Estuary is extremely appealing to novice and experienced network music performers alike. An additional benefit of developing experience as a live coder and network ensemble performer, is the ease with which those skills can be attained and extended (Ogborn 2012). Provided of course that sufficient time is spent cultivating those skills, particularly in areas that develop musical expression.

3.3 Ensemble communications

In the context of network music performance communication between ensemble members becomes challenging when members are not physically located in the same room. (Freeman & Troyer 2011). Bishop (2018, p. 6) describes communication as "the transfer of information that occurs between members of a group" and identifies various forms of communication. In the case of UPLOrc, communication occurs in a number of different ways.

Our primary mode of communication, and perhaps the most challenging to master as a new member, is that which occurs when live coding with MiniTidal. Similar to the communication of an instrumental ensemble, the audio transmitted from Estuary while UPLOrc is live coding is interpreted by each member in real-time. Since almost all of our live coding activities are improvised, it is impossible for anyone to predict what the outcome of a live coding performance will be, and therefore members are required to adjust to what is heard in real-time. Marie et al. (Forthcoming, p. 6) refer to this as a "layer of unpredictability." UPLOrc, and so too SuperContinent, are required to deal with these unpredictabilities as they occur.

Another, which points to the limitations or restrictions of the technologies UPLOrc and SuperContinent use, has to do with what Marie et al. (Forthcoming, p. 6) further refer to as "layers of unpredictability between human and machine." For example, if one member of the ensemble unknowingly makes a change in their code that initiates the aforementioned audio glitches, almost all [15] members of the ensemble will experience the unwanted effect. This will be a direct result of a process that no one in the ensemble has control over, due to some combination of events that are simply incompatible in that moment. A simple readjustment or removal of a piece of code should quickly resolve the issue. This continuous readjustment of code in real-time, which is essentially the act of live coding, is centred around the notion of emergence and group flow. Bishop (2018) defines this as performing "in a way that cannot be attributed to any one individual." Being aware of one's position in and amongst the other voices who would like to be heard, is essential to maintain the balances of power and freedom of expression in collaborative performance contexts Collins (2003), Knotts & Collins (2014), Knotts (2018).

Our second mode of communication is in the form textual communications. UPLOrc engages in these interactions using the Estuary terminal chat window, allowing members to communicate during a

rehearsal or performance. Further communication takes place during post-rehearsal discussions on Discord - a practice I initially observed as a member of SuperContinent. I incorporated this into our own practices as I observed the benefits of post-rehearsal reflection. This provides members the opportunity to voice their opinions and make suggestions, or simply to reflect on the shared experience. Discord's voice hangout functionality, originally intended for use with streaming and playing online games, has recently become a tool UPLOrc has been using during performances (Laubscher et al. 2021*a*). Some of the the newest members have only performed as a network ensemble once prior, and therefore Discord was a useful tool in directing and prompting other members during specific stages of our performance. During an earlier performance (Laubscher et al. 2021*b*), we opted to perform without using Discord as an extra line of communication. This is sufficient in certain situations (with SuperContinent for example, where constraints and ensemble goals are different from that of UPLOrc) and may become unnecessary when members become more comfortable in their ability to perform.

4 UPLOrc performance cycles

UPLOrc performance cycles consist of three related activities; workshops, rehearsals and concert performances. Workshops and rehearsals are structured to prepare the entire ensemble for upcoming scheduled performances. Our first cycle, approximately six months long, was the longer of the two, with cycle two (Laubscher et al. 2021*a,b*) lasting four months. During this time I attempted to develop members' skills as quickly as possible, hence the difference in cycle length. Our debut online performance was held at Estuary's *five year since commit* [16] event in December 2020 (Laubscher et al. 2020). The circumstances and my experience as an instructor were much different in both cycles, allowing me to learn from previous errors and correcting them where possible. I present some notable approaches and problems that emerged from the preparation of my fellow ensemble members for performance.

