

# **Insights into MIRLCAuto: A virtual agent for music information retrieval in live coding**

**Why legibility, agency and negotiability matter in AI-powered live coding environments**

Anna Xambó

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*Coding Literacy, Practices & Cultures Colloquia 29.4.2021*

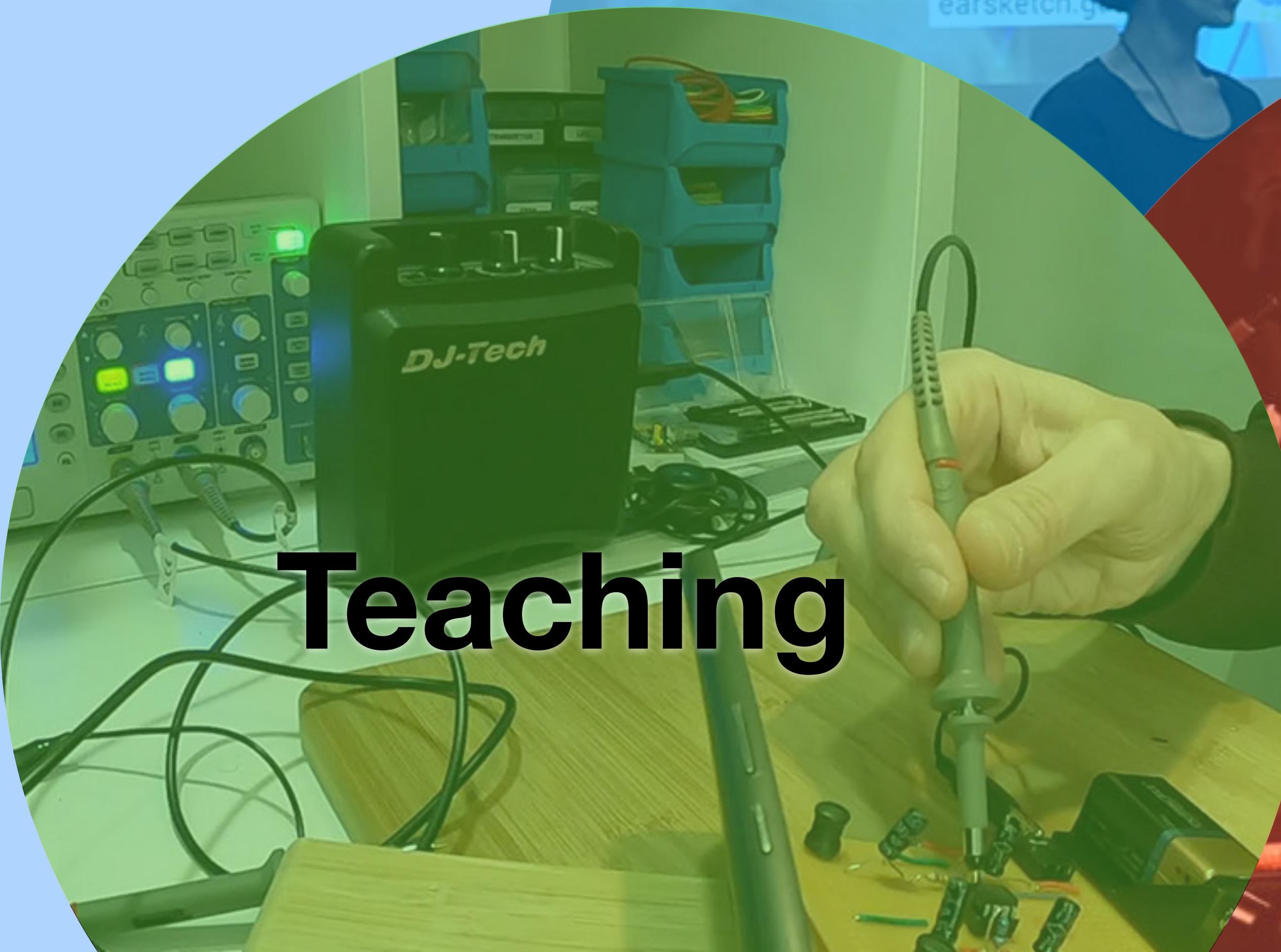
about me



# Research



# Teaching



# Practice



about DMU / MTI<sup>2</sup>



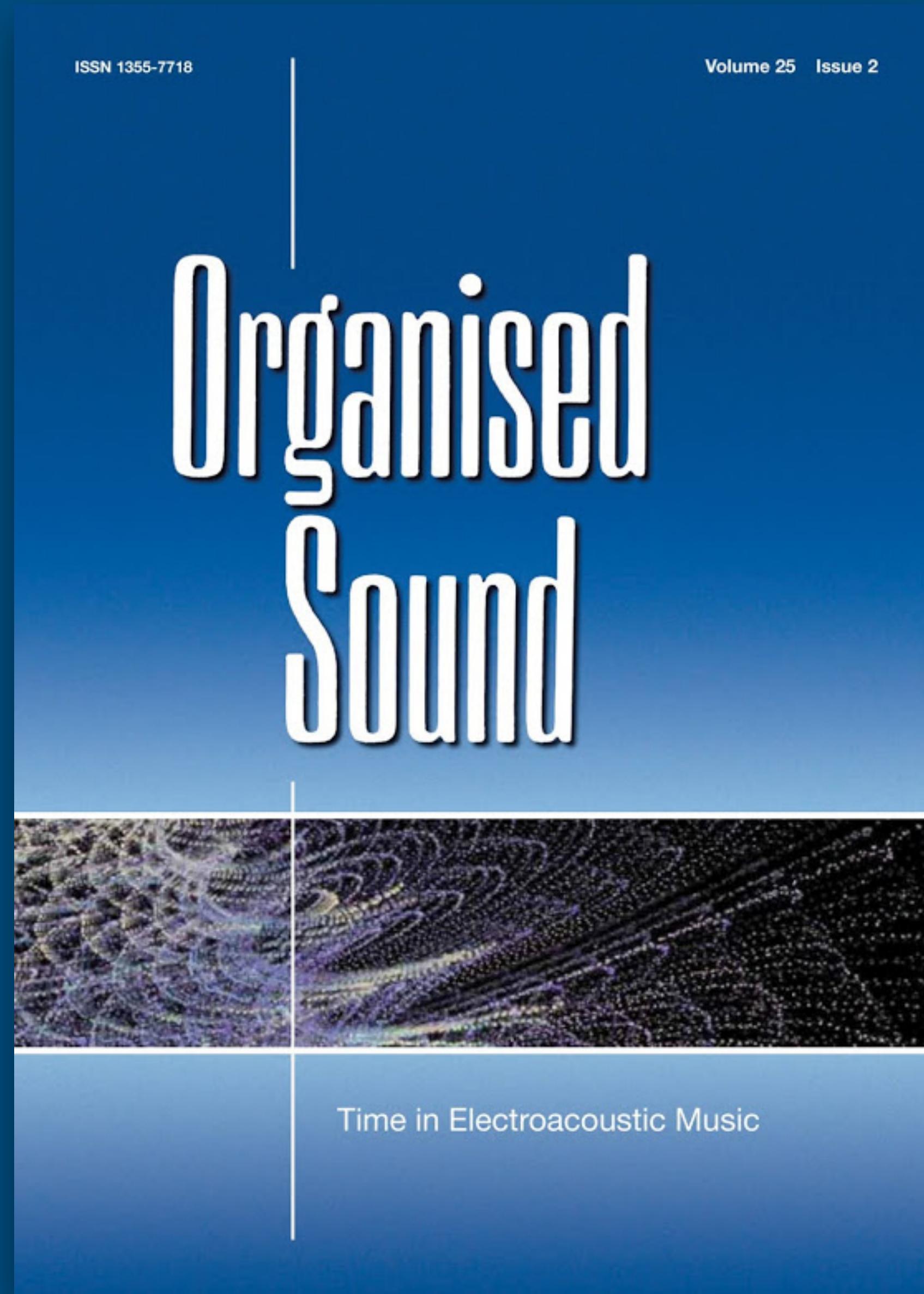


**MTI<sup>2</sup>**  
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- 4 faculties: ADH, BAL, H&LS, CEM
- Gold rating in the 2017 Teaching Excellence Framework





## Music, Technology and Innovation - Institute for Sonic Creativity (MTI<sup>2</sup>)

- RC established in 1999 by Prof. Leigh Landy (RC part of LMS, CEM).
- Topics: new technologies for electroacoustic music & sonic art.
- Related undergraduate and postgraduate courses.
- International research: OS journal, EMS21 (10-13 November 2021)...

Organised Sound: <https://www.cambridge.org/core/journals/organised-sound>  
EMS21: <http://www.ems-network.org/ems21>

# about the project

they are  
the robots

<https://vimeo.com/515416972>

