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TOPLAP Athens: A Networked Live Coding Community

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ABSTRACT

TOPLAP Athens, founded in 2021, is the first Greek-speaking live coding community that focuses on artistic and performative aspects of live coding. This paper outlines the community’s formation, goals, and challenges, highlighting its commitment to fostering collaboration and growth in Greek live coding. Despite geographical dispersion, the group maintains regular online meetups and has performed at significant events such as ICLC 2021, 2023, and 2024. There is a primary focus using SuperCollider and OscGroups for networked performances, prototyping networked setups for handling incompatibilities across different operating systems, and forming a heterogeneous rhizomatic network for creative explorations. While rooted in academic research, the community has evolved to emphasize the artistic and performative aspects of live coding, combining scholarly endeavors with practical exploration and creative expression. Organizational hurdles common to decentralized communities are discussed, along with individual approaches within the group. The paper also discusses future vision, including the exploration of interactive AI and polyglot (i.e. multilingual) live coding performance.

1 Introduction

Self-organized and community operated grass-roots organizations that demonstrate a flat-hierarchy are gaining more and more attention in recent years, maybe as an outcome of the manifold of crises. The undeniable success of hackerspaces, where like-minded people are meeting in physical spaces, proves the social importance of supporting such organizations in any possible manner (Marttila, Nilsson, and Seravalli 2014; Toombs 2017). While there is a significant difference between physical and virtual social interactions, during and after the pandemic, the significance of virtual spaces for exchanging ideas and promoting collaboration has emerged.

TOPLAP (Ward et al. 2004) is one of the many examples of a successful grass-roots organization. Its main goal was to promote live coding, and establish a common ground for enabling research and artistic practices around algorithmic art-forms. As of September 2024, there are 26 TOPLAP nodes around the globe, all of them identifying with a geographical area. While most TOPLAP nodes¹ are located in Europe, there is presence in almost all continents with the exemption of Africa.

In light of previous community reports (Champlin et al. 2023; Fraser et al. 2023; Hoogland et al. 2023), we would like to contribute our take on making and sustaining live coding communities. Since the inception of TOPLAP in 2004, there is a strong tradition of self-organized groups practicing live coding, either in a local or a global setting. The TOPLAP mailing list dates back to February 2004² and it is still active to a certain extent, as chat servers are popular nowadays. TOPLAP Athens is the first greek live coding community, founded in 2021 by a group of greek-speaking computer musicians. It is a group situated in Athens, Greece, but also of diaspora-Greeks who are mostly meeting virtually in video conference platforms and chat servers. Its members pursue research in the field, and follow recent trends by exchanging information on research works (such as Collins et al. (2003), Wang and Cook (2004), and Blackwell et al.

¹<https://blog.toplap.org/nodes/> (accessed 2024-09-30)

²<https://raw.githubusercontent.com/yaxu/unravelling/master/livecodemlarchive.txt>



Figure 1: *Logo of TOPLAP Athens.*

(2022)) and by organising live coding events. Our common interest in live coding practices gave rise to the idea of forming a goal-oriented community around this artistic practice.

In this article we will present practical tips related to organizational aspects of the community, a discussion on collaborative live coding performance practices and tools, individual approaches for musical live coding performance, and fragments of vision statements.

2 History and Context

2.1 Origins

The TOPLAP Athens community was created in 2021 by Vasilis, Penny, Giorgos, and Iannis as a spin-off of the MOSAIC academic study group at the Department of Audiovisual Arts of the Ionian University in Corfu, Greece. The objectives of MOSAIC were to perform practice-based research into the integration of real-time audio and visual synthesis methods through coding. TOPLAP Athens endeavors to extend this research beyond the borders of academia, develop live coding from a performer’s perspective, and explore its interaction with current performing arts communities at large. Kosmas is the latest addition to the core group of the collective. Our backgrounds are mixed, but what brings us all together are the words *music* and *technology*. As a community we organize performance events, rehearsals and research sessions. Additionally, the group engages in outreach activities such as lectures and invitations for extended collaboration in artistic as well as in research contexts.

The website (<https://toplap-athens.github.io>), which is hosted on *GitHub* under the domain name TOPLAP Athens, was constructed using the *Hugo* open source static site generator in *Emacs Org Mode*. It includes TOPLAP Athens members’ individual biographies and projects along with member collaborations. Shortly after, we introduced the community’s logo, following the TOPLAP design but with the name written in Greek characters (see Figure 1).