4.1 UPLOrcShops

UPLOrc workshops (UPLOrcShops), like all of our other ensemble activities, are scheduled according to the times that best suit the majority of the group. These are held every Wednesday for one hour and involves prepared content that is presented and demonstrated during the session. Members listen in using Discord's voice channel capability, where I am able to display my screen directly in the application. Depending on the prepared content I may either opt to have TidalCycles running in Atom, since it would be ideal for members to fully grasp the language and all its capabilities. Only when I demonstrate code that requires audible output, do I open Estuary in Microsoft Edge. The second portion of the session is usually dedicated to collectively experimenting with some of the content covered in the workshop, thus reinforcing some of the concepts discussed.

All UPLOrcShops are recorded using screen capturing software, mainly so that they can be reviewed and improved upon, but also so that members can view missed content. I reflect on all activities in weekly UPLOrcShop documents, briefly discussing an overview of the particular workshop, preparations for rehearsals and workshops and, problems in the session and possible solutions. These documents are distributed to members of the ensemble so they may be informed of what they should prepare for the next session, thereby also becoming familiar with the content covered during the workshop. All videos that are made available to ensemble members are archived, unlisted videos that are uploaded to YouTube. These are only accessible to individuals who have access to the URL link.

To maintain engagement with other members of the ensemble, I have developed strategies to provide them with a wide range of instructional and educational tools to learn and experiment with TidalCycles. Some of these include content in the form of instructional videos where I discuss a chosen topic and dissect it from a technical point of view. These videos follow a similar format and approach such

as the multitude of tutorials available on YouTube. Alex McLean himself has a series of freely available TidalClub Tutorials I include as supplemental content [17]. This typically involves a demonstration of how I would approach a completely improvised line of code, explaining the thought process and decisions that were made. Further tasks are given to ensemble members in the form of problem sets, a set of instructions provided in plain English. This is deliberately done so that members will eventually be able to compile TidalCycles code drawing from what they have learned in workshops and tutorials. Should members choose to complete this task, it should assist them in preparing sufficiently for rehearsals.

Conducting UPLOrcShops in this manner, in accordance with many other university music departments (Cheng 2019), is purely pedagogically motivated and attempts to facilitate the development of essential twenty-first century skills (Feerrar 2019). At the time of writing it is not clear whether any skills have been developed by the current members of UPLOrc (not including myself). I, on the other hand, have experienced increased awareness of my sonic surroundings when I collaborate with others (Cheng 2019). This is futher explored in Laubscher (Forthcoming).

4.2   Rehearsals

UPLOrc rehearsals are currently held on Fridays for one hour, divided into two parts. The first, is a thirty minute "jam" [18] in which we improvise the entire performance. As our end-of-cycle performance/s draw near we move to rehearsing pre-planned improvised or "comprovised" content, an idea put forward in the work of Dudas (2010), Tsabary (2012) and Tsabary & Woollard (2014). We attempt to extend this notion that live coding in laptop performance can be approached from either a compositional or improvisational perspective, or a combination of the two. For instance, Albert (2012), reports on a similar approach taken by the Laptop Orchestra of Louisiana (LOLs), where performers are improvising within a structured, pre-

planned arrangement of musical events. These events are often organised in terms of their duration, density, and gestural structure.

The second portion of UPLOrc rehearsals involve a post-rehearsal discussion on our Discord server channel with the same name. I use this as an opportunity to determine how members are responding to the content. A general question is given to members each week to determine whether anyone had any issues or problems that they'd like to bring to everyone's attention, or sometimes whether anything in particular stood out to them. I pose this general question to prompt thoughts and extract ideas from my collaborators, seeking to promote a collaborative atmosphere where everyone has the opportunity to express their musical thoughts and ideas freely. Of course anyone is free to prompt ideas or ask questions, as it is intended to be a collaborative project where we interact with, and explore each others point of view.

4.3   Performance preparation

UPLOrc first performed online in December 2020, as part of performance cycle one. Together with our performance on 24 June this year, we felt that we needed to re-examine how we plan and execute our performances. While these performances each had several interesting moments, at times it became challenging to hear ourselves. It was clear that we needed to incorporate a wider range of sampled sounds. Additionally, we sought to include more rhythmic, harmonic and melodic material. I decided to compile a new strategy that would best suit our current situation and subsequently distributed a package of documents and tutorial content to ensemble members. In this I describe multiple strategies on how to express various musical elements using TidalCycles functions.