Can we build a **virtual agent** that learns from human live coders using **machine learning** algorithms and a **large dataset of sounds** which goes beyond the approach of following live coder actions (also known as the call-response strategy) and creates **legible and negotiable actions**?

A screenshot of a live coding interface. At the top, there's a header with text like "Description", "A Server object is a representation of a server application", and "Auto Scroll". Below this is a "Post window" containing a list of messages from different users:

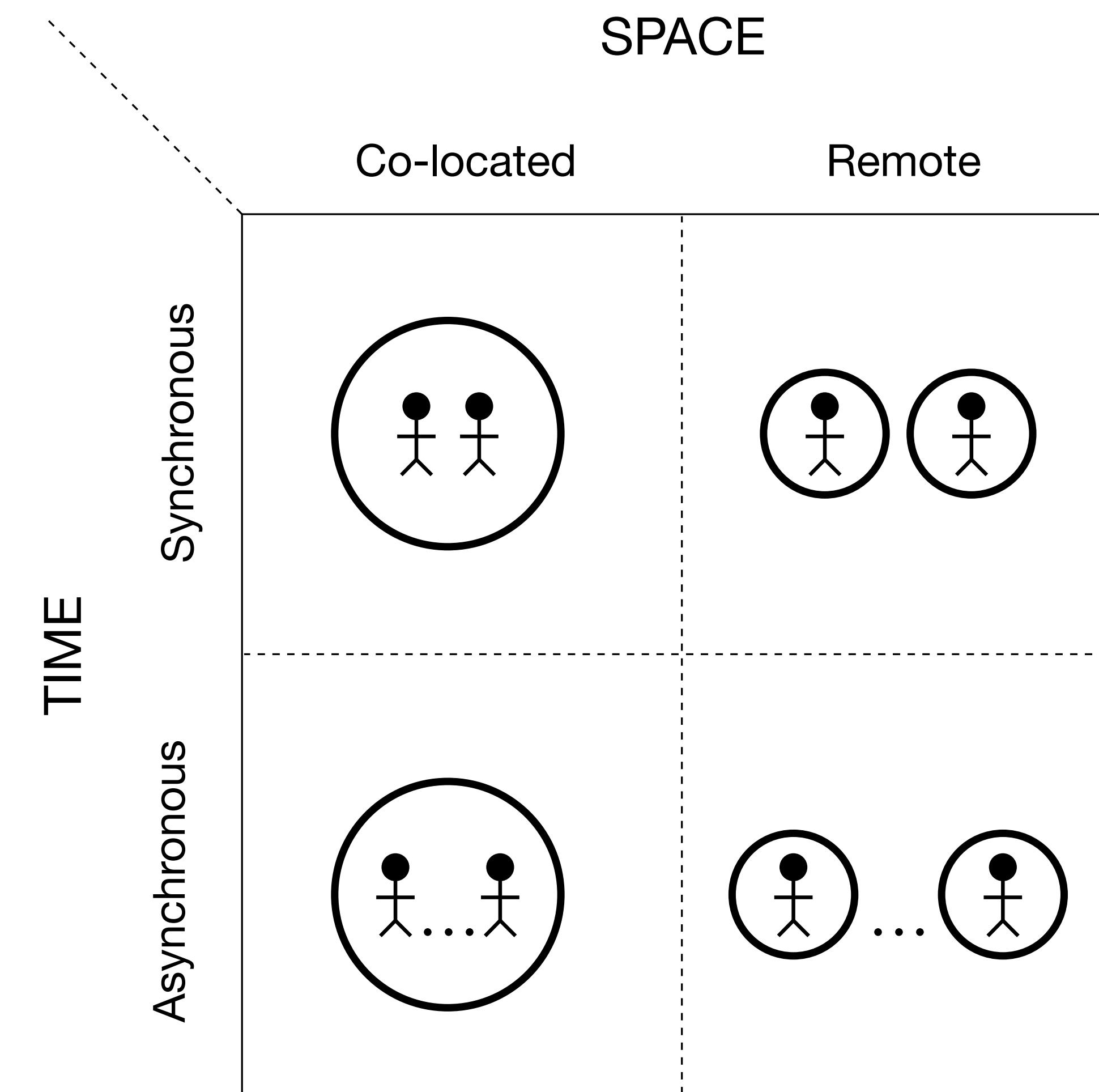
```
#alo: hello! my ip is 192.168.1.100
#anna: hello! my ip is 192.168.1.100
#anna: hello! my ip is 192.168.1.100
#Sillywalks: hello! my ip is 192.168.1.110
#dong: hello! my ip is 192.168.1.107
#alo: hello! my ip is 192.168.1.106
#Darien: hello! my ip is 192.168.1.105
#cindy: hello! my ip is 192.168.1.116
#Brandt: hello! my ip is 192.168.1.109
#alex: hello! my ip is 192.168.1.106
#mojojojo: hello! my ip is 192.168.1.106
#dum dum dum dum: hello! my ip is 192.168.2.3
#dum dum dum dum: hello! my ip is 192.168.2.3
#Feldman: hello! my ip is 192.168.1.110
#Cage: hello! my ip is 192.168.1.110
```