Our main goal is to collaborate and make music together. Additionally we demonstrate individual projects, pieces and art, to elicit informal feedback. We focus on the social aspect of music as collective and collaborative human activity, and thus we strive to further build up collaborative performances. The current small size of the group facilitates the organization of frequent rehearsal meetings, but as the team grows, we look forward to reconfiguring the activities and supporting a variety of sound performances, including solo performances, duets or ensembles. Supporting peer-to-peer learning is also a high priority of the group, and it is not limited to live coding but extends to various related research topics. Our professional and research career commitments oblige us to reside in separate countries of Europe and in the USA. Although in very special occasions we meet in Athens, our only viable option is to work together online. Thus, rehearsing and performing live over the network becomes a necessary solution. This gives us a concrete motivation and necessity to develop a fully effective practice of networked live coding and to explore its expressive artistic and technical capabilities to the full extent.

Further objectives of the group are to explore philosophical questions related to the art of live coding, which underlie the technological and creative aspects of this practice, and to critically engage with the implications of fundamental advances in technology through practice as well as through theoretical discourse. In this spirit, we explore creative practices of AI in a live coding context and question how these influence practitioners and the field alike. As an example, one might ask, can it be useful developing an AI agent for code completion in musical live coding and can it contribute to the performer’s creativity? We also reflect on the team’s orientation and practices; what it means for us to be a team when physical communication is minimal, and how we would like to further develop our collaborative practices.

We present the first case of a purely live coding community in Greece. While the group’s main goal is to foster the growth of live coding in Greece, we admit that the absence of many of our key members from Athens, due to professional

commitments, presents a significant challenge. Currently, we try to make the most of networked media through online channels, such as email and chat servers, while we recruit new members through conferences and other events. At the same time we continue discussions to develop alternative means for achieving this goal.

2.2 Institutional Ties

The main institutional support for TOPLAP Athens stems from PEARL, the Performance Environments Art Research Laboratory (PEARL) at the Department of Audiovisual Arts of the Ionian University. Iannis Zannos, as director of PEARL, supports TOPLAP Athens, especially since one of the main research objectives of the laboratory is connected to live coding. The *sc-hacks-redux library*³ for networked live coding over OSC is a research outcome of PEARL lab. Additionally, the lab maintains OscGroup servers and free VPN clients which enable experimentation with this environment from any location in the world. In 2020, PEARL organized the first international workshop on networked live coding in the context of online games at the festival of Digital Culture and Audiovisual Challenges of the Department of Audiovisual Arts. In 2024, PEARL and the core team members of TOPLAP Athens co-organized a networked live coding performance as a satellite event of ICLC2024.

Additionally, TOPLAP Athens has ties with Freesound⁴, created by the Music Technology Group at Universitat Pompeu Fabra, particularly through its recent research initiatives in which Panagiota (Penny) Anastasopoulou participates as PhD candidate. Current work inside the Freesound team focuses on the way we can utilize big databases in the context of creative practices. Ongoing research aims at improving the characterization of heterogeneous sound collections for use in practices such as live coding. More specifically, live coding is used as an evaluation method to assess the effectiveness of various sound analyzers and descriptors. Tools of this nature and their artistic evaluation are actively explored within our team.

3 Challenges

3.1 Meetups and Organizational Issues

Organizational issues involve channels for internal communication, scheduling and attending meetings, spaces for promotion, and performing in public. Given the context of a community-driven organization, we can report that this particular issue can be a hard problem. There is no easy solution, it is all about drive and motivation for self-organization and live coding practice.

Internal communication is conducted by different platforms, such as a chat server, a messaging app group discussion, and emails. It turns out that due to the fragmented nature of social media the best tool is emailing. Emails are certainly static and a slow communication style in comparison to a chat server, still we mainly use emails for scheduling meetings and other issues that may require attention due to user preferences.

Following the ICLC 2023 in Utrecht, we aimed to meet on a monthly basis, and this gradually evolved to bi-weekly meetups. Of course this is not set in stone and fluctuates, as during the summer season we do not schedule meetups, and when we plan some event or publication we can meet multiple times within a week. Due to the diaspora of the TOPLAP Athens members in different geographic locations, our meetings are held as video conferences. Problems can start as little as time zone differences can make it difficult to schedule events that are convenient for all members. Scheduling and attending meetings is also challenging due to individual workload. It turns out that taking initiative and responsibility for scheduling meetups is necessary in flat-hierarchy organizations.

3.2 Technical Limitations

One issue with a predominantly virtual community when practicing music is the artists' absence from a physical location, which alters the perception of the sound according to the speakers/headphones of each member. Additionally, during a performance, members are only able to communicate through chat tools, where bodily gestures and eye contact is often minimal. The lack of situated presence and an audience can be also a challenge, consequently making hard to establish a dialogic liveness during a performance.

