Open Band: A Platform for Collective Sound Dialogues

Ariane Stolfi[*]
Universidade de São Paulo
Butantã, São Paulo - SP
São Paulo, Brasil 03178-200
arianestolfi@gmail.com

Mathieu Barthet
Centre for Digital Music
Queen Mary University of London
Mile End Road
London, UK E1 4NS
m.barthet@qmul.ac.uk

Fábio Goródscy[†]
Instituto de Matemática e Estatística
Universidade de São Paulo
Rua do Matão, 1010
São Paulo, Brazil
fabiog@ime.usp.br

Antonio Deusany de Carvalho Junior
Instituto de Matemática e Estatística
Universidade de São Paulo
São Paulo, Brazil
dj@ime.usp.br

ABSTRACT

Open Band is a web-based platform for collective “sound dialogues" designed to provide audiences with empowering experiences through music. The system draws on interactive participatory art and networked music performance by engaging participants in a sonic web “agora" in collocated and/or remote gatherings, regardless of musical level. In this paper, we present our artistic intent grounded in Eco’s concept of Open Works and the initial design of a web-based open environment that supports social musical interactions. Interaction operates by means of a multi-user live chat system that renders textual messages into sounds. Feedback gathered across several public participatory performances was overall positive and we identified further design challenges around personalization, crowd dynamic and rhythmic aspects.

[*]Also composer of the pieces.
[†]Main programmer of the software.

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CCS CONCEPTS

• **Applied computing** → **Performing arts**; **Media arts**; **Sound and music computing**; Language translation; • **Human-centered computing** → *Mobile devices*; Interaction design theory, concepts and paradigms;

KEYWORDS

Audience Participation, Interactive Music, Web Audio, Performance, Participatory experiences

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1 INTRODUCTION

Amongst the factors that can keep people away from playing music, are to be noted the poor access to musical instruments due to cost and the time and complexity required to learn an instrument. A growing number of works point to web audio technologies as a basis for developing more accessible audio interfaces [23], since they are ubiquitous on modern computers and mobile devices and easy to distribute [17]. Furthermore such technologies can be used to design interactive systems, independent of any extra software installation [31].

This work is part of a larger project that aims to use interactive web audio technologies to build an “open" artistic work following some of the principles advanced by Umberto Eco [7], an art work in motion, that can be shaped by each audience participant who interacts with it. We apply these principles to design a web-based multi-user musical

instrument for experimental collective music improvisations. The system facilitates participatory performances which are opened to any willing person regardless of musical level or background, yet they require a device with access to a web browser and loudspeakers (such as a smartphone, tablet or laptop). Musical interaction is operated through the production of text messages, a technique users of modern communication devices are usually familiar with.

The remainder of this paper is organized as follows. In Section 2, we present related works on digital participatory art and networked music performance. Section 3 describes the design of our initial prototype from the artistic intent to the technological requirements. The web-based client/server architecture of the system is detailed in Section 4. In Section 5 we describe a use case and associated performances making use of pre-established sample packs. We provide our conclusions and outline the future work we envision in Section 6.

2 RELATED WORKS

Participatory art and Eco's Open Works

This work inscribes itself within participatory art and Eco's vision of Open Works which we introduce in this section. Western performing arts (music, dance, theatre, etc.) practices have traditionally restricted creative interventions from audiences. Contemporary Western performances are predominantly presentational, with performers preparing and providing music for another group, the audience [25].

In contrast to presentational performances, which intrinsically create a divide between audience and performers, participatory performances [14] seek to blur the boundaries between audiences and performers by giving equal role to participants, building up on the notion of "communitas" (unstructured communities in which all members are equal allowing them to share a common experience). Such aspiration from participatory art corroborates Eco's conceptions of "open works", which, according to Robey in [5], require of the public *"a much greater degree of collaboration and personal involvement than was ever required by the traditional art of the past."*.

In Open Works, it is *"the artist's decision to leave the arrangement of some of their constituents either to the public or to chance, thus giving them not a single definitive order but a multiplicity of possible orders"*. These motivations interestingly resonate with the contemporary perception of audience's role changing from primarily passive to one "co-creating values" [22], with audiences who increasingly want to "shape" their own experiences. Another important rationale of participatory art is to improve audience cognitive engagement in performance through an active form spectatorship involving a physical engagement in the performance [14].

