

# Disabled Approaches to Live Coding, Crippling the Code

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## Abstract

The project takes a Universal Design approach to exploring the possibility of creating a software platform to facilitate a Networked Ensemble for Disabled musicians. In accordance with the Nothing About Us Without Us (Charlton, 1998) principle I worked with a group of 15 professional musicians who are also disabled. The group gave interviews as to their perspectives and needs around networked music practices and this data was then analysed to look at how live coding software design could be developed to make it more accessible. We also identified key messages for the wider design of digital musical instrument makers, live coders and performers to improve practice around working with and for disabled musicians.

## Definition of terms

In this paper I will use the terms Disabled and Non-Disabled in line with the social model of describing Disability (Oliver 1990). The social model of disability describes how disabled people are not disabled by our bodies, but by a society which creates environments in which we cannot function. This is the process of society and structures, actively disabling people. For example, the person who uses a wheelchair is disabled by the decision not to include lifts and ramps to a building. It is the design of the environment which disables them. Following this theory, a person with a fatigue condition is disabled from taking part in a project because of the long days scheduled or the distance travelled. The design of the project has disabled the person. A Non-Disabled person is one for whom the structure and design of society broadly works. I will also use the term d/Deaf which is a term which refers to two differing communities and political positions on deafness. Small d refers to those who have partial hearing, or use English as their first language, and capital D deaf referring to those who use sign language and consider themselves “culturally deaf” that is, to live in a more visually orientated culture, outside of spoken language (Woodward,1972).

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I use the term Disabled Musicians to mean disabled people who have a professional or semi professional music practice, as distinct to using music as a therapeutic or community building practice with disabled people. It may be that some of our findings may be suitable and transferrable to the therapeutic and community music research environment.

## Why we did it

### Dreams and Possibilities - a manifesto

- We would like to see action from the Live Coding community to listen to the needs and concerns of disabled musicians around the making of live coding musics and platforms.
- We would like to see ensembles, rehearsals, conferences and performances which respond to the requirements of disabled people.
- We would also like to see the community provide learning opportunities for disabled musicians to learn live coding and software development.
- We would like to see disabled access built into the core of music technology software.

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Disabled Access and Universal Design - Why disabled people must be at the heart of developing technology

The extension of the social model approach is the “nothing about us without us” concept which holds that those for whom a service, system or environment is designed, must have a contributing say as to its design. By incorporating diverse voices in the design of something, we can more reasonably design something which fits those it will serve. This work is extrapolated by Jutta Treviranus in her work on Universal Design.

The first principle of Universal Design, is Equitable Use, and is broken down into the following four categories.

1. “Provide the same means of use for all users: identical whenever possible; equivalent when not.
2. Avoid segregating or stigmatizing any users.
3. Provisions for privacy, security, and safety should be equally available to all users.
4. Make the design appealing to all users.” (Shein, Treviranus, Brownlow, Milner, & Parnes, 1992).

The next logical step to Universal Design is the concept that everything that is made, should be made by a wide range of people for the full range of people. In this way we can ensure that we turn made for, into made by. By incorporating this into our design we can avoid cultural appropriation, perpetuating stereotypes, assumptions, supremacist perspectives, and oppression. For example, a recent development of gloves which interpret sign language into spoken text has met with a negative reaction from some d/Deaf communities (Errard, 2019). Academics from the d/Deaf community roundly criticized the gloves, which claim to turn sign language into spoken language, for a number of reasons. Firstly, that the gloves only interpreted alphabetic spelling, which is a tiny part of sign language, secondly that the hand and finger movements are just a small part of signing, which uses facial movements, mouth movements, and eye movements as a part of the language. Thirdly, philosophically, the gloves reinforce a notion that d/Deaf people’s communication is a thing which needs to be ‘solved’ for non signers, and puts the responsibility for that back onto the signer, to buy, train and use the gloves for the benefit of the non-signer. This was seen as cultural appropriation and a colonialist approach to technology and disability. If d/Deaf people had been included in the conceptualisation of the project, and if the makers had read and understood disability culture and politics, this

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could have been averted. Something more useful and equitable could have been created. From a development point of view then, it is vital that approaches to disabled technology come from the community, with an equitable approach, rather than to fix a problem perceived by the non-disabled community. One example of this kind of thinking comes from The Inclusive Design and Research Centre's project Co-designing Inclusive Cities which

‘...offers citizens a way to actively participate in the iterative design and growth of communities that meet their needs. Including the most unique and diverse needs—the “edges”—in the co-design process is an effective strategy to ensure our design stretches and responds to a broader range of needs. If we reach the edge, the design will also work better for the centre and will be more flexible and generous.’ (IDRC 2019)

It is this co-design which we can import to music technology, and specifically Live Coding in order to make it more flexible, robust and inclusive.