The interface also includes a "Interpreter" section with "Active" and "Server" status indicators, and a "0.07s" latency metric.



# Collaborative Live Coding

Allik, A., Xambó, A. (April 7–8, 2018). “Collaborative Network Music”. Rewire 2018, The Hague, The Netherlands. Organized by Music Hackspace. Funded by Rewire.



# Collaborative Live Coding

CSCW matrix adapted to music systems by Alvaro Barbosa (“Displaced Soundscapes 2003”)

# Machine Learning in Live Coding

- **Machine listening:** Algoravethmic remix system (Collins 2015), APICultor (Ordiales and Bruno 2017), Cacharpo (Navarro and Ogborn 2017).
- **Online training process:** The Mégra system (Reppel 2020), Sema (Bernardo et al. 2020).
- **Other approaches:** Rule learning (Paz 2015), Cibo's performance style generation (Stewart et al. 2020), Collaborative live coding improvisation (Subramanian et al. 2012), Gamification (Lorway et al. 2019).

# Human-Data Interaction and the EPSRC UK Network Plus

## The three tenets @hdinetwork

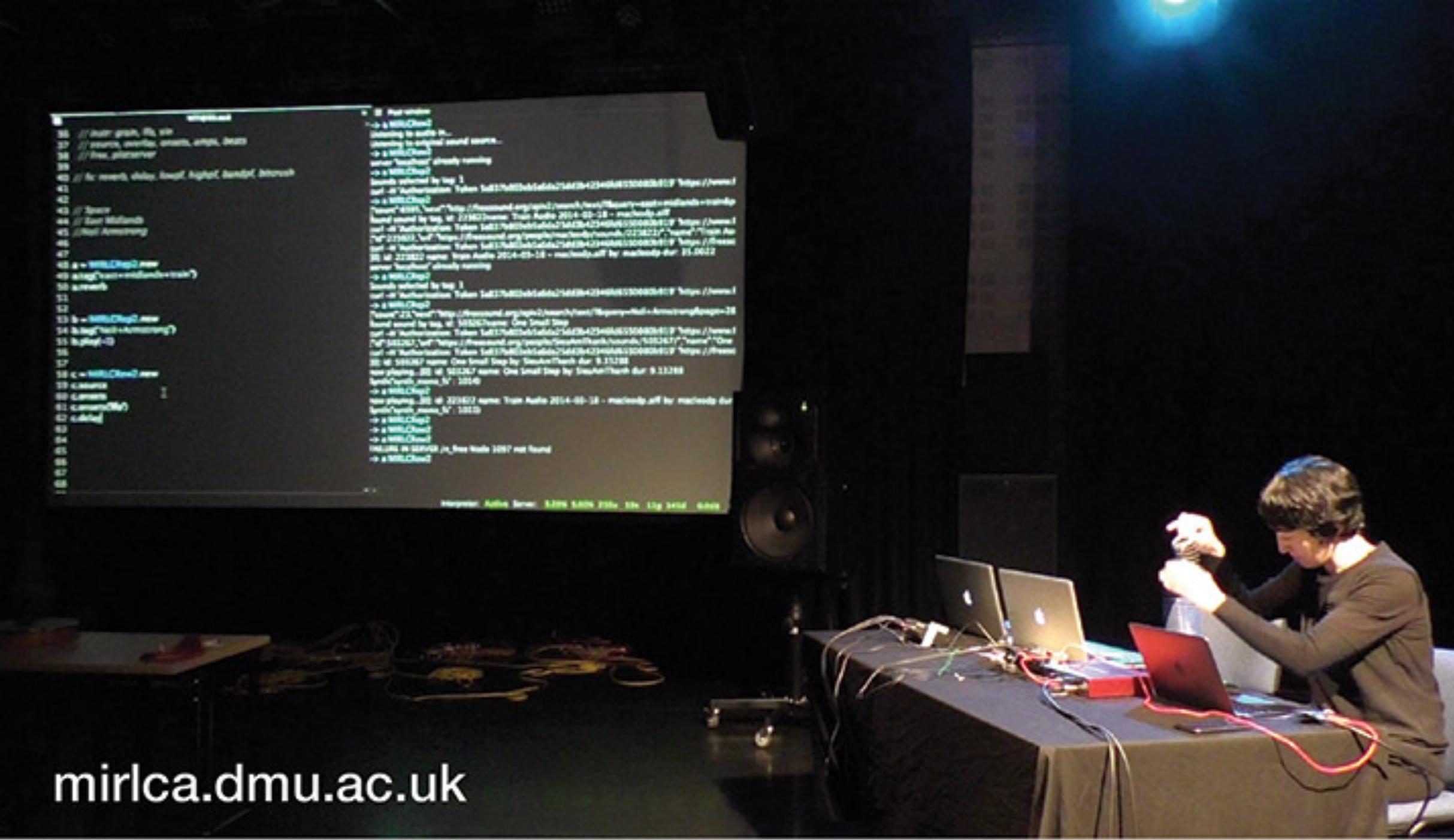
- **Legibility:** Making the processes of sharing data about a person, and others' analysis and use of that data, comprehensible to that person.
- **Agency:** Giving a person the capacity to interact with their systems so as to control and correct the above-mentioned processes.
- **Negotiability:** Giving a person the capacity to interact with the people who do the above-mentioned analysis and use, so as to change and correct what those people do.

