Livecoderas Latinoamericanas: Diversity, educational access and musicking networks in live coding in Latin America

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Live coding in Latin America has always been tied to educational access concerns and has been disseminated through the region by way of free workshops offered outside of academic institutions. Although there is significant live coding activity in Latin America, live coding outside of the European context has been little explored. We interviewed 11 female practitioners active in live coding nodes in Latin America to uncover the challenges this group faces in terms of access to music education and live coding with the aim of determining what strategies can be implemented to mitigate these challenges and promote diversity in the future. We also consider the role of collective activity and how interaction between live coding nodes in the region has led to the formation of safe spaces in which participants can share resources. The results show that live coding offers attractions for those who have faced challenges in music academia while those with non-music backgrounds found an introduction to sound creation through live coding. This suggests that live coding provides new opportunities for inclusiveness that could be taken advantage of by music academics.

1. INTRODUCTION

Latin America is a complex and diverse region comprising historical, social, cultural and religious features. Latin America is a plural unit resulting from a hybrid origin, which shares characteristics such as the processes of conquest and colonisation, the *mestizaje* (the mixing of European and indigenous cultures), the independence processes, and later the geoeconomics dominance of the United States (Gómez-Santibáñez 2017).

Various Latin American intellectuals throughout history have sought a model of identity based on historical, social and cultural coincidences that go beyond the Latin origin of the language spoken in this region. These intellectuals sought an inclusive vision of Latin America as 'Our America' (De Sousa Santos 2017) among them are: Simón Bolivar (Venezuela), José Martí (Cuba), Domingo Faustino Sarmiento (Argentina), José Vasconcelos (Mexico) and Gabriel García Márquez (Colombia). This idea of 'Our America' integrates a historical and geographical logic that is different from the Anglo-Saxon concept of America (Torres-Martínez 2016).

In the musical field, various authors have argued that sound creators in Latin America share similar concerns. Aharoniaán (1993) aimed to show that Latin American composers have ten characteristics in common, while González (2013) stated that musical creators in Latin America are concerned with tradition, modernity and social issues. Others have aimed to preserve and document the creations of Latin American artists. An example of this is the Latin American electroacoustic music archive (Dal Farra 2013).

More recently, several political and economic problems have emerged in the region, and gender violence has had an increasing impact in Latin America. Societies in different countries (Chile, Argentina, Mexico and Uruguay) have taken to the streets and social media using the phrase *ni una menos* (not one female less) to demonstrate against gender violence (Agüero 2018).

Concerns with gender violence have bled into the field of live coding in Latin America. The manifesto of the live coding collective LivecoderA, which was initially written by Iris Saladino a live coder from Argentina, strongly refers to gender inequality and describes a *livecodera* (Spanish term for female live coder) as someone who experiences gender violence on a daily basis (LivecoderA n.d.). From this perspective, we decided to interview 11 female live coders from the region with the aim of discovering more about the problematics they face in terms of gender.

The background of live coding in Latin America ties to projects relating to promoting access to education that displays that live coding in the region has always had a link with access concerns. The first country in Latin America that saw significant live coding activity was Mexico. Cárdenas (2018) has described how live coding activity in Mexico began in 2000 with Sergio Luque's SuperCollider workshops, which were realised in government institutions in Mexico City. Luque's students consequently began to deliver further

Organised Sound **28**(2): 173–184
doi:10.1017/S1355771823000407

free live coding workshops in the Centro Multimedia or CMM (Multimedia Centre) in the National Centre of the Arts in Mexico City and from 2010 a regular monthly *taller de audio* (audio workshop) was established in the CMM in which participants worked in pairs to live code audio and visuals.

Similarly, the beginnings of live coding in Colombia relate to an educational project. In 2012 the Colombian government provided funding to create music schools for disadvantaged children in Medellín (Betancur 2022). A music engineer working on the project had recently travelled abroad and had come across the term 'live coding'. The members of the project began to research live coding and contacted the creators of the programming language chucK in Stanford University, who supported the project, and the children started to learn chucK. The first Algorave, an activity in which algorithms are explored in conjunction with electronic dance music (Collins and McLean 2014), in Colombia was realised in 2013 in Medellín by a group of 20 children aged between 8 and 13 years (Betancur 2022).

During the following years, live coding started to spread throughout the region by means of free pedagogical workshops. In 2018 the Mexican collective RRGTRN carried out live coding workshops in Ecuador, Peru and Colombia in which participants created localised programming languages (Angel, Teixidó, Ocelotl, Cotrina and Ogborn 2019). As of 2020, TOPLAP (an organisation to promote live coding) has nodes of live coders registered in Mexico, Argentina, Colombia, Peru, Brazil, Ecuador and Costa Rica. Despite this quantity of activity, live coding in Latin America has not been widely explored, although Cárdenas (2018) has documented the beginnings of live coding in Mexico and various Latin American live coders have presented their projects and research in the International Conferences on Live Coding that were hosted in the region in 2017 (Morelia, Mexico) and 2021 (Valdivia, Chile).