### Why Live Coding?

In this paper we specifically focus on live coding as a way of exploring disabled networked performance, building on a recent strand of live coding research that considers diversity from various angles (Skuse & Knotts, 2018; Ocelotl, N. del Angel, & Teixido, 2018; Armitage, 2018; N. del Angel, Teixido, Ocelotl, Cotrina, & Ogborn, 2019). By making this work about live coding, we have the opportunity to design things from scratch. Coding is Design. When we code something we make it new from scratch, and we can make it to suit ourselves. This allows us multiple levels of engagement with the Universal Design movement, which can support disabled people in making their own technology, and having access to the skills to adapt it as they see fit. This shift in power from the “made for” to the “maker” means

that Disabled coders can be at the forefront of countering (potentially unintentional) ableist music making.

There are also a number of key connections between the concerns of live coding research and those of disabled studies. Firstly a focus on open source software potentially responds to a major concern for disabled artists: the costs of software purchase, maintenance and deployment to diverse computing platforms. Secondly, live coding can often be accomplished without a requirement for specific hardware such as MIDI control surfaces, whose buttons, faders and pots can cause difficulty for disabled people with motor control issues or upper limb difference. Thirdly, and conversely, live coding's enthusiastic embrace of alternative and diverse programming interfaces connects readily with the use of additional hardware, such as eyegaze and headmouse controllers, that might be required by people with particular needs. Fourthly, live coding often takes the form of networked performances using a shared media surface. Moreover, when such networked systems transmit code rather than sound, bandwidth requirements are reduced substantially, making them useful to home-based Disabled artists, for whom the majority of their work may then be performed over the network. Finally, the work of the Live Coding community in breaking down expectations about performance and audience (for example watching someone code is a relatively new progression in terms of gig expectation) can create an opportunity for us to rethink how performance can be made more Disabled. Networks and online presence continue to be a powerful and revolutionary tool for the Disabled community (Pearson & Trevisan, 2015). There are obviously important concerns around surveillance, facial recognition technology, racist algorithms, and oppressive regimes (Umoja Noble, 2018; Eubanks, 2018). However, on a very simple level, Disabled people with limited mobility, or with limited income are able to meet, support each other and undertake activism online (Berghs et. al., 2019). We are still subject to these oppressive technologies of course, alongside trolling, hate speech and unfair representations in social and traditional media. But, we are also liberated from bodies and minds which do not easily meet and communicate in person. In this

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way, networked activity offers a means of collaborating specifically useful to home based disabled people. In this case the question of the impact of networks can come down to ownership, authorship, and agency—whose algorithms are these? Who do they represent (and fail to represent)? How do users have control over changing how something works, understanding how their data is used, and governing its use and aggregation. So again, by shifting “made for” to “made by” we have the opportunity to address power imbalances, structural oppressions and bias.

## What we did

In order to reflect the principles of Universal Design, and ensuring that the users had as much influence on the process as possible, we interviewed disabled musicians to find out their requirements and then attempted to design systems according to our findings. I began by contacting home-based disabled musicians worldwide using social media (disabled twitter, Facebook, Instagram). I conducted 15 online interviews with home-based disabled musicians to explore their approach to making music, their requirements from a music making applications (How should it be laid out? What platform works best? What controller adaptations may be useful? etc.) their requirements for learning and work-shopping ideas (How long can they concentrate for? How long can they control the software for? How best to communicate during the workshops?), and their requirements for performance (Can they do real time performances consistently? Would they need to pre-record aspects of the work? How long can they perform for? etc).

The interview process was granted Ethical Agreement by the University of Plymouth Arts and Humanities Research Ethics Committee, and all data is held in compliance with GDPR, the UK’s Data Protection Act (2018).

## The Interviewees

The interviewees represented a wide range of disabled musicians, and also included two non-disabled academics who work in the fields of adaptive music technology and live coding (although one of these has lived experience of being disabled, they do not currently identify as disabled). The group of disabled musicians included a range of backgrounds and experiences, from acoustic performers who had limited experience of working with music technology to those who have performed as live coders. The interviewees also represented a range of impairments, racial identities, genders and sexualities. This was explicitly chosen as a strategy as to not foreground a white male perspective. As the pool of ‘disabled musicians who are interested in networked performances’ is a particularly small group of people, we were unable to be as diverse as we had hoped. However our group were reasonably mixed. Disabled identities included limb difference, mobility issues, hypermobility, stroke recovery, d/Deaf, M.E., Diabetes, Schizophrenia, Autism, and ADHD. 2 Interviewees identified as black British, 2 as British Asian and the rest as White. 9 interviewees were male and 6 female.