Participatory music performance using Web technologies

Human-computer interaction (HCI) and communication technologies provide great potential to facilitate participatory art forms in our digital age as they can be used to mediate and transform creative information remotely, in (quasi) real-time and scalable ways. Within the field of digital participatory art, several authors investigated how to create participatory music performances using web technologies (see [30] for a review of some of them). Web applications for participatory performances have been proposed e.g. in [3, 8, 16, 29, 32], each of these studies manifesting specific artistic and audience creative agency models.

The massMobile framework [28] was used to let audiences control stage lighting effects or create musical loops from instructions provided through a graphical user interface (GUI) on their smartphones. Mood Conductor [8] also relies on the use of smartphones to enable audience members to conduct performers in terms of emotional directions. In Open Symphony [30, 32], audience members can generate live graphic scores interpreted by performers by voting for music playing modes on their smartphones. In this work and others, such as A.bel [3] and the CoSiMa framework [16], smartphones are employed both as a sound control and diffusion interface leveraging the loudspeakers embedded in the devices.

3 DESIGN OF THE OPEN BAND SYSTEM

Artistic intent

A Web "agora". This project grew out from the discernment of an implicit contradiction with contemporary social media. Although social media provide ways for people to be highly connected, they may also induce a form of isolation, inciting to be frequently absorbed in one's own individual device. In this work, are are attempting to build a collective experience that could break that isolation and put every members of an audience in a web "agora".

Eco's framework. We are framing our work within Eco's conception of "open work" [6]. Being "in movement", open works can be changed by every participant, providing freedom to the performer to change it or to the audience to interpret. In Open Band, we are inviting the audience to join as performers, since everything typed in gets converted into sounds that are played back to everyone. Eco's vision of open work includes systems with a certain degree of indeterminacy, ambiguity and even deliberate "dis-ordering". Such principles occur in Open Band, especially when a large number of users interact. The project involves an anonymous multi-user chat, where everyone can be free to express themselves without risk of being pointed at or judged.

Mapping Language to Sounds. Music is, as pointed by Koelsch [15], a social activity that put people in contact, and can lead to "increased social cohesion of a group", and promote cooperation between individuals. As the author says, making music collectively generally involves a high degree of coordination of actions, e.g. to synchronize to musical beats. In this project, we are proposing a system where participants don't need to have previous musical skills. The act of writing, seen as a "technology" in McLuhan and McLuhan [19], can be used as a way to crystallize verbal sounds into the visual space. Unlike speech systems mechanisms, that convert speech into text, we are atomizing texts to trigger sounds one after the other, to generate music. Taken as separated letters, words are played as musical phrases, which thus gives non musicians access to simple musical experiences. When participants start to talk one after the other using the chat, messages get superimposed. The rhythm becomes mores frenetic and it becomes more difficult to recognize how a specific message is sounding, like when several people talk at the same time.

Participatory music performance. Being hosted in a web chat, the system can be easily accessible to anyone having access to a device with a web browser (e.g. computer, laptop, tablet or smartphone) compatible with web audio technologies, and an Internet connection. Once in the chat, everything that is typed in can be heard by anyone connected to the same message server. For participatory performance with the system, we use a version of the server hosted in a localhost, to make a closed network of people and to lower the bandwidth requirements for the audience and reduce delay time in playing the messages. We usually connect one of the devices to a PA sound system to increase the volume and thus the musical perception. A performance can have a conductor who uses special commands to change the samples and to change the overall dynamics of the piece. The conductor can also completely turn off the sound which may be used at times. There is no hierarchy amongst audience participants, and everything which is typed in is played with no distinction.

In another use case, the system can act as an instrument, in solo performances or within free improvisation contexts, for musicians who know the samples and the commands to change sounds. Currently, the system is closed with some musical choices previously defined by composers, that we will discuss in Section 5, but the samples are easily changeable just replacing files in folders on the server side.

Technological design

To ease audience participation, the project is presented as a website, with no login and with open access. During performances, a person also acting as conductor typically runs the site on a local host, and provides a private WiFi network for the audience. The website can be projected on a screen using a projector and a PA can be used to provide visual and aural feedback even for those not joining the chat.