# MIRLCAuto

## A Virtual Agent for Music Information Retrieval in Live Coding

- Within the HDI Network Plus Theme “**Art, Music & Culture**”, led by Prof. Atau Tanaka (Goldsmiths).
- **MIRLCAuto (MIRLCA)** is a project led by Dr. Anna Xambó that explores live coding and machine learning (ML).
- Emphasis on how **legibility**, **negotiability** and **agency** can be used to address the tension between human creativity and system autonomy in live coding.

<https://mirlca.dmu.ac.uk/>



[mirlca.dmu.ac.uk](http://mirlca.dmu.ac.uk)

## MIRLCAuto: A Virtual Agent for Music Information Retrieval in Live Coding

Partners: IKLECTIK, Leicester Hackspace,  
L'Ull Cec, Phonos, MTI<sup>2</sup>

Collaborators: TOPLAP Barcelona, FluCoMa, Freesound

Awarded with an EPSRC HDI Network Plus Grant

### Partners

IKLECTIK [off-site]



phonos



### Collaborators

toplaphc



freesound

## Online Workshop

Performing with a virtual agent: machine learning for live coding

### London (IKLECTIK)

7/9/11.12.2020 - 19:00-21:00 (GMT)

### Barcelona (L'Ull Cec)

11/13/15.1.2021 - 19:00-21:00 (CET)

### Leicester (Leicester Hackspace)

25/27/29.1.2021 - 19:00-21.00 (GMT)

More info at:

[mirlca.dmu.ac.uk/workshops](http://mirlca.dmu.ac.uk/workshops)

# The Team



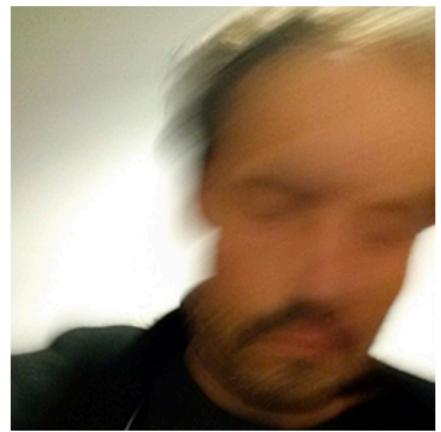
**Anna Xambó** is a Senior Lecturer in Music and Audio Technology at De Montfort University, a member of Music, Technology and Innovation - Institute of Sonic Creativity (MTI<sup>A</sup>2), and an experimental electronic music producer. Her research and practice focus on sound and music computing systems looking at novel approaches to collaborative, participatory, and live coding experiences. She is PI of the EPSRC HDI Network Plus funded project "MIRLCAuto: A Virtual Agent for Music Information Retrieval in Live Coding", investigating the use of a live coder virtual agent and the retrieval of large collections of sounds.

[annaxambo.me](http://annaxambo.me)



Active as an experimental music maker, **Ángel Faraldo** extends his work with sound installations, site-specific actions and sound design for dance and opera. He is interested in processes that maximise minimal resources, developing a critical and ecological perspective of live-electronic music, as materialised in his cycle The Feedback Study Series, his digital synthesiser MISS or his approach towards the no-input-mixer. Furthermore, he does significant labor performing and producing live-electronic music, especially as a member of Vertixe Sonora Ensemble, and as artistic director of the Phonos Foundation in Barcelona. He has studied at the Royal Conservatoire of Music (Madrid) and the Institute of Sonology (The Hague), obtaining his PhD degree from the Music Technology Group at Pompeu Fabra University (Barcelona), where he is currently a teaching associate.

[www.angelfaraldo.info](http://www.angelfaraldo.info) | [www.upf.edu/web/phonos](http://www.upf.edu/web/phonos)



Since 2006, helped by a fuzzy network of collaborators, **Sam Roig** has been directing l'ull cec, a cultural organization that has produced a wide assortment of public events and artistic projects related to sonic arts and experimental music, as well as dissemination activities around audio technology topics related to these disciplines. He is currently a PhD candidate at the University of Huddersfield and co-organises the MIRLCAuto's project workshops.

[lullcec.org](http://lullcec.org)



**Richard Forrest** is a retired Electronics / Software engineer who worked in the Automotive and Aerospace industries. He is a member of Leicester Hackspace which is a venue for people to pursue their creativity in digital, electronic, mechanical and computer projects. He has just launched his own embedded software consultancy which offers to design embedded software using techniques that Richard has developed using the experience he has gained during his working career. Richard has performed music as a violin player in a symphony orchestra and as a chorister, having sung all the harmony parts at different times during his life. He has an appreciation of classical, modern, jazz, film and television theme music and a good grasp of music theory.

[leicesterhackspace.org.uk](http://leicesterhackspace.org.uk)

[zoag.net](http://zoag.net)



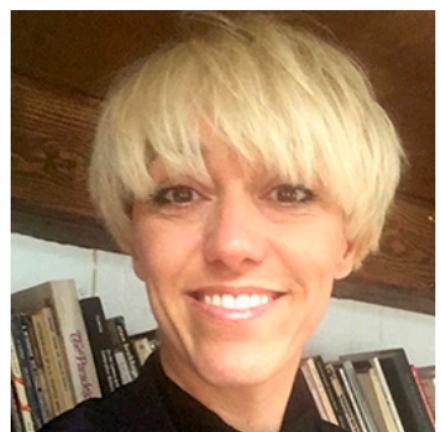
**Eduard Solaz** founder and director of IKLECTIK, London. IKLECTIK focuses on experimentation in arts, sound art, installation and cross disciplinary works. They expand their space as a research arts laboratory where interdisciplinary lines can overlap to create projects that explore processes and techniques, address social, political, cultural and critical issues.