Armitage (2018) states that there has been no research related to underrepresented groups on the live coding scene and realised a study in which eight UK-based female live coders were interviewed about their experiences. Armitage discovered that the visibility of female role models and access to female-only live coding workshops that generate safe spaces led to more participation of female live coders in the UK. Another factor that motivated female live coders' participation in the UK was the performative aspects of Algorave and that it is viewed as a welcome and open scene. A participant in Armitage's study highlighted the lack of non-white live coders in the UK, which suggests that racial representation is a problem in live coding.

Aside from Cárdenas's (2018) overview of live coding in Mexico and India, there has been little research focused on live coding outside a white European context. Armitage and Thornham (2021: 91) propose that many studies on live coding, due to their preoccupation with the fetishisation of software and the concept of technology as a tool that facilities the human agent, promote 'masculine, white and Western conceptions of technology' that 'negate non-white, non-Western, non-masculine bodies, expertise and histories', arguing that a more inclusive way to conceive live coding studies is to focus on the idea of technology as kinship. Their interviews with eight female live coders showed that their experiences highlight a reciprocal and embodied techno-human relation that opposes the concept of agency.

This study focuses on the experiences of female live coders in Latin America to uncover the challenges this underrepresented group faces in terms of access to music education and live coding. We aim to determine what strategies can be implemented to mitigate these challenges and promote gender diversity in live coding in Latin America. Armitage (2018) found that characteristics of the Algorave scene made underrepresented groups feel welcome in the UK. In recent years, various live coding networks have emerged in Latin America, and we aim to explore how these networks play a role in the promotion of diversity. Are there features of the live coding community in Latin America that attract a wider range of people to the practice? In what way could live coding be harnessed as a promotor of diversity in the sonic arts?

To respond to these concerns, we aimed to interview female live coders from each of the TOPLAP nodes registered in Latin American countries. We conducted semi-structured interviews with 11 female live coders from Mexico, Argentina, Colombia, Peru and Chile. We were unable to connect with female live coders in Costa Rica, Ecuador and Brazil. As of August 2022, no female live coders have participated in events organised by Algorave Brasil (Fuser 2022). Similarly, there are no females active in TOPLAP Ecuador (Romero 2022). The collective tacococodin in Costa Rica have collaborated with a Costa Rican female live coder (whom we were unable to reach) but the core collective comprises four males (Sáenz 2022). This suggests that gender representation within live coding is a problem in Latin America.

The interviews were carried out in Spanish via video conferencing during August 2022. The artists were asked questions relating to their discovery and initiation to live coding, their educational background and experiences, the challenges faced within live coding and education, and the role of collectives in their practice.

https://doi.org/10.1017/S1355771823000407 Published online by Cambridge University Press

Table 1. Participants' backgrounds

Country	Music background	Other arts background	Humanities background
Mexico (3 participants)	0	1	2
Colombia (3 participants)	3	0	0
Peru (1 participant)	0	1	0
Chile (2 participants)	1	1	0
Argentina (2 participants)	1	1	0
TOTAL	5	4	2

2. OVERVIEW OF THEMES RAISED IN THE INTERVIEWS

In the interviews, we asked about the artists' educational background, how the artists discovered live coding, why they were attracted to the practice as well as the challenges they had faced with respect to access and participation in live coding. After completing the series of interviews, we listened back to the recordings to identify common themes raised.

All participants had studied or were currently studying to at least undergraduate level and 55 per cent of the participants had educational backgrounds outside of music (Table 1).

As a general overview, some repeating issues relating to academia not being considered a secure space to obtain knowledge were raised in most countries (Table 2). It is likely that the theme of academia arose as it is the primary source of knowledge for people who are of an educational age and most participants were of educational age. Another topic that was raised by all participants was the general challenge of accessing music education (Table 2).

Owing to the issues already stated, the artists turned to live coding as a medium of sound creation, mainly because live coding can offer a safer space where artists can share knowledge and resources through horizontal relationships. All participants mentioned that it is practised outside of academia, and the fact that it relies on a textual/visual form of notation was an incentive for 91 per cent of the participants. Some participants also highlighted the aesthetics of failure and the aspect of open-source software as something that attracted them to the practice (Table 3).

2.1. Challenges with educational access

All participants experienced problems relating to accessing music education at all levels, from basic music lessons at an early age to university. In the case of university studies, the system in Latin America requires music notation literacy and a prior grounding in music theory. This represents an issue due to the lack of access to this knowledge in primary and secondary school. Not all schools deliver music as an individual artistic subject as the approach to arts education is more interdisciplinary due to a lack of specialised teachers. Depending on the specialisation of the pool of teachers available, other arts subjects such as fine arts, theatre arts or dance may be offered as an alternative to music, or an interdisciplinary arts subject may be available. This means that to gain music literacy skills it is necessary to pay for private lessons from an early age and access to this will depend on economic family support. Kelly-McHale and Abril (2015) discuss a deficit-based educational issue which refers to the view that students from minorities enter education with a lack of necessary skills. One of our participants commented:

> Marianne Teixidó (Mexico): It's a matter of class and of having the economic resources to be able to access music education. To take music classes is a privilege and I did not have this privilege.