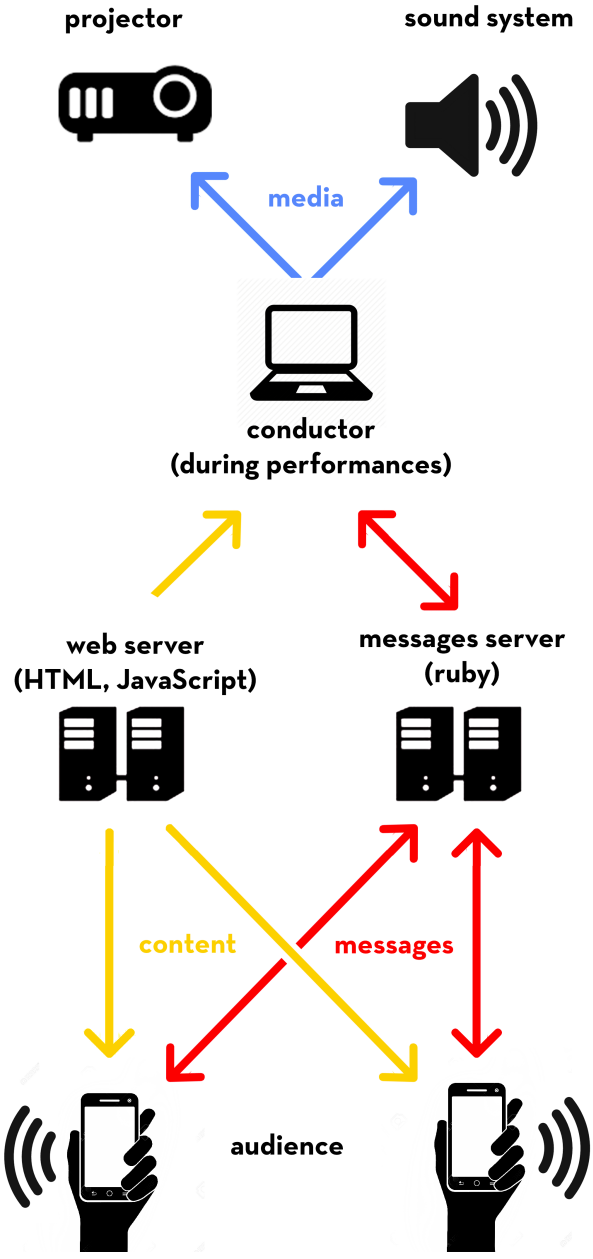

Figure 1: Overview of the Open Band system. The audience interacts with the system trough a website. During performances, a participant can act as conductor to change dynamics and sound packs. The website can be projected on a screen and sounds diffused using a PA.

Since text messages are probably the main form of communication on smartphones nowadays, we chose to experiment with this type of communication as input to produce interactive music. Many kinds of interfaces use typing as input, such as in live coding [4], audience participation pieces, to receive feedback from the audience [24], or to get user data as source for algorithmic compositions, and using keyboard as music controllers [9].

We addressed these requirements by developing a client/server web-based architecture which is described in the next section. The project was developed following an agile methodology called Lean Ux [18], that consists in having always a working version of the project since it's start, and to perform gradual changes for each performance as we receive feedback of the audience and the composer.

4 OPEN BAND SYSTEM WEB ARCHITECTURE

The project was built having two server-side components that are independent: one of them is a typical web server that serves web content such as HTML, JavaScript and audio files and is based on the Web Audio API [27]; the other server component is responsible for making messages deliverable (see Figure 1). This is a desirable feature, just as it makes possible to change the messaging technology at any moment, as well as allows different front-ends to receive or send messages.

Front-end

The front end was designed to be as minimalist as possible, with only a text input for the messages. The idea was to use minimal design elements to avoid distraction from the main contempt of the messages sent and the sounds generated from them in real time. There is no register nor login windows, and the site is totally open for every user.