Some useful strategies have emerged from planning our second performance cycle. First, I explicitly list each action that needs to be performed in a step-by-step manner. Instructions are provided, asking the performer to make small changes, in addition to

computing their code more often. In an attempt to incorporate a wider range of musical phrasing UPLOrc turned to two applicable TidalCycles functions. The *struct* and *up* functions enabled UPLOrc to incorporate rhythmic and harmonic transformations in combination with our chosen sound palette for the performance. This, and all our performance preparation documents, are accessible from a dedicated GitHub repository. [19].

UPLOrc members are also provided with an additional document referred to as a "Cheat Sheet." This has been a useful tool for UPLOrc, especially for the beginning live coder. Taking a quick glance at the sheet often prompts ideas for improvising, and acts as a quick reference guide for some essential TidalCycles functions. With the wide range of functions that TidalCycles offers, I have noticed that novices tend to struggle retaining all the functionalities of the environment. This sheet was compiled to assist members with this problem. An essential advantage of working with TidalCycles is that users are, usually within a short amount of time, able to compose complex combinations of TidalCycles functions [20]. More often than not, these function combinations produce equally complex musical material. For that, essential functional programming knowledge (McLean 2014) has become of great important when it comes to understanding the behaviour of a particular TidalCycles function. For example, when examining a function such as *struct*, one can deduce that it accepts a boolean pattern (true and false values), expressed in binary numbers (zero's and one's). *struct* therefore, is useful for compiling rhythmic patterns with TidalCycles code, by simply assigning a pattern of binary numbers to a *struct* function:

```
struct "0 1 1 0 1 0" $ s "bleep:2" #up "1 3"
```

Studying and analysing TidalCycles functions in terms of their behaviour and construction, has stimulated a greater understanding of the environment and what is musically possible within the constraints we have set for ourselves. Design constraints are essential for defining the limitations of "musical expression" (Magnusson 2010, p. 69), and while developing an understanding of the technology UPLOrc uses to perform, I would argue that the most important aspect of our preparation is owed to a combination of these two perspectives. Magnusson (2010) further points to the importance of time spent experimenting and discovering the constraints within which an entire ensemble is able to perform using a programming language similar to, but not excluding, TidalCycles.

5 Lessons learned

Throughout this article I have pointed to the majority of the problems that UPLOrc has encountered thus far. An additional problem we have yet to address is the manner in which we express our musical ideas. This is an avenue I feel needs to be explored further in my research. Combining our collective experience and knowledge from a variety of fields in musicology such as composition, performance, technology and education, is our greatest advantage. With this combined expertise we aim to further develop and cultivate our identity as an ensemble, in the process of experimentation, exploration and presentation of ourselves in the form of live streamed YouTube content. Due to the limitations of some of our current equipment UPLOrc will, for the foreseeable future, continue experimenting and performing with TidalCycles. Though completely sufficient for UPLOrc at this time, in the near future we aim to incorporate other technology into our performances. This would require additional invested time and funding to learn how to navigate these tools.

The aforementioned problems some of us experience with "glitching," is a continuous issue for UPLOrc'ers. Not only do we need to monitor the constraints of the MiniTidal language in Estuary, but so too do we have to monitor Estuary to ensure that our audio output remains without any unintended glitched effects. We did manage to maintain a steady audio output during our YouTube event on 31 July, at the cost of having to reduce the amount of func-

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tions we were able to include in our performance. The way in which I planned and compiled instructions for our final performance ultimately included the perspective of one person - my own (Laubscher et al. 2021*a*). For this project to be truly considered collaborative, where participants are equally responsible for making decisions, more invested time from our members is required. Controlling and performing musical gestures in this purely instructional manner becomes problematic in that control over the musical output can only be performed in a memorised and sequential manner, as suggested by Salazar (2017) and Ogborn (2012). This ultimately limits and, to some extent, removes the control a participant exerts on their overall musical output, thereby depriving them of their individual musical agency (Knotts 2015, Bishop 2018).