Once in the academic system further challenges are faced. The approaches taught are based on Western note-based languages, which privileges aesthetics conditioned by traditional notation of musical parameters, virtuosity and individuality. If a student creates in those aesthetics, they are more likely to receive opportunities and visibility that triggers a subset of problems relating to the generation of safe spaces. Some 80 per cent of the participants who had studied music highlighted a gender gap, describing music academia as male dominated with discrimination in terms of gender, race and social class. Some participants stated that gender minorities are subjected to *microviolencias* (microaggressions) and spoke of academia's vertical structures and aesthetic boundaries:

> Laura Zapata (Colombia): The academic world and composition are masculinised, hierarchic, vertical, and

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Table 2. Main problematics raised during the interviews

Country	Accessing music education	Problems in academia	Gender gap	Discrimination
Mexico (3 participants)	3	2	1	1
Colombia (3 participants)	2	2	2	2
Peru (1 participant)	1	0	0	0
Chile (2 participants)	1	2	1	2
Argentina (2 participants)	2	2	2	2
TOTAL	9	8	6	7

Table 3. Attractions of live coding

Country	Practised outside academia	Horizontal structures	Aesthetics of failure	Open source	Text / visual notation	Diversity of role models
Mexico (3 participants)	3	1	1	1	3	2
Colombia (3 participants)	3	3	2	2	3	2
Peru (1 participant)	1	1	1	1	1	0
Chile (2 participants)	2	2	0	1	1	1
Argentina (2 participants)	2	2	0	0	2	2
TOTAL	11	9	4	5	10	7

phallocentric. I started studying classical music and I was profoundly disillusioned by the pyramid structures, but that is not a specific problem of musical academia, it is a problem of academia and institutions in themselves. I faced macho sayings like women can't be virtuosos and there was discrimination to enter the university for being a woman. I started to study electroacoustic composition and there were a lot of men. There were only two women in my generation.

Iris Saladino (Argentina): In academia there are more men than women in terms of students and teachers. Academia is elitist. There is elitism in the teaching and learning process. There is a system of values in notated music. I didn't feel valued or recognised. There are *microviolencias* (microaggressions). There is no generation of safe spaces in terms of learning spaces or social spaces. There are very few people who have humility and respect.

Constanza Lobos (Chile): My aesthetic guides had a lot more to do with what was going on in TOPLAP Valdivia than in academia and other references like what they (live coders) were doing in Argentina. I started to work together with Florencia Alonso (an Argentinian live coder) as more than the academic approach, we were more interested in things that we had in common in terms of Latin American parallelisms. There are certain biases in academia. There was a course with 40 students and a fifth were women. This bias diverts females towards gendered activities such as singing and provokes a situation in which there are no female teachers. It was difficult to integrate live coding with the curriculum because of the issue of tradition in academia.

Alexandra Cárdenas (Colombia): In my generation there was a brutal case of colonialism in the conservatoires. I wanted to be a composer but not in the elitist world of classical music.

These issues have been raised by several researchers in other latitudes. Lamb and Dhokai (2015: 124) discuss problems that stem from what they term the 'grand narrative' of music education, which means that it focuses on the narratives of 'white, anglophone, heterosexual men' and ignores the narratives of other individuals, especially those not from the Northern and Western hemispheres, which can lead to the alienation of students who do not identify with those characteristics. De Quadros (2015) argues that music

https://doi.org/10.1017/S1355771823000407 Published online by Cambridge University Press

education focuses on the acquisition of skills and techniques and ignores larger goals of personal meaning, while Woodford (2005: 30) describes music education as having 'highly prescriptive pedagogies' that 'stifle the creativity' of students.

There are statistics that point to gender inequality in music classrooms. In the UK, male entrants outnumber female entrants in the GCSE and A Level music examinations (Savage 2015). In terms of Latin America, it is more difficult to obtain statistics but in the case of the Music, and Artistic Technology Degree in the National Autonomous University of Mexico, the average intake of female students since the course began in 2016 has been 5–10 per cent (Rodriguez-Martínez 2022).

2.2. Live coding as a promotor of diversity

Owing to the preceding problematics, live coding offered the participants an alternative approach to sound creation. All participants discussed how live coding is practised in spaces outside of academia and, in those spaces, many discovered the practice and developed skills:

> Yotzin Viacobo (alias Querrá) (Mexico): A friend proposed to do a from-scratch night in her house, so I went to their party and that was when I discovered live coding.

> Laura Zapata (Colombia): I saw SuperCollider a semester in university, but the rest has been autodidactic or in alternative spaces outside of academia. What is interesting about live coding is that it is practised in alternative spaces. A party can be an educative space as well, by showing and disseminating the code on the screen we can understand oh there you're doing a delay.

Another common theme mentioned by 82 per cent of the interviewees was the community's emphasis on horizontal communication that creates networks of exchange:

> Ximena Portal (Peru): You can ask for technical help, there is always someone available to give you advice, the communication is horizontal and that allows you to access knowledge.

