Collective Sound Checks

Exploring Intertwined Sonic and Social Affordances of Mobile Web Applications

Norbert Schnell
IRCAM – Centre Pompidou
STMS lab IRCAM-CNRS-UPMC
Paris, France
norbert.schnell@ircam.fr

Sébastien Robaszkiewicz
IRCAM – Centre Pompidou
STMS lab IRCAM-CNRS-UPMC
Paris, France
sebastien.robaszkiewicz@ircam.fr

Frédéric Bevilacqua
IRCAM – Centre Pompidou
STMS lab IRCAM-CNRS-UPMC
Paris, France
frederic.bevilacqua@ircam.fr

Diemo Schwarz
IRCAM – Centre Pompidou
STMS lab IRCAM-CNRS-UPMC
Paris, France
diemo.schwarz@ircam.fr

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Abstract

We present the *Collective Sound Checks*, an exploration of user scenarios based on mobile web applications featuring motion-controlled sound that enable groups of people to engage in spontaneous collaborative sound and music performances. These new forms of musical expression strongly shift the focus of design from human-computer interactions towards the emergence of computer mediated interactions between players based on sonic and social affordances of ubiquitous technologies. At this early stage, our work focuses on experimenting with different user scenarios while observing the relationships between different interactions and affordances.

Author Keywords

Sound, music, collaborative, mobile devices, web technologies, HTML 5, sonic interaction, social interaction

ACM Classification Keywords

H.5.2 [Information Interfaces and Presentation]: User Interfaces – Auditory (non-speech) feedback; H.5.3 [Information Interfaces and Presentation]: Group and Organization Interfaces – Collaborative computing; H.5.5 [Information Interfaces and Presentation]: Sound and Music Computing – Systems

Introduction

Recent mobile devices include a full set of features (*e.g.* multimodal sensing, digital processing, audiovisual rendering), which turns them into powerful computing platforms within reach of anyone. Many sectors took advantage of this development and artists have adopted mobile technologies as an opportunity to create new forms of artistic expression [1].

Many works on collaborative music interfaces and multi-user instruments have investigated the design of hardware interfaces and centralized computer music systems [2, 5]. Even if the design of collaborative music making scenarios based on mobile devices inherits many aspects from these approaches, the intrinsic autonomy and ubiquity of mobile technologies demands to profoundly reconsider the emergence of play and collaboration in this context.

Early research on *mobile music* has focused on how to use mobile devices for sensor driven sound and music generation [10, 4]. Commercial applications have turned mobile devices into self-contained musical instruments [11] and augmented reality soundscapes[1]. Further research focused on the phones' mobility and ubiquity to explore setups that involve a larger number of users: Wang's and Essl's *Mobile Phone Orchestras* [12, 7] let the electronic music ensemble members perform for