Interface and Interaction. The interaction process happens through an open chat interface, where there is no distinction between users. Hence no one can tell who is playing what. Each message sent to the chat is loaded into a chat room and played as a sequence of samples with no hierarchy. In an inter-semiotic translation [21] between text and sound, we decode the text messages as musical information, through concatenation of samples. To touch or click in the messages on screen make them play again. Unlike speech synthesis mechanism, our sound chat does not concatenate syllables, so words cannot be understood as words, but only as sound rhythmic sequences. Besides the sounds generated from the textual inputs of participants, there are also commands that can be live coded. Those commands are hidden from the public to create some degree of surprise when used by a participant acting as conductor. They can change the audio samples pack, change the global volume or turn the sound off.

Figure 2: Interface of the Open Band chat on mobile device.

Open source project. A second project is maintained [12] as an alternative for people who would like to reuse the project without having to amend the server component. It is possible to change the audio files and play one's own performances.

The current implementation treat all provided sounds as samples, and each ASCII character is associated to a sample (mp3 audio files used by the system are named after the given ASCII number they relate to). When a user enters the chat, the audio samples are loaded into a buffer, and they are played when messages are sent. In the version used in performances so far, samples are played one after another, as indicated by the sequence of the letters on the messages.

Back-end

The current implementation of the messaging server is written in Ruby, making use of the Puma, Sinatra and Faye frameworks, as well as the WebSocket technology for server/browser communication. The code tries to be easily reproducible on Linux platforms and is released as open source [13]. The messaging technology plays a main role in such application and early versions of the project frameworks like PubNub and Peer.js have been tested, but the decision of sticking with

the Ruby server was made having in mind that it was important being able to make the performances even without any internet access, what couldn't be made with the other frameworks.

5 PARTICIPATORY PERFORMANCE USE CASES

Sample design

In version of the project presented in this paper, all the sounds are played as samples, and each samples pack works as an interactive music composition by itself. As we don't know the order, nor which sounds are going to be played by the audience in each performance, we seek to cut samples that could stand to be played alone and at the same way could be easily combined with one another. To this end, we cut the samples based on James Tenney's concept of clang, or aural gestalts, a minimum unity of a sound object, that is similar to Pierre Shaeffer's concept of "cellule" sound-objects, short or redundant objects [20]. Being simple sound units we believe that such sounds can be more suited to random combinations than complex sounds, with less risk of rhythmic or tonal inconsistencies.

We are also making an analogy with the phonetic alphabet "technology" itself based on the idea of atomization of the spoken language [19]. To leave room for chance, we tried to cover high degree of variation of sound clangs, and made four different compositions of packs of samples, with different sonorities, that can be changed in real time by typing in special commands during the chat. (see the description of "samples3/" below). To maintain a certain rhythm, the samples were cut in fixed and multiple formats, in order to enable them to fit within a time grid.

Galaxies (samples0/). The default pack was sought to maintain some phonetic relation with original letters, to introduce public to the system. Most of lowercase letters sounds was cut from Haroldo de Campos readings of his long poem Galáxias [2], to make also a tribute to concrete poetry defined by-Campos et al. [1] as a "tension of thing-words in time space. Dynamic structure: multiplicity of concomitant movements". For special characters, we implemented in this pack symbolic semantic-sound relationships such a the use of a cash machine sound for the dollar sign. We also use other more iconic analogies, such as using subtractive graphic synthesis made by spectral visuals such as shown on figure 3. This is the default sample pack and is generally used for introductory parts in the performances to make the audience familiar with the sounds and letter associations on the website and during the performance.

Percussion and chords (samples1/). The second pack of samples deals more with materials in the realm of pop electronic music, such as elements of traditional electronic samplers, chords and guitar samples. We associated percussion material to consonants, trying to identify sounds that resemble the original phonetic of the letters, such as bass kicks for the "B" ans cymbal for the "S". For vowels, we used synthesized sound made from additive samples in a C major scale. For some special characters, we took samples from Velimir Khlebnikov's Radio of The Future [26].

Collaborative samples set (samples2/). This sample set was put together by Viktor Kisil, professor of Music Production at Anhembi Morumbi University, who asked his students to make some short samples for a performance. This pack is made from his collaboration in mapping the samples with the ASCII table. It contains samples from different kinds of sources, concrete and synthetic sounds, and also includes a lot of special sound effects. Relations between sounds and letters are more arbitrary than in the other samples packs.