> Alexandra Cárdenas (Colombia): They do not judge you in the community of live coding. No one is above or below anyone else.

Participants also signalled the lack of aesthetic barriers and the freedom that live coding offers:

> Marianne Teixidó (Mexico): Live coding is not subjected to the same rules or requirements as Western classical training.

> Alexandra Cárdenas (Colombia): There isn't an aesthetic judgement.

> Florencia Alonso (Argentina): Live coding lacks the boundaries and structures of traditional tools of sound-based expression. The possibilities are infinite.

> Yotzin Viacobo (alias Querrá) (Mexico): Live coding represents freedom for me.

> Paz Godoy (Chile): It's like a game, like Lego.

Live coding offers an alternative introduction to sound creation without the need for music literacy as it is based on textual notation. All participants with backgrounds outside of music cited this as a reason for becoming interested in live coding. Also, the majority of those with musical backgrounds (80 per cent) mentioned text as resonating with them in a different way to traditional notation.

> Marianne Teixidó (Mexico): The thing that's different with live coding is the textual part, the possibly to write and reflect. It's very easy to practise and rehearse, it's super potent.

> Iris Saladino (Argentina): Something about writing text really resonated with me.

> Yotzin Viacobo (alias Querrá) (Mexico): It seemed so interesting to me that a text could sound.

> Paz Godoy (Chile): What I liked about it is that the process of creation and the way get to the final product makes more sense as you can see the path to get there.

> Ximena Portal (Peru): In live coding we can literally see all the code that we've run and follow the process.

> Alexandra Cárdenas (Colombia): I felt more comfortable with live coding because I'm verbal and like words.

Some participants highlighted that live coding, rather than promoting virtuosity, promotes the aesthetics of failure:

> Laura Zapata (Colombia): It has to do with an exercise of clearing the ego, what you do in that moment will never be able to be recreated again like it can be in traditional composition. It's very usual to see codes with lots of errors but it's the experience of how I go about choosing the different possible solutions that are only inside of me in that moment.

> Marianne Teixidó (Mexico): It offers the possibility of the error and getting out of the canon.

> Ximena Portal (Peru): If you fail, you just carry on.

Some of the participants described how live coding centres on the use of open-source software and the hacker culture, citing this as a reason for easier access to the practice:

> Laura Zapata (Colombia): It's not just a creative practice, it's got to do with a whole philosophy around hacktivism, and I realised I could freely access

https://doi.org/10.1017/S1355771823000407 Published online by Cambridge University Press

> pedagogical tools. Although programming has been dominated by men, in these hacktivist spaces there's dialogue.
>
> Paz Godoy (Chile): Because it's open code it breaks with the hierarchical logic of knowledge and the idea that you've got to go to university and pay an expert who's going to teach you the secret. It's the logic of sharing, it's the hacker culture, for me it was easy to access, it's something open.

Most participants stated that there are visible live coding role models of all genders who promote access:

> Marianne Teixidó (Mexico) (on a workshop led by Alexandra Cárdenas): Someone who's a woman who teaches you that really, it's very easy, it provoked an interest to learn more.
>
> Iris Saladino (Argentina): I started to work with Alex McLean who strives for the world collective of live coders to be open and respectful.
>
> Alexandra Cárdenas (Colombia): Alex McLean is the mentor of many people, but especially women, he looks to support diversity.
>
> Laura Zapata (Colombia): Olivia Jack and Alexandra Cárdenas came to give a workshop and they placed live coding in a feminist discourse, as something outside of academia.

According to the interviews, live coding opened a safe space of learning and creation where horizontal structures and ethical codes form the basis of interaction between participants. These features of live coding are opposed to the situations that some interviewees faced in formal educational environments.

The use of technology has permitted the creation of alternative spaces of learning outside of universities and this has been taken advantage of by a diverse range of people with interests different to those offered by universities' curricula. Autonomous learning has played a fundamental role in live coding networks. Louth (2015) proposes that music technology has autonomous learning at its centre that creates an emancipation and an aspect of empowerment of the individual. A collateral result of this is the diversity of sonic and visual aesthetics of artists who use live coding as a creative tool. Magnusson (2014) states that there is no singular aesthetic associated with live coding. The lack of aesthetical boundaries offered the interviewees a sense of creative freedom that they had not found in academia.

Some interviewees also discovered a creative freedom in live coding through its relationship with the hacker culture. Masu and Morreale (2022) propose that when electronic music teaching is focused around hacking and open-source software, students tend to view the creative process as exploratory, free and playful. Landy (2022) signals that hacking culture is naturally anti-elitist, permeates society and is therefore relevant to a wide range of people.

Another fundamental aspect of live coding is collective creation in which artists can collaborate, participate and provide feedback to each other. Brown and Dilon (2018) mention various favourable aspects of digital performance, such as accessibility to creative practices for people of different levels and abilities, cooperative and shared learning, and cultural resonance, and that it allows participants to overcome geographical barriers that promote a meaningful engagement with music.