6   Conclusion and future research

As the principal researcher of my forthcoming research titled, *Establishing a laptop orchestra in South Africa: An emic-centred inquiry into computer music performance* (Laubscher Forthcoming), I aim to further understand the interactions between myself and other network musicians I encounter. This article has provided me with an opportunity to reflect on the work I have completed thus far. In this process of writing this reflective piece, and as a member of the live coded and network music communities, I have been able to reach some initial assumptions about my work. At the time of writing, my current research examines whether and to which extent a novice live coder is able to develop a musical identity as a network performer within a pre-determined set of constraints (Bishop 2018). The study will be conducted with my own progress as a live coding performer in mind, and as such is presented from an insider's perspective (Morey & Luthans 1984). Through interaction, communication, observation and experimentation, UPLOrc is closer to establishing a distinct musical identity - an identity that is in constant flux. Similar to the exploration of the musical possibilities of new modes of connectivity and communication through the use of Mini-Tidal and Estuary, UPLOrc is constantly redefined

through the development of our individual identities as performers of network music (MacDonald et al. 2002).

While pre-determined musical parameters and technological constraints may limit the possibilities of musical expression, the musical decisions and actions of members of an ensemble should not. The question "does technology facilitate or constrain creativity" posed by (Bishop 2018, p. 13), and placed in the context of collaborative live coded performance, remains unanswered at this time. I hope my forthcoming research will provide more information that extends to a more complete answer of this question. Myself and the other members of UPLOrc recognise that we have much to learn as an ensemble and as individuals within the current constraints and limitations we currently face. We intend to extend and expand on the practices we have developed thus far, with particular attention to restoring performer agency through increased engagement and development as live coding musicians.

Notes

[1]   Located in Ontario, Canada, Research at NIL is focused on developing media and software for collaborative network music performance and is funded by the Social Sciences and Humanities Research Council of Canada (SSHRC). Visit https://nil.mcmaster.ca for more information.

[2]   Accessible from
`https://estuary.mcmaster.ca/`

[3]   Six performances to be exact. See `https://www.youtube.com/playlist?list=PLroSCmh5yBWAHsSjTMY3hXtNoVB1I8Snh`

[4]   Science, Technology, Engineering and Mathematics education.

[5]   See `https://orcid.org/0000-0003-1947-7055`

[6]   See `https://www.up.ac.za/school-of-the-arts/article/2821812/public-lectures-`

[7] `https://slack.com/intl/en-au/`

[8] `https://discord.com/`

[9] Accessible at `https://github.com/dktr0/estuary`

[10] `https://www.chromium.org/`

[11] For more in-depth information about how to access and use Estuary, see Ogborn (2019, June 11) and Ogborn (2020, December 3).

[12] Other live coding environments hosted on Estuary include CQenze, LaCalle, Sucixxx, Togo, BlackBox, Punctual, CineCero, TimeNot, Seis8s and Hydra.

[13] https://github.com/dktr0/Punctual

[14] Integrated Development Environment

[15] I say "almost all" because this is also dependent on the computing abilities of the device a particular member is using

[16] Five years since Estuary was first released.

[17] See `https://www.youtube.com/watch?v=M-Y5pAEBXXQ&list=PL2lW1zNIIwj3bDkh-Y3LUGDuRcoUigoDs`

[18] Another common term used by live coders on the Estuary platform.

[19] See `https://github.com/djmelan3/Academic_Articles/tree/main/DHASA_2021`

[20] See https://tidalcycles.org/ for detailed information concerning the capabilities of TidalCycles

Acknowledgements

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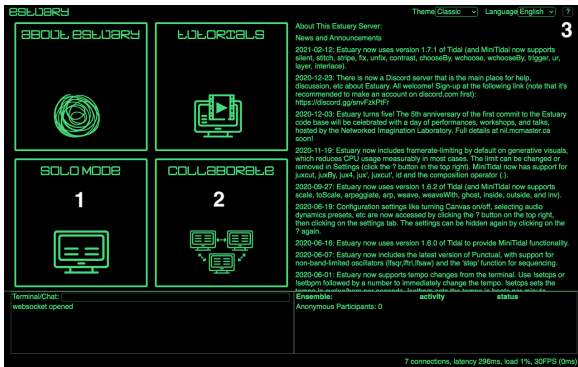
Figure 1: Estuary login screen

Figure 2: UPLOrc screen layout