## What we learned

### Findings

Findings from the interviews show a wide range of preferences, requirements and adaptations. Those requirements broadly fell into four categories, physical adaptations, communication preferences (partially sighted / d/Deaf etc), fatigue requirements, social interaction. We mention this because physical adaptations and communication preferences are often foregrounded in disabled access projects, whilst fatigue requirements and ways of structuring activities and social interaction are less commonly considered. The paragraphs below show the different responses to the questions which were put to the interviewees.

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## Hardware

There was a roughly even spread between those who favoured the use of a computer and those who preferred to use a tablet or phone, with some saying that they would often switch between the two. Preferences for using a computer included the larger screen size being easier to view, the keypad being easier to control than a touch screen, that there is more control over connecting different applications, and that it is easier to plug in adaptive hardware such as eyegaze or Headmouse. Preferences for tablets and phones included being easier and lighter to transport, that the touchscreen is less impactful on hands and wrists, that the touchscreen allows interaction for those with less motorcontrol, and that they are generally cheaper to purchase than a computer.

## Design and Display

The majority of interviewees requested that an electronic music environment's colour scheme and display be customisable, with users able to choose their own background colour, font type, size and colour. In addition to this, interviewees requested that the different elements of a user interface or display are placed in separate windows which can be moved around the screen, resized, and zoomed in, or out. This reflects a networked community perspective where each individual is able to define the circumstances in which they work best. By providing customizable design and display we give each person (not just disabled people) the ability to create their own workspace. One of the interviewees controls his computer with a Headmouse, using his tongue to move the cursor and blowing into a tube to click. The Headmouse has no double click or right click function, and in order to 'ctrl click' he has to request his assistant to hold down the ctrl button. For this user it is important that there are no double click or right click actions. In order to type he has to select a screen alphabet and click on each letter, this is a slow a laborious process. For this user, typing proves problematic and laborious.

## Barriers to engaging with new music making software

One of the key barriers to engaging with music technology was cost, a place where the open source live coding community have already made significant inroads. There were also concerns around whether using computer coding to make music is a 'real' musical activity, and whether it would be seen as such in the community. Another barrier was the time it would take to learn a new approach to music making. Many disabled people have pain and fatigue conditions which means that they have less time to function on a daily basis. They may only be able to concentrate or cope with the display screen or controllers for 10-20 minutes a day. This means that it is important that results can be heard after a relatively low amount of time working with the software. In addition to this requirement, two of the interviewees told me that many disabled music technology applications have a limited progression, which does not allow for continued growth and learning. So although the research shows that the disabled musicians would like to see results fast, they would also like there to be the opportunity to grow with the software and increase complexity as they learn. Some of the musicians raised the issue of unnecessary technology being made for the disabled community without their consultation. As discussed above with the Sign Language Gloves. A further barrier was raised around the issue of updating and fixing problems. Much software is made specifically for disabled people by individual developers and university departments. However there is limited budget and time-frame for these projects once the software is built. This then leads to issues when the software is no longer compatible with the latest updates, or the disabled person accidentally changes a setting that requires in depth knowledge to fix. This issue of bespoke software requires bespoke support which is rarely available. Therefore, there is a preference for standardized software to be made disabled friendly so that it is regularly updated along with the mainstream aspects of the programme. Another barrier was the perceived difficulty of learning to code computer music, and a gap in knowledge around what live coding is. In some cases it was considered as an activity where the

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musicians would have to start from scratch and was only suited to programmers or coders.