We can also observe the change of perspective in the approach to learning music that stems from the use of text, and not from traditional notation of musical parameters, to generate a sonic result. All those from non-music backgrounds found an attraction in the use of text and the ability to visually observe the creative process through the act of coding. According to Schafer (1977), through the sense of sight, we collect the most information about the world. Schafer (1975) proposed the use of graphic notation in the classroom to respond to this sensory inequality and as a form of musical initiation for those without knowledge of traditional notation. Live coding responds to this dominance of sight through its reliance on text.

All the preceding discussion illustrates that live coding is an attractive field for creators who have faced diverse problems in formal music educational environments and challenges with accessing music education.

2.3. Challenges with accessing live coding

Challenges relating to accessing live coding were also raised. Live coding still privileges a social class, requires access to computers and cultural capital, and is practised in urban centres in Latin America:

> Marianne Teixidó (Mexico): People think just because you have a computer, and the software is open source that means live coding is accessible. Just because the information is there doesn't mean that everybody can use it. Someone who has basic computer skills isn't necessarily going to be able to access the software and download it.
>
> Yotzin Viacobo (alias Querrá) (Mexico): Live coding comes from certain privileges and access to certain types of circles. If I'm a girl from Mexico City who's been active in music circles with the same people (realising live coding), why hadn't I come across it before? I think the people who do live coding had the luck to be able to access this type of musical expression but not everyone has a computer to be able to do this. Don't take it for granted that all people understand the logic of

https://doi.org/10.1017/S1355771823000407 Published online by Cambridge University Press

> programming and not all people have the time to do this type of thing. I didn't know anything about programming. I downloaded SuperCollider and I didn't understand anything, it doesn't seem like a very intuitive interface to me.
>
> Iris Saladino (Argentina): It's necessary to consider distributed systems in reaction to centrality in which everything is focused on Buenos Aires. We're looking to decentralise the workshops throughout the country to generate more nodes.

The issues stated by the artists reflect important problems in Latin America. In the educative realm, digital disadvantages have a strong impact on teaching and learning processes. Access to digital tools is linked to income level and geographical location. According to the OECD (2020), the gap in terms of internet use between the richest and poorest in the region is 40 per cent and the disparity in use of digital tools between urban and rural areas is 25 per cent. This reflects that not everyone can access tools such as computers and the internet. The same study signals that a high percentage of adults in Latin America have little or no computer skills, which reflects barriers with respect to learning skills such as creative coding.

In Latin America, live coding is largely practised in urban centres. This is due to the availability of resources such as the internet and academic and non-academic learning centres. The OECD (2020) points out that users of digital contents in cities far outnumber those in rural communities. In some countries in Latin America, those in cities have four times the amount of access to digital tools compared with those in rural communities. Although live coding offers advantages in terms of equality and safe spaces, these can only be taken advantage of by those with certain socioeconomic and geographical characteristics.

To broaden access to live coding, the participants have implemented diverse initiatives to mitigate the problems exposed; for instance, the delivering of workshops in rural areas to create new nodes in the network so that these new nodes can continue to spread the skills to more distant locations. These actions demonstrate that the Latin American live coding community is conscious of these problems. It is important to highlight that lack of technological access is a complex issue that involves the state, society, industry and population of the different countries of Latin America.

3. THE LIVE CODING *MUSICKING NETWORK* AND ITS ROLE IN THE PROMOTION OF DIVERSITY

Most interviewees highlighted the importance of collective activity and described the live coding community as a safe space. One participant described the value of live coding as dependent on the movement:

> Iris Saladino (Argentina): Does the artistic and social value of live coding depend on the resultant works or on the movement itself? I incline more towards the latter, the poetic, artistic and social value occurs because of the movement.

Magnusson (2014) states that live coding is often perceived as a movement and Collins and McLean (2014) refer to Algorave as a movement. Various sociological studies have pointed to music's ability to promote the formation of social groups and social cohesion (Brown and Ulrik 2006; Torino 2008). Crossley (2020) proposes the terms *music world* and *musicking network* to analyse music movements and the social networks relating to them.

The term *music world* is conceived as a 'less prescriptive alternative to scene, subculture, or tribe' to aid with 'the identification and analysis of interesting clusters of musical interactivities' within a wider network of a society (Crossley 2020: 72). Crossley outlines the characteristics of a *music world* as follows:

- Narratives: Aspects of the *music world* are discussed and dissected through verbal and written means constructing a history.
- Collective identities
- Stylistic or social conventions such as the way in which performances are realised or audience behaviours.
- Resources: Associated esoteric skills, instruments, or technologies.
- Focal-time spaces: Events where social relationships are formed.

Crossley (2020) argues that *music worlds* also focus on one of these characteristics: a locality, an aesthetic or a political or organisational ethos. In terms of geography, *music worlds* can be local, trans-local or virtual, or all these things at once.