The tools used in live coding are the means of artistic communication and they should be tailored to our creative goals. Live coding often uses aleatoric algorithms that introduce randomness in the sound outcome. In a networked collaborative performance where everyone shares (sends/receives) OSC messages from the same server but runs them locally

³<https://github.com/iani/sc-hacks-redux/>

⁴<https://freesound.org/>

(see Chapter 4), it leads to aleatoric commands creating different outputs –different values from code result in varying sound outputs for each participant. Having distinct outputs while including aleatory can make it hard to maintain a unified artistic direction. This unpredictability could also frustrate those aiming for specific effects, soundscapes, or music outcomes. Nevertheless, we try to take advantage of this behavior that arises from the tools used and explore the concept of a piece that simultaneously exists and evolves in slightly (or significantly) different forms.

The barriers of networking technology abilities are bringing challenges to our artistic visions. Generally, technical issues such as time delays and latency can disrupt the flow of real-time collaboration, making it challenging to synchronize. For instance, it can be difficult to play strictly-timed rhythmic music. More specific challenges we face is connecting in OscGroups (see Chapter 4) via VPN. To solve this issue, we are looking for alternatives to OscGroups that work over a standard web port. A WebAssembly or Rust based solution is conceivable, and we are looking for individuals or groups that are up to the task for creating a port of OscGroups with such technologies.

4 Tools and Technical Developments

We carry out the artistic activities we organize by sharing our audio and code through the web. The main tool used by the group for networked live coding is OscGroups. In our networked collaborations, we use SuperCollider. It is compatible with OscGroups, while also being the primary language of all the current members. Besides that, we are experimenting with other languages, as some of our members are using and making several programming languages for live coding.

OscGroups is an open-source client-server application by Ross Bencina. More specifically, it is a C-based application for sharing OSC data amongst a group of users via the internet. Binaries⁵ are available for MacOS, Linux and Windows. It has been tested in many networked performances in diverse settings since 2019. While it can work for the majority of users connected over usual private internet providers, it may require a VPN network to operate with wireless modems over G4 or G5 networks, or when some users are working behind a firewall such as those operated by academic institutions. For this reason, we have set up VPN networks on cloud services such as Digital Ocean and within the networks of supporting institutions. To perform with OscGroups in SuperCollider, the specialized library named *sc-hacks-redux* was developed by Iannis (Zannos 2024). This library enables us to exchange OSC messages between the local SuperCollider application and the OscGroups client, to configure SuperCollider to execute code snippets exchanged over OSC, as well as to send and receive OSC messages sent by motion tracking systems or local sensors of various kinds. During our networked rehearsals, we execute shared code at each participant’s local *sclang* environment and we produce sound locally.

The following collection summarize additional projects that are developed by the members of TOPLAP Athens and are being explored in our activities. The creation of various live coding tools brings about diverse approaches within the community and motivates us for elaborative discussions. We acknowledge the importance of engaging with tool development, being equally important as performing, but also fostering opportunities for learning and creative explorations.

Synerg(e)ia: An early self-contained minimal environment for networked collaborative live coding, which served as an early alternative experiment (Agiomyrgianakis et al. 2022). Synerg(e)ia leverages the collaborative remote coding capabilities of the *Emacs* editor and programming environment by running a single SuperCollider session in *Emacs*, to which multiple users can login via *tmux*. It was built for remote collaborations between live coders. Synergia provides an interface that allows code sharing and real-time audio synthesis. It uses the terminal multiplexer *tmux* in the *Emacs* editor and utilizes the OSC communication system *OscGroups* to communicate data and produce audio between collaborators. It depends on sharing code and running it on each performer’s system by sending messages to the client’s SuperCollider programming environment using a version of the *sc-hacks-redux* OscGroups class and BALC library⁶ for live coding (sound and rhythm manipulation) in SuperCollider. Open-sourced code⁷ and a demo of networked collaborative live coding⁸ are available.

MelodyLine: Project that introduces a virtual agent for live coding⁹, designed to support audio retrieval from Freesound’s heterogeneous sound collection using high-level melodic patterns (Anastasopoulou 2022). The aim is to explore sample-based live coding techniques and enable real-time user interaction for the retrieval and manipulation of audio segments through intuitive, melody-driven controls.

Live Hardware Coding (LHC): System for live coding on the lowest level of information¹⁰, that of individual bits (Diapoulis and Zannos 2012). LHC establishes grammatical structures based on regular expressions, which can be used

⁵<http://www.rossbencina.com/code/oscgroups>

⁶<https://github.com/Vasileios/BALC-lib>

⁷<https://github.com/Vasileios/Synergia-Collaborative-Live-coding>

⁸<https://youtu.be/-0LVr4dkgdE>

⁹<https://github.com/allholly/MelodyLine>

¹⁰<https://github.com/gewhere/lhc-tokens>



Figure 2: The announcement and a photograph from the inaugural concert in Athens.

as a generative substrate for a musical performance. It can be further developed for multilingual mini-language live coding and it is readily used to explore tangibility with code as musical material.