Orquestra Errante (samples3/). These samples were cut from recordings of free improvisation group Orquestra Errante, conducted by Rogerio Costa at University of São Paulo, mostly produced on traditional acoustic instruments, such as saxophone, flute, clarinet, trombone, guitar, percussion and voice. The instruments were often played with extended

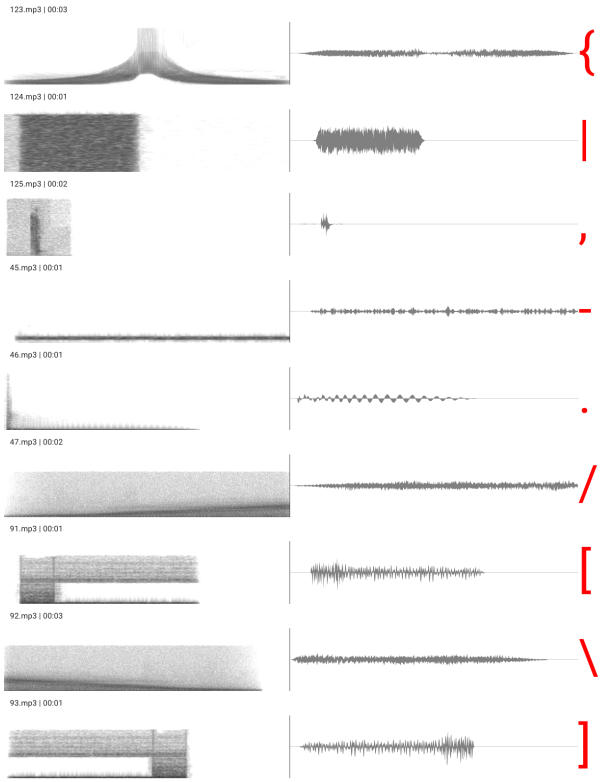

Figure 3: Spectrographs and waveshapes of some of the samples from the first sample pack. These were obtained by subtractive graphic synthesis.

performance techniques during rehearsals or in studio. We searched in an archive of several past free improvisations of the ensemble, to find sounds evoking letters, or repetitions for numbers or that evoked the shape of the characters for some special ones.

Overall performance apparatus

The performances are designed to be made in any space that can fit a laptop and a network hub. All interested participant are invited to join the network with their device and connect to the the application in a web browser. As web browsers are now ubiquitous, the only limitation for connecting to the application is the device being able to join the network through WiFi. A regular laptop should be able to run the application without any issues. The last performances were made on a laptop with AMD A4-5000 processor and 4GB memory. Any devices that can install Ruby gems should be able to host the server. The source code is hosted on Github as open source software and there is a shell script with the application to easily start the server. In most of performances, we used a projection of the chat on a screen.

Performance procedure

Audiences were first asked to join a specific Wifi network running the server, and then enter an IP address that was provided to them (e.g. in the projection). As users enter the web page, they start to write messages trough the chat. At some point, a participant acting as conductor (one of us hold this role) change the samples to cause some degree of surprise. The performances usually lasted for about 20 minutes and ended when the conductor typed the command “stop!", witch brings the system to silence.

Settings and Participants

To date Open Band has been performed at five occasions, namely at the Bigorna Festival, at a public square (see Figure 4), at various concerts and in private spaces.

During the first performance at the Bigorna Festival (see figure 4), the audience included about 70 people, 30 of whom were able to connect to the chat (due to restrictions of our current router we could not support more connections). The audience was formed mostly by students of Music Production that had collaborated on the third samples packs.

During the second performances at the ABRAPEN Conference, the audience was mostly composed of traditional musicians who were conference attendees. There was about 25 participants in the audience who demonstrated their interest by asking information about the system and about the sounds chosen through the chat. There was more interest by

Figure 4: People interacting during an Open Band performance at at public square.

the audience in trying sound combinations together than by just exchanging textual messages anonymously [1].

The third performance was held on a web radio. 10 participants actively joined the chat and 20 participants listened to the performance through the radio [2].

The fourth performance was held at a concert of experimental music in a bar, where there was about 40 participants [3]. The audience was formed by experimental musicians and enthusiasts, who kept experiencing with sound combinations, more than with discourse.