Live coding is a *music world* as it displays the characteristics proposed by Crossley. Narratives have been constructed though the various blog posts and articles featured on web pages such as toplap.org and tidalcycles.org and these have helped build a history of live coding. The concept of *TOPLAP* nodes corresponds to the idea of collective identities. Live coding has long been connected to performance conventions since the publication of the *TOPLAP* manifesto which demands for the code to be seen by the audience (Toplap 2020). Live coding is also often associated with specific customised software (Magnusson 2014) which exemplifies the resources feature. Focal-time spaces such as gigs play an important role as shown through the realisation of events such as *Algoraves*.

https://doi.org/10.1017/S1355771823000407 Published online by Cambridge University Press

Live coding also has an organisational and political quality displayed through its connection with politically charged texts such as manifestos and the organisation of the *TOPLAP* nodes. In terms of geography, it is local, trans-local and virtual all at once.

Crossley (2020) argues that a *music world* is also a social network, proposing the term 'musicking network' to describe this aspect. Small (1998) coined the term 'musicking' as a non-prescriptive way to refer to taking part in music in any capacity, actively or passively, which includes listeners, audiences and even the ticket sellers at the event. According to Small, the act of musicking forms human relationships and it is in these relationships, and not just in sounds, in which meanings of the musical act are found. Musicking is a fitting term to describe live coding activities in which passive activity is just as important as active activity. The ethos of showing the code on the screen described as an 'explicit act of audience inclusion' by Magnusson (2014: 9) and an invitation for the audience by Cocker (2016) demonstrates that the passive audience, and not just the active coder, is a key aspect of live coding and thus musicking encompasses this broader concept of participation.

In the interviews, we found that many discussed the horizontal aspect of live coding relationships:

> Laura Zapata (Colombia): Live coding collectives are nodes and every node in the network is of equal importance.

The idea of equality links to Small's (1998) concept of musicking, which states that the act of musicking is for everyone. As such, 'musicking network' is a suitable term to refer to the social organisation of live coders in which local nodes form part of a larger network.

Crossley (2020) argues that musicking networks may emerge for homophilic reasons, which refers to how participants gather because of similarities such as shared values, beliefs, or tastes. This promotes a shared identification that can create bonds and encourages those involved in the network to work for social change. Crossley also signals that musicking networks can form for heterophilic reasons, which means that participants come together because of their differences. This could mean that participants lack the resources, information, or skills necessary to achieve their artistic goals and so they form relationships with others who possess those things to collectively achieve the goal.

In the following section, we present case studies of four nodes in the Latin American live coding musicking network to discuss how their formation relates to Crossley's concepts of music worlds and musicking networks to analyse the roles these nodes play in the promotion of diversity in live coding.

3.1. Case studies of nodes

3.1.1. Clic

Clic (Colectivo de Live Coders) is a node that emerged in 2018 in La Plata, a city in Argentina located 50 km from Buenos Aires. Since its formation, the members of Clic established a *Código de Convivencia*, a set of guidelines that also functions as a manifesto published on their website designed to discourage acts of racism and sexism as well as to outline the democratic nature of the group (CliC – Colectivo de Live Coders n.d.). It is based on the code of conduct proposed by Activismo Feminista Digital (Digital Feminist Activism), an Argentinian foundation that promotes the empowerment of women and a feminist internet. Any member who does not abide by these rules will be asked to leave the group. Benefits of participating in Clic were highlighted in the interviews:

> Iris Saladino (Argentina): I haven't felt discriminated or degraded. Clic is open, inclusive and respectful. Collective action is the only thing that makes changes happen. It feels like a form of resistance to be involved in a collective in a society which promotes the contrary.

This links to what Crossley (2020) states about musicking networks establishing a solidarity that encourages members to strive for social change. Saladino described Clic as a 'horizontal' collective that promotes the sharing of ideas, explaining that when there is a consensus supported by the *Código de Convivencia*, it is possible to avoid problematic hierarchical structures that have occurred in other Argentinian live coding collectives in the past.

Clic was also described by Saladino as a 'collective without borders' with considerable online activity that links to Crossley's concept of a 'trans-local virtual music world'. Clic has grown from a local group with four founding members to a node with international reach with participants from all over Latin America. As of August 2022, 496 members can be found on their Telegram group chat. This broadening has changed the node's dynamics both positively and negatively:

> Florencia Alonso (Argentina): Although there are instances of 'mansplaining' in the group chat, the international reach can offer fruitful exchanges between live coders based in different countries in the continent and promotes the sharing of information.

This links to Crossley's observation that musicking networks evolve for heterophilic reasons. The sharing of information and knowledge can be viewed as a way for members to collectively achieve their artistic goals.

https://doi.org/10.1017/S1355771823000407 Published online by Cambridge University Press

3.1.2. La Salpicodera

La Salpicodera is a node of live coders in Bogotá that emerged after Alexandra Cárdenas and Olivia Jack introduced software in a workshop and subsequently the participants continued to gather to further explore the tools. Members began tinkering around in each other's houses and reflecting on the tools and purposes of live coding. The formation of this node links to the homophilic motivations described by Crossley (2020) in which participants join to explore common interests:

> Laura Zapata (Colombia): Members are always rethinking live coding to construct pedagogical spaces to promote new nodes in the network with the objective of disseminating the knowledge for everyone.