[iklectikoffsite.org](http://iklectikoffsite.org)



**Tony Abbey** is a retired Space Electronics engineer specialising in cooled CCD cameras for X-ray astronomy at Leicester University. Now volunteering at The National Museum of Computing at Bletchley Park where he is helping to rebuild the 1949 Valve Computer - EDSAC which kickstarted computing in the UK. Helped start up Leicester Hackspace where he was a director and is now company secretary. Interested in electronic music from a teenager. Built his first transistor oscillator keyboard instrument in the 1960's so he could play 'Telstar' by the Tornados. He became interested in electronic music at Southampton Uni where he did an Electronic Engineering degree and have the LP of 'Switched on Bach' by Walter Carlos (later Wendy Carlos). Fan of Kraftwerk and the Pet Shop Boys. He wants to learn if the on-line composing project is music as he would define it.

[leicesterhackspace.org.uk](http://leicesterhackspace.org.uk)



**Isa Ferri** is IKLECTIK's assistant curator and sound engineer. After obtaining her Master in Collection and Exhibition Registrar (2009), she started her career working for Massimo De Carlo and Massimo Minini Gallery, for then specialising in production and development of automated artworks facilitating the meeting of Engineering and Art. In 2017 she got the Diploma in 'Music Technology and Production' becoming permanent part of the IKLECTIK team in London and of the Sziget Festival Main Stage Sound Engineering team in Budapest.

[iklectikoffsite.org](http://iklectikoffsite.org)

# Outline

- **Legibility:** Show us your screens. Code and processes should be clear.
- **Agency:** Learning and influencing from ‘situated musical actions’.
- **Negotiability:** Co-design as an ongoing conversation.

# **Legibility**

**Show us your screens. Code and processes should be clear.**



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## ManifestoDraft

### 'Original' TOPLAP draft manifesto (with focus on music performance)

We demand:

- Give us access to the performer's mind, to the whole human instrument.
- **Obscurantism is dangerous. Show us your screens.**
- Programs are instruments that can change themselves
- The program is to be transcended - Artificial language is the way.
- Code should be seen as well as heard, underlying algorithms viewed as well as their visual outcome.
- Live coding is not about tools. Algorithms are thoughts. Chainsaws are tools. That's why algorithms are sometimes harder to notice than tools.

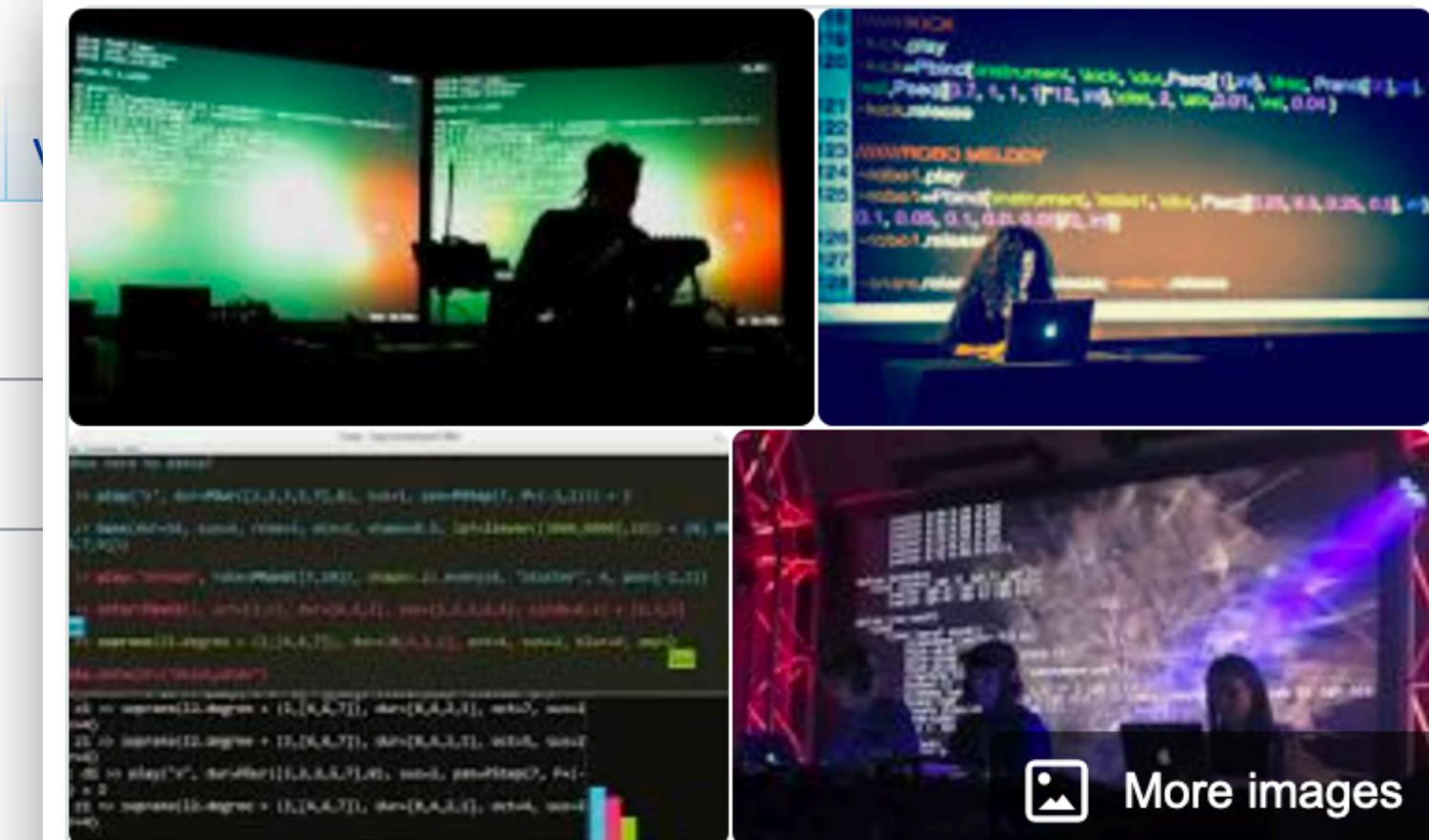
We recognise continuums of interaction and profundity, but prefer:

- Insight into algorithms
- The skillful extemporisation of algorithm as an expressive/impressive display of mental dexterity
- No backup (minidisc, DVD, safety net computer)

We acknowledge that:

- It is not necessary for a lay audience to understand the code to appreciate it, much as it is not necessary to know how to play guitar in order to appreciate watching a guitar performance.
- Live coding may be accompanied by an impressive display of manual dexterity and the glorification of the typing interface.
- Performance involves continuums of interaction, covering perhaps the scope of controls with respect to the parameter space of the artwork, or gestural content, particularly directness of expressive detail. Whilst the traditional haptic rate timing deviations of expressivity in instrumental music are not approximated in code, why repeat the past? No doubt the writing of code and expression of thought will develop its own nuances and customs.