The last performance held to date was conducted as part of a Computer Music Concert at the *Instituto de Matemática e Estatística* (IME), with an audience composed mostly of

[1] A recording of the performance at ABRAPEN is available at: https://www.youtube.com/watch?v=NOWapLq6eiU

[2] A recording of the radio session can be heard at: https://soundcloud.com/asss/banda-aberta-na-radiograve-reset-do-universo

[3] A video of the screen recording of the performance at the bar is available at: https://www.youtube.com/watch?v=DpCuU41tWM8

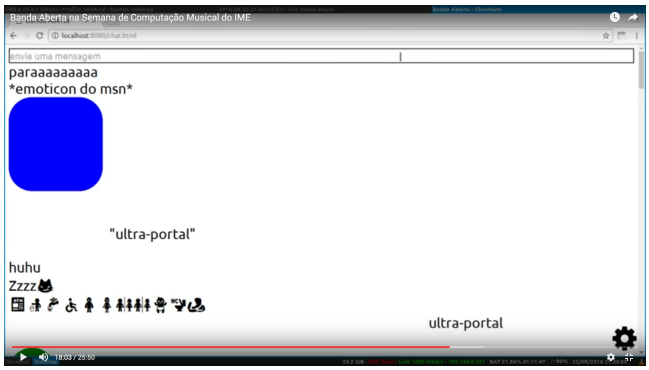

Figure 5: Screenshot during the performance at IME, with people inserting CSS data on the chat.

programmers and computer scientists[4]. During this performance, some of the participants discovered a flaw on our site's security that made possible to send JavaScript and CSS commands through the chat interface, as shown in Figure 5. Participants kept trying to make things move on the screen and change visual aspects of the site, despite the sounds that were been played. This illustrated a surprising example of use of our system with audiences using their creative agency in a collaborative way.

Qualitative evaluation

We discuss here several aspects that emerged across the five performances presented in the previous section. Depending on the profile of the audience, the way to use the system can go in different ways. We could see that in musical contexts, the audiences spend more time experiencing with the samples and rhythm, typing phrases without meaning. However with a younger public, the participants tended more to play by discussing in anonymous ways. As conversations get more intense, layers of sounds overlap, creating more frenetic rhythms.

Noticeably, in all instances, we received a lot of feedback from the public through the chat, showing interest from the participant who supported the project. The engagement of active participants was generally high, but some users complained that it was difficult at times to identify which sounds corresponded to which message, diminishing their sense of creative agency. Specifically when there were more people that our router could support, like during the Bigorna Festival, there was some frustration from users who could not join the chat.

The anonymity of the chat is also a disputable point, as sometimes the users use the platform to make political discourse and wanted to have their messages identified with them. At the Festival Bigorna where the audience was very young there was unfortunately some case of homophobic and misogynist discourse employed by the participants. Our current systems does not have a straightforward way to prevent such messages to be sent. However, besides such issues, we believe that the anonymity benefits a high engagement, since people don't get ashamed of saying things and therefore producing sounds through the chat.

After the concert at IME, five people from the audience answered to online survey about the project. No user found it difficult to use the application, two of them felt musically limited by the resources of the system, and everyone felt that they were collaborating in the process during the performance.

[4]A video of the screen at IME's performance is available at: https://www.youtube.com/watch?v=xs23z1IfPfY

6 CONCLUSIONS AND FUTURE WORK

We presented in this paper Open Band, a novel system to create participatory music performances by sonifying participants' textual messages in a live chat platform. The free interaction and ease of use has shown to provide a high degree of fun for some participants during five performances which were held in various settings. The system fosters a sense of play that resembles that of games, but also affords socio-political standpoints as expressed by free speech in a chat system. Messages decoded into music also give the possibility of communicating beyond symbolic written language sharing of phrases purely at the sonic level, without expected literal sense.

To date, Open Band has been developed mainly as a performance project and creative coding experiment, with fixed collections of samples. We seek in the future to expand it to be a framework to be used in different musical contexts. Although it is quite simple for any enthusiast to change the samples packs in the open-source software.

In future work, we wish to use the Audio Commons API[5] and/or the Freesound API[11] that grants access to a collection of more than 300k sound samples released under Creative Commons licenses [10], enabling interesting media re-purposing. We are also interested in developing more complex text-to-audio mappings, to use gestural controls from users, and real-time analysis of the overall dynamics in the text flow produced by the crowd (mapping textual dynamics to musical dynamics).

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