3.1.3. TOPLAP Valdivia

TOPLAP Valdivia, Chile is a local node of six live coders that was founded in 2019. As of 2022 there are five male members and one female integrant:

> Constanza Lobos (Chile): Despite the disequilibrium in terms of gender representation, members are committed to promoting visibility of female live coders by inviting international female artists to collaborate and relationships have always been harmonious between us. My aesthetic guides had a lot more to do with what was going on in TOPLAP Valdivia than in academia.

Crossley (2020) argues that connections formed by musicking networks bring about similarity and this leads to members becoming artistically influenced by others.

3.1.4. LivecoderA

LivecoderA is a *trans-local virtual* node of female live coders that emerged in 2022. Many participants originate from or reside in Latin American countries:

> Alexandra Cárdenas (Colombia): LivecoderA stemmed not only from the necessity to have a forum for discussion about live coding but to have an environment in which members can discuss personal issues in a secure space.

Cárdenas's proposal that LivecoderA provides a space for discussing personal problems outside of live coding highlights that relationships are co-evolving alongside the live coding activity that encourages continued participation. This relates to Crossley's idea that musicking networks emerge because participants come together to explore their similarities, in this case in terms of gender and feminist beliefs. Crossley (2020: 89) states that '*musicking networks* and friendships co-evolve and are mutually reinforcing' and that the friendships established through musicking networks provide 'incentives for continued participation'.

Although the name LivecoderA in Spanish refers to a female live coder, the collective is open to all:

> Jessica Rodríguez (Mexico): Participants do not necessarily have to identify as female as it is an open platform with the intention of broadening representation, diversity and embracing femininity. However, the virtual nature of the node has led to some issues of trolls and 'mansplaining' in the group's online posts.

Rodriguez's comments show how discrimination problems can arise due to the insecure nature of virtual environments.

In 2022, LivecoderA organised an online concert and discussion, what Crossley (2020) terms a 'focal-time space', in celebration of International Women's Day. The group is also compiling a database of members that will be published on the TOPLAP website:

> Marianne Teixidó (Mexico): We're making a database of members of LivecoderA and plan to publish this on the TOPLAP website to combat lack of representation of female live coders.

This links to the *narrative* feature of Crossley's concept of music worlds. By publishing this database, a new narrative of live coding will be constructed. LivecoderA is also contributing to the narrative of live coding through the writing of a manifesto that is published in English and Spanish on their webpage (LivecoderA n.d.):

> Iris Saladino (Argentina): Members of LivecoderA can continue to add their own ideas to the manifesto to create a collective identity. The manifesto speaks of an empowerment and freedom which is possible because the members have been able to meet within the context of a secure international collective.

This highlights that, despite some problems with online abuse, trans-local virtual live coding networks have enabled the creation of safe spaces in which gender minorities can feel confident to express themselves.

3.1.5. Sensáfona

Sensáfona is a node in Lima, Peru with four members:

> Ximena Portal (Peru): Participants of Sensáfona combine live coded visuals and audio with dance and musical instruments. Each member focuses on a specific skill with the aim of creating collaborative performances.

The interdisciplinary nature of the node highlights that it emerged for what Crossley refers to as heterophilic reasons. Each artist in the collective is dedicated to a particular skill and they come together to share these abilities to collectively achieve their goal.

Sensáfona is actively promoting the diffusion of live coding in Peru through the realisation of free online educational workshops:

https://doi.org/10.1017/S1355771823000407 Published online by Cambridge University Press

Ximena Portal (Peru): Within the educational workshops it is important to achieve a horizontal approach to pedagogy.

3.2. The nodes' roles in promoting diversity

The interviews revealed that the nodes play a role in the promotion of diversity in live coding in Latin America in the following ways:

1. Through the promotion of horizontal relationships, they generate safe spaces for gender minorities that permits the sharing of knowledge.

   Iris Saladino (Argentina): Clic is a horizontal collective.

2. They promote the evolution of personal relationships which incentivises continued participation.

   Alexandra Cárdenas (Colombia): LivecoderA stemmed from the necessity to have a forum in which members can discuss personal issues in a secure space.

3. They realise free pedagogical activities to promote access to live coding and the formation of new nodes through pedagogical approaches such as learning through play and non-hierarchical student-instructor relationships.

   Laura Zapata (Colombia): Members consider how to disseminate knowledge through a philosophy of pedagogy through play.

   Ximena Portal (Peru): We treat the students as equals and the people imparting the workshop do not impose themselves as leaders.

4. They contribute to the visibility of gender minorities through the creation of events, such as the one organised by LivecoderA to mark international women's day in 2022, to showcase their work (what Crossley terms 'focal-time spaces').

5. They contribute to what Crossley terms the 'narrative' in that they produce texts, such as the database and manifesto of LivecoderA, which will begin to construct a different history that may impact future perspectives on live coding.