Performances and events closely meeting these manifesto conditions may apply for TOPLAP approval and seal.



## Live coding



Live coding, sometimes referred to as on-the-fly programming, just in time programming and conversational programming, makes programming an integral part of the running program. [Wikipedia](#)

# Legibility

“Show us your screens”

<https://toplap.org/wiki/ManifestoDraft>

```
// instantiation  
~a = MIRLCRep.new  
~b = MIRLCRep.new  
  
// GET SOUNDS BY TEXT  
  
// getsound(id=31362, size=1)  
~a.id(323399)  
~a.id(19246)  
~a.id(19247)  
~b.id(19248)  
~b.id(192468)  
  
// random(size=1)  
~a.random  
~a.random(2)  
~a.random(3)  
~b.random  
  
// tag(tag="noise", size=1)  
~a.tag("nail", 3)  
~a.tag("chimes", 2)  
~a.tag("noise", 2)  
~a.tag("hammer", 2)  
~b.tag("grain", 2)  
~b.tag("humming", 3)
```

## The role of the live coding language

# Legibility

MIRLCRep 1.0

```

31
32 // Hello !
33
34
35
36
37
38
39 // Tag
40
41 a.tag("morse"+"two")    I
42
43
44 b|
45
46
47
48 c
49
50
51 d
52
53
54 e
55
56
:: Anna Xambó ::

  × Post window
  server 'localhost' already booting
  -> a MIRLCRep2
  Booting server 'localhost' on address 127.0.0.1:57110.
  Found 0 LADSPA plugins
  Number of Devices: 8
    0 : "Built-in Microph"
    1 : "Built-in Output"
    2 : "Scarlett 6i6 USB"
    3 : "BlackHole 16ch"
    4 : "Soundflower (2ch)"
    5 : "Soundflower (64ch)"
    6 : "ZoomAudioDevice"
    7 : "Multi-Output Device"

    "Scarlett 6i6 USB" Input Device
      Streams: 1
        0 channels 6

    "BlackHole 16ch" Output Device
      Streams: 1
        0 channels 16

  SC_AudioDriver: sample rate = 44100.000000, driver's block size = 512
  SuperCollider 3 server ready.
  Requested notification messages from server 'localhost'
  localhost: server process's maxLogins (1) matches with my options.
  localhost: keeping clientID (0) as confirmed by server process.
  Shared memory server interface initialized
  Sounds selected by tag: 1
  curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'https://www.freesound.org/api/sounds/?tag=morse&limit=1'
  -> a MIRLCRep2
  {"count":7,"next":null,"results":[{"id":47487,"name":"sw-13.wav","tags":["electronic","morse","noise"]}]
  found sound by tag, id: 47487 name: sw-13.wav
  curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'https://www.freesound.org/people/galeku/sounds/47487/'
  {"id":47487,"url":"https://freesound.org/people/galeku/sounds/47487/","name":"sw-13.wav","tags":[]}
  curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'https://freesound.org/people/galeku/sounds/47487'
  [0]: id: 47487 name: sw-13.wav by: galeku dur: 83.5293

```

Interpreter: Active Server: 0.22% 0.29% 8u 1s 52g 134d 0.0dB M R

```
Standardizer training Done  
Standardizer training Done  
PCA training Done  
PCA test Done  
Trained 0.0058023906312883  
Test complete  
13
```

```
*****  
Accuracy (0%-100%): 92.307692307692%  
Continue training or Save to JSON files?  
To continue training: [nameVariable].continuetraining  
To save to JSON files: [nameVariable].save  
*****
```

# Legibility

## The role of the console (Post Window)

# **Agency**

**Learning and influencing from ‘situated musical actions’.**

# Agency

## The role of Interactive Machine Learning

- **Interactive machine learning** (Fails and Olsen 2003).
- Interactive machine learning as a **creative musical tool** (Fiebrink and Caramiaux 2016).
  - ML toolkits for music e.g. Wekinator (Fiebrink et al. 2009), ml.lib (Bullock & Momemi 2015); FluidCorpusMap (Roma et al. 2019), and so on.
  - Long-term co-design process (Fiebrink & Sonami 2020).
  - Multi-user models in mobile music (Roma et al. 2018).

# Agency

## Learning from ‘situated musical actions’

- Lucy Suchman (1987) introduced the term '**situated action**' to refer any action as being linked to the context where it happens (from a study on users using an expert photocopier system designed to help them).
- A '**situated musical action**' (Xambó et al. 2021) refers to any musical action related to a specific context (where we expect the VA to help us in that action within that context).
- Defined by live coders / workshop attendees as a '**music style**', '**music preference**' (Gerard Roma), '**different instruments**' (Hernani Villaseñor), '**parts in the composition**' (Iván Paz), '**snapshots**' of a musical biography/life journey (Jonathan Moss), other...?