5 Concerts

The inaugural concert of TOPLAP Athens happened in 2023 in Athens at On/Off studio by Giorgos, Penny, and Vasilis and introduced the community to the Greek scene (see Figure 2). At On/Off we started with solo performances before coming together to play as a team. This allowed us to introduce various approaches to those who were unfamiliar with live coding. Penny began her solo performance by utilizing the Freesound Quark in SuperCollider to download and manipulate samples from Freesound. Giorgos demonstrated how to adjust settings based on the roll of dice using an hourglass, incorporating probability concepts. Vasilis' idea was to experiment with the techno genre by fusing rhythmic elements with ambient and noise sounds. Our aesthetics in that live coding performance were an experimental blend of rhythmic elements and granular, sustained-drone sounds. Our next event as a team is an online Satellite event in ICLC2024, which was performed using telematics. Penny was in Barcelona, Spain, Giorgos in Gothenburg, Sweden, Vasilis in Athens, Greece, and Kosmas in New York, USA. All our data was sent via OSCGroups to a server that was hosted at PEARL in Corfu, Greece. Iannis Zannos, Martin Carle and Thanasis Epitidios were responsible for the networked communication and sound mixing. At that performance we demonstrated a combination of sustained (clouds) sounds using sampling, and techniques such as granular synthesis. Three performers synthesized various sounds and one altered them using feedback based systems. Another TOPLAP Athens group performance was in the Euleroom's stream for the 20th birthday of TOPLAP20. There, Giorgos, Iannis and Vasilis performed one after the other telematically using the OSCGroups system to share code and sound. Examples of individual appearances of our group members in live coding conferences are Giorgos' ICLC2021 performance, Kosmas' ICLC2023 performance as part of the duo Serenedipitous Liquidators, and Penny's performances in TOPLAP Barcelona events (VIU2023, VIU2024, Algobiente2024).

6 Individual Practices

"I am conducting live coding almost on a daily basis in my room. My language of preference is SuperCollider where I often engage in endless from scratch live coding sessions that may run across several days and nights. Of course I do not listen to the musical outcome continuously, I simply mute the audio output and continue whenever I feel like it. I consider this as a slow live coding practice, slowly evolving towards its autonomy. I am working towards developing self-learning algorithms that evolve during the timespan of a musical performance."

~Yorgos

"I like to experiment and to combine ingredients. I practice live coding and experiment with extended live coding in collaboration with performers, musicians, and dancers, by utilizing the body and musical gestures to sound and graphics using data from sensing technology."

~Vasilis

"I like taking any sound and turning it into music. Or maybe better, showing how it is already music. Navigating through crowdsourced recordings feels like I am uncovering hidden worlds. So much information out there, people willing to share and connect through the medium of sound. Using code to help me in this process and push me to explore more excites me. Especially if it is in real time. You get where this is going."

~allholy

“My live coding practice revolves around re-appropriating creative code snippets (primarily SCTweets) and their playful entanglement within the live coding context. Additionally, I incorporate Human-Computer Interfaces, biosensing and gesture recognition technologies, such as MIDI controllers, Brain Control interfaces, and Real-Time Motion Tracking Software, to inject my bodily gesturings into the communal algorithmic unfolding.”

~Kosmas

“I have conducted collaborative projects with dancers in Greece and Japan since 2018, These proved extremely interesting to me. I believe that networked collaborations involving embodied performance with sensors, in dance or related forms of performance, and involving multiple types of media are a central field for experimental research of technological arts and will lead to new insights and art forms.”

~Iannis

7 Vision and Future Work

We have chosen live coding as our creative practice due to its inherent liveness and improvisational nature. Forming a collective where we can perform together and explore the concept of a live coding ‘band’ has been an interesting experience. One of our plans is to engage more members in our team, and we are excited about the many possibilities of such growth. Regarding the artistic practices, some indicative future plans include experimentation with large language models, small and big sound databases, machine listening technologies, distributed ledger technologies, live writing, and mini-languages. Another point that arises through our recent practices is to give visuals the same attention as sound. We also keep a keen eye on developments of polyglot live coding environments and look forward to contributing to this line of technical challenges. Finally, in our collaborative practices, we already experience the interactions between different human agents and further seek to explore software agent systems in practice, as a means to facilitate conversational live coding.

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