### **Preferred methods of learning new software**

Methods showed a diversity of preferences, with the majority wanting to learn by trial and error, with help files to refer to as support. The quality and accessibility of help files was brought up by at least half of the interviewees as an issue for learning new software. Our interviewees told us that help files must be written in clear language, in an accessible font and be consistent throughout the programme. A small minority preferred to use video tutorials, but with the stipulation that these should be scripted, structured, captioned and given tags to enable the user to skip through to the section they require. Video tutorials should show the actions at the same time as the explanation, along with clear captions. The view of the screengrab must be clear and legible. Interestingly, those who preferred video tutorials were also the people who had the most experience of working with music technology and live coding. It is possible that this correlation shows that video tutorials are currently more accessible for those with background knowledge and / or confidence in the field (although more research would be necessary as this is a small sample size). Only one person said that they would prefer to have someone help them on a one to one basis, with two expressing that this would be their absolute last resort due to social anxiety or communication barriers. Three said that they would find an online workshop situation difficult due to social anxiety, attention span or communication issues. Accessing forums for support was also considered to be challenging for reasons of social anxiety and a fear of being dismissed or undermined for asking ‘stupid questions’. It was also raised that often the responses received in forums can be either incorrect or overly complex, leading to frustration. Finally, there were comments about how forum environments can often be challenging for those for whom social interaction is difficult, and can lead to arguments or flaming due to confusion over the tone of a comment.

### **What would a disabled friendly gig look like?**

The response to this question showed a range of requirements and preferences amongst the group. In a live environment where the performer was present, most welcomed a quiet or silent space where they could relax before, during and after the gig. It was also mentioned that many chill out rooms tend to become colonized by groups and their focus changes from quiet space to alternative music or VIP space. One of the musicians said a private space for people to go to if they needed space and quiet would be good for the general audience. There were also requests for healthy / diet appropriate food and drinks (for those who have allergies and intolerances) and sugary foods and drinks (for those with diabetes). A flexible approach to programming (the running order) was also considered desirable, with musicians having the ability to rearrange their performance order, or slightly adjust times based on how they were feeling. However, one of the musicians said they needed a clear structure and knowledge of what would happen in which section, and how long each section would be. Other musicians asked for “relaxed performances”, where the generally accepted protocols of attending a concert were suspended. One of the musicians said that he would prefer to blend into something which had already started and then drop out when he felt he needed to. For him, arriving at a specific time and being ready to perform was a huge anxiety trigger. Four of the musicians liked the option of being able to pre record something and send it in advance in case of illness, and 3 of the musicians said they would prefer to perform in the venue, but would like the option of a networked performance if they were unable to make it in person. In addition to these specific needs, all interviewees agreed on wheelchair accessible venues, captioned performances, signing translation and remote access.

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## What issues are there around performing live in a networked ensemble?

Many of the performers cited a lack of eye contact and visible communication between players to be a major concern in playing in a networked ensemble. Others were concerned about computer latency, and internet speeds. Concerns around latency were also expressed in terms of hearing back the ensemble playing out of sync with your own playing.

## Preference for a networked ensemble or live coding ensemble

Three musicians said that they would prefer an opportunity to perform via network with other disabled musicians using their existing musical set up. Four musicians said that they were currently interested in finding out more about live coding and being part of a live coding networked ensemble.

## Implementing Findings

These responses lead to two specific channels of development, firstly, what changes could we make to live coding software, which would support disabled people in becoming part of the community? Secondly, how might we change our working practices to accommodate disabled people in ensembles and performances?

### Software Design Messages

1. The need for complete flexibility of layout, design and display, allowing people to create a workspace which works for them.
2. The need for the software to deliver musical results quickly, but also allow for ongoing progression and development of skills and complexity.
3. The need for well documented, plain language, accessible help files.

4. The need for captioning and scanning through video tutorials.
5. The need for the software to be accessible on both computer and tablet, with the option of using assistive hardware such as eyegaze or Headmouse.
6. The need for disabled access to be fundamentally a part of the main programme for any software to reduce issues around updates.
7. The need for more disabled people to be involved in design and making of their own technology rather than acting as focus groups for non disabled makers.

### Changes in Working Practices

1. Learning and development in the disabled musician community around Live Coding, and approaches to making music in this way.
2. The need for performers to be able to dip in and out of obligations depending on their circumstances, without this being seen as a negative by others.
3. The need for live performances to be flexible, relaxed, with appropriate rest spaces and nutrition available.

## What we are doing next

I am working with the Universal Design Research Centre at OCAD (Ontario College of Art and Design) to make a software system which will allow networked performance from a wide range of disabled musicians on various platforms using various music programmes.

I will then invite the interviewees and a wider group of disabled musicians to explore the software and begin making music. There will be several one to one feedback sessions and a discussion group where the musicians can advise on further potential issues or adaptations.

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The group will meet online and explore ways in which we can use the platform to make music together. Within this group we will create a “working with” document for each person to outline any needs they may have around rehearsal or performance etiquette, communication needs or group behaviours. As a group we will then work to find a way to work which supports and respects each of those needs equally. This working practice will reflect a non-hierarchical networked structure, allowing for flexibility and non-judgmental responses to requests.

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