mirlca / code

Notifications

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main ▾

-o Commits on Apr 28, 2021

**added archive/load methods**

Anna authored and Anna committed 17 hours ago



4fe5a0a



-o Commits on Apr 26, 2021

**improved printing credits and file directories functions**

Anna authored and Anna committed 3 days ago



67c2d76

**added warnings and improved instructions**

Anna authored and Anna committed 3 days ago



529b620



-o Commits on Apr 24, 2021

**improvement training process showinfo method**

Anna authored and Anna committed 5 days ago



81e80ca

**fixed issues #6, #8, #12, #13, #14, error handling and directories**

Anna authored and Anna committed 5 days ago



c79bf96



-o Commits on Feb 21, 2021

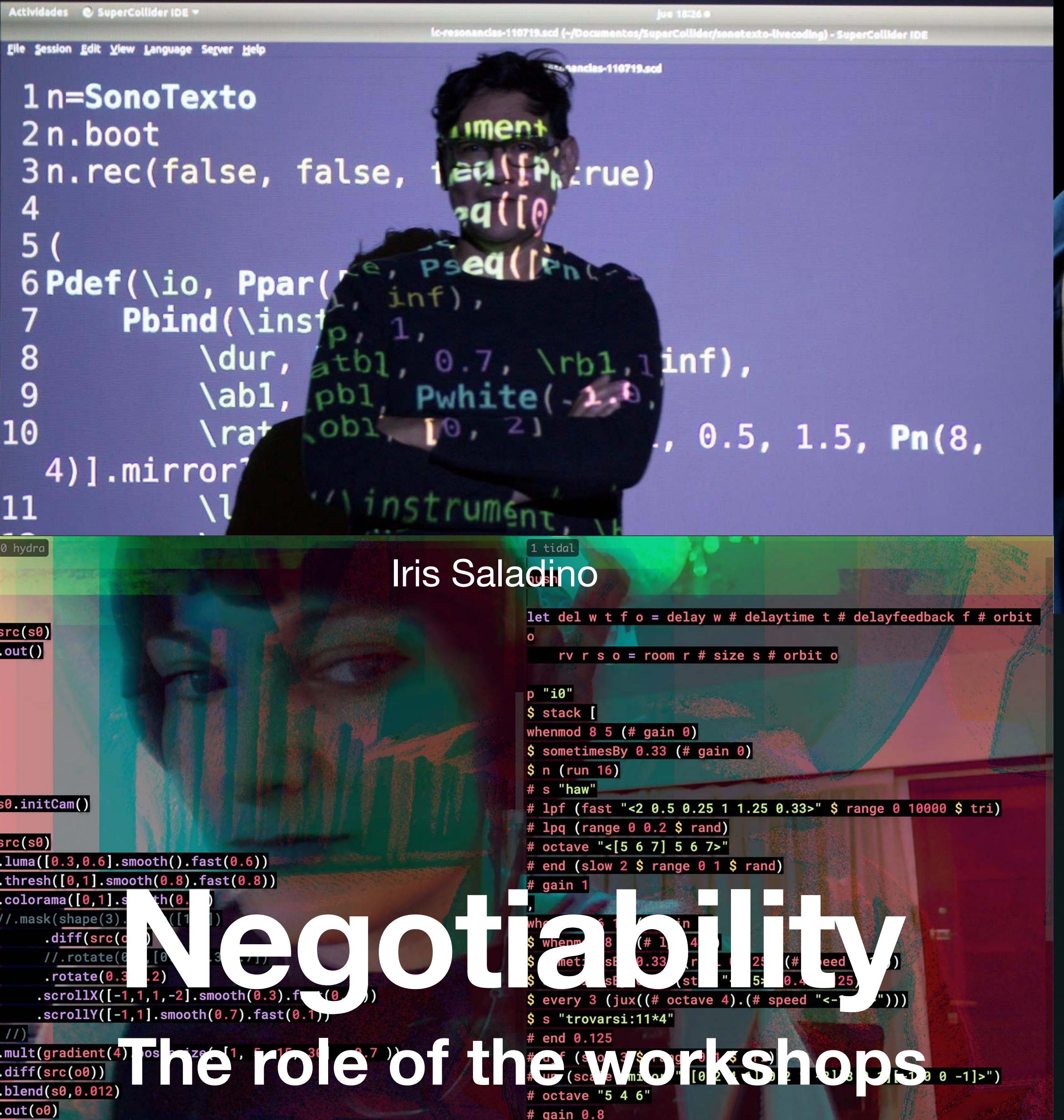
# Agency Influencing from ‘situated musical actions’