The organisation of the live coding musicking network in Latin America offers a further advantage in terms of the interaction between nodes. Crossley (2020) states that musicking networks may contain inequalities that provoke negative effects and proposes that the way to avoid this is through the sociological concept known as *closure*, which refers to how much interaction there is between different nodes in a network. When nodes within a network are connected, information regarding undesirable behaviours of people involved within the nodes is passed around and as such those members' reputations become damaged, which can lead to lack of opportunities for them (Coleman 1988, 1990, cited in Crossley 2020). Members of nodes understand these social repercussions and therefore when there is closure within a musicking networking, discriminatory behaviours are diminished (ibid.).

There is closure in the live coding musicking network as interviewees spoke of collaboration and exchanges between members of different nodes. Many nodes are becoming trans-local and contain participants from several countries as is the case with Clic and LivecoderA whose participants are active in various Latin American and European nodes. According to the theory of closure, the interaction between nodes will lead to a decrease in discriminatory behaviours and this may be a factor that has led to the live coding community being described as open and welcoming by participants in studies such as ours and the one realised by Armitage (2018).

4. CONCLUSIONS

The results of the interviews highlighted various ways in which live coding provides opportunities for inclusiveness. Many of the participants developed their live coding skills in workshops and environments outside of academia delivered by a diverse range of instructors in which a hacktivist approach was followed and a focus on the aesthetics of failure. The results showed that live coding has certain qualities that may attract a wider range of people, especially those with non-music backgrounds, to participate in sonic creation, and these benefits could be taken advantage of in academia.

In Mexico, although there are university curricula that integrate the teaching of software such as SuperCollider (e.g., the curriculum of the undergraduate degree in Music and Artistic Technology in the National Autonomous University of Mexico), the curriculum design situates it within a pedagogical approach grounded in Western music aesthetics with a focus on mathematical models of algorithmic composition. There is no emphasis on the aesthetics of failure and the hacking culture that can provide important benefits during the learning process such as a sense of freedom and exploration as outlined by Masu and Morreale (2022).

To begin to mitigate some of the problems participants' faced in academia, one approach is to consider a redesigning of university curricula that emphasises how and why to use live coding tools and includes discussions surrounding the hacking culture so that students can freely explore these tools without aesthetical barriers. Masu and Morreale (ibid.) propose practical suggestions for incorporating hacking culture in the classroom such as the implementation of activities that promote critical reflection on the relationship between technology

https://doi.org/10.1017/S1355771823000407 Published online by Cambridge University Press

and music, activities that develop collaboration and attitudes of sharing and the encouragement of students' appropriation of existing tools so that they can explore personal compositional aesthetics. Software such as sonic pi was developed with pedagogical use in mind and promotes the aesthetics of failure, but this philosophy is not explored in music academia in Latin America where there is still emphasis on correctness, virtuosity and the Western canon.

The participants also highlighted that collective activity plays a part in the promotion of diversity in live coding. It is necessary to consider ways of incorporating an ethos of collectivity and horizontal relationships within music academia that is traditionally centred on the concept of the individual. Landy (2022) states that collectivity does not usually form part of music programmes where the tradition has been to teach students to work in an individual way. Landy encourages the integration of collectivity in music and technology curricula and proposes that this can be achieved though the incorporation of hacking culture and DIY approaches. It is the responsibility of educators to consider the organisation of social relationships within the classroom in which power can be exploited to create a hierarchical situation in which those seen to possess knowledge can abuse those considered lacking in knowledge.

The sociological context of Latin America provokes challenges with regards to accessing music education and technology. The interviews showed that the live coding community is conscious of these problems and is implementing initiatives to begin to combat the centrality of live coding by offering free workshops outside of urban centres to stimulate the formation of new nodes which can continue the spread of live coding skills to more distant areas. Many of the nodes in the Latin American musicking network are involved in pedagogical initiatives to disseminate live coding skills. The interaction between nodes throughout Latin America is promoting the formation of a safe space in which gender minorities feel comfortable to participate.

Despite the positive outlooks offered by the interviewees, there are signs that gender discrimination in live coding is still a problem. It was a challenge to find female participants in various Latin American nodes and our sample size was small. Gil Fuser of Algorave Brasil stated that there are problems with gender and race diversity in the Brazilian live coding community (Fuser 2022). Collectivity is a factor in the promotion of safe spaces, but these can only be formed when there is a conscious effort between participants to create horizontal relationships and implement strategies to promote these relationships.

A key issue unearthed in the interviews that was not fully developed in this discussion was the exploration of Latin American identities. Many participants spoke of how they reflect on the cultural, social and political contexts of their countries through the act of live coding. For future work it is necessary to consider how Latin American approaches to live coding connect with the wider sociological context of the region.

Acknowledgements

We would like to express our gratitude to the live coders for granting us the interviews and giving their permission to publish extracts of them in the article: Florencia Alonso, Celeste Betancur, Alexandra Cárdenas, Paz Godoy, Constanza Lobos, Ximena Portal, Jessica Rodriguez, Iris Saladino, Marianne Teixidó, Yotzin Viacobo (alias Querrá) and Laura Zapata.

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