<https://github.com/mirlca/code/commits/main>

# **Negotiability**

**Co-design as an ongoing conversation.**

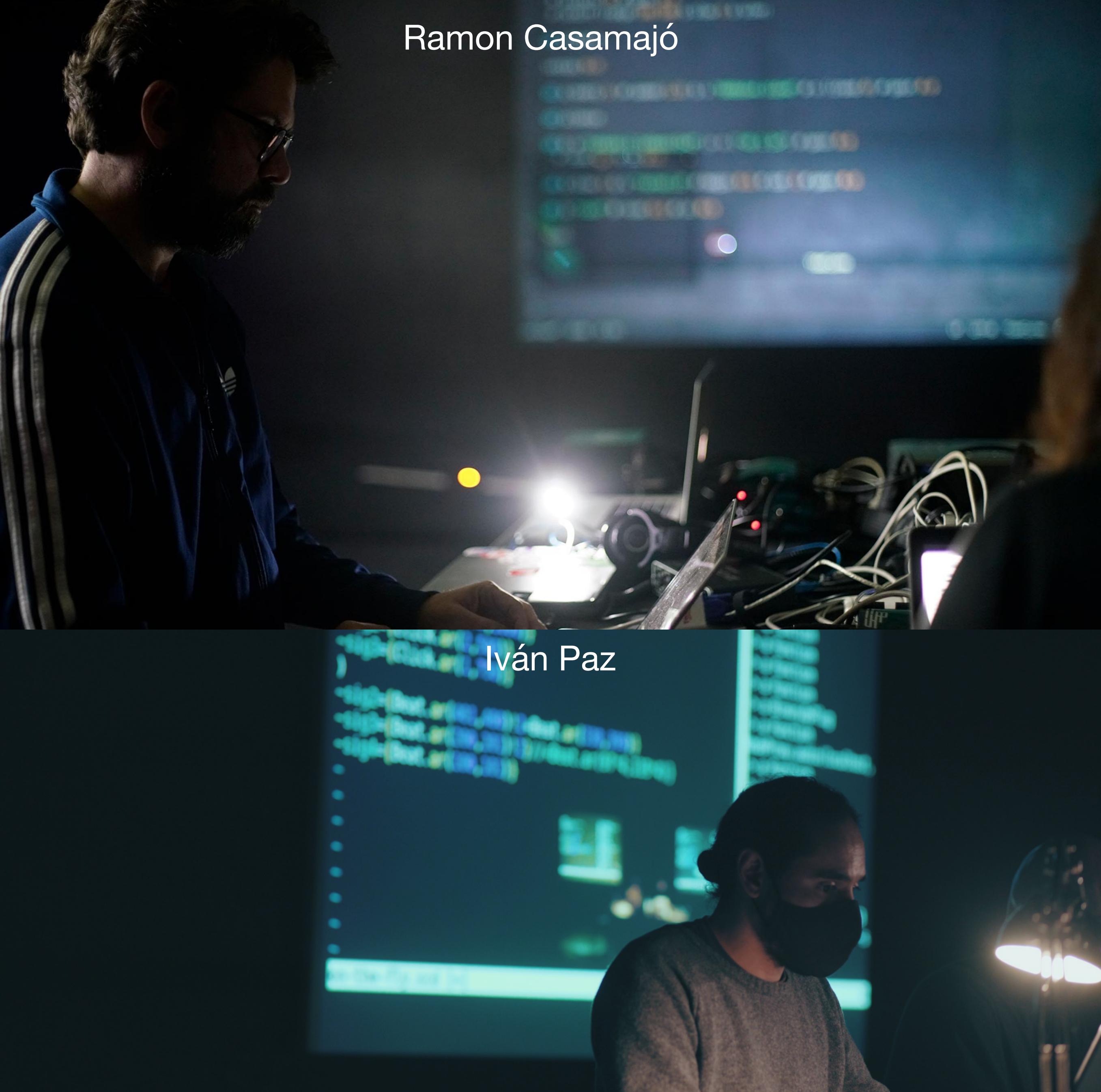
Hernani Villaseñor



# Negotiability

## The role of the workshops

Ramon Casamajó



```

QBRNTHSS_MIRLC.scd          tidal.scd
1 // Hi! This is a little test of how to integrate the use of MIRLC
2 // with Tidal Cycles (the language I usually use to live coding)
3
4 a = MIRLCa.new(path: p);
5 a.tag("voice");
6 a.similar;
7 a.similarauto(0,3,10);
8 a.solo();
9 a.mute(6);
10 a.stop;
11 a.info;
12 a.play;
13 a.playauto // args: |times = 4, tempo = 30|
14 a.playautodown; // Varispeed-like playback. args: |start = 1, end = 0, times = 1|
15 a.autochopped(25,3); // Chop the audio and play some fragments backwards. args:
16
17 scratch.tidal
18
19 -- tempo
20 setcps (140/60)
21
22 hush
23
24 d2
25
26 -- sometimes (# coarse 15)
27 $ slow 10 $ segment $ coarse "airhole":0, "itchtoys:3", "vermonaDM"
28 # gain (range 0.85 $ slow 5 $ tri)
29 # pan (slow 2 $ (segment 1 $ rand))
30 # ...

```

# Negotiability

## The role of the concerts



## Wishlist

Anna Xambó edited this page 3 days ago · 19 revisions

### MIRLCa

#### Training mode

- Make training incremental and persistent across sessions. Ideally, some accounting about the files downloaded should be in place so to avoid repeated downloads biasing the training.
- Create subfolders for the "ok" and "ko" sounds.
- Instead of random sounds, can we also have the same 130 sounds from the manual training.
- In training by ID, add a second argument with the good/bad label e.g. a.trainid(3333, "ok").

#### Pages 2

Find a Page...

Home

Wishlist

#### Clone this wiki locally

<https://github.com/mirlca/code>

#### Performance mode

- Load as many models as wanted. It can be an argument of the instantiation.
- Be able to configure what candidate of the list of best candidates to retrieve: random, 2nd and 3rd, etc.

#### Overall

# Negotiability

The role of the code repository

# Conclusions

## **Why legibility, agency and negotiability matter in AI-powered live coding environments**

- There are as many approaches to ML and live coding as practices in live coding.
- To make a meaningful research/tool beyond personal use, these 3 tenets are helpful to find a versatile solution to the nature of the live coding community, which should align with an open culture and DIY practices.
- It is also a way of bringing ML concepts to the live coding community adapted to their respective live coding environment. It is just the beginning of a promising area of research and practice.

# Forthcoming Events

- **29th April** - Different Similar Sounds: A Live Coding Evening "From Scratch" with TOPLAP Barcelona members Ramon Casamajó, Chigüire, Iván Paz and Roger Pibernat at Sala Aranyó, UPF, Barcelona, Spain. Organised by Phonos. This concert will be by invitation only due to COVID restrictions and premiered online at a later date.  
**Link to the event:** [https://www.upf.edu/web/phonos/noticies/-/asset\\_publisher/vEIxpLMdz5F/content/id/244759906/maximized](https://www.upf.edu/web/phonos/noticies/-/asset_publisher/vEIxpLMdz5F/content/id/244759906/maximized)
- **6th May** - Online participation at "Event 3. Human and AI musical performance & education", ARTIFICIA Festival: <https://www.articia.pro/participate/ai-music-sessions-2021/>
- **17th May** - "Dirty Dialogues" with Dirty Electronics Ensemble (led by John Richards), Jonathan Moss (performer), Anna Xambó (performer) and Sam Roig (Q&A moderator) at PACE, Leicester, UK. Organised by MTI<sup>2</sup>. This concert will be pre-recorded due to COVID restrictions and premiered online at a later date.

# References

## Weblinks

- Collaborative Network Music workshop @ Rewire 2018: [https://media.qmplus.qmul.ac.uk/media/t/1\\_5I7w74um](https://media.qmplus.qmul.ac.uk/media/t/1_5I7w74um)
- They are The Robots: <https://vimeo.com/515416972>
- HDI Network: <https://hdi-network.org>
- MIRLCAuto project: <https://mirlca.dmu.ac.uk>
- MIRLCA GitHub repo: <https://github.com/mirlca>
- TOPLAP Manifesto Draft: <https://toplap.org/wiki/ManifestoDraft>

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- Lorway, N., Jarvis, M., Wilson, A., Powley, E., & Speakman, J. (2019). Autopia: An AI Collaborator for Gamified Live Coding Music Performances. In *2019 Artificial Intelligence and Simulation of Behaviour Convention*. Falmouth, UK.

# References

## Readings (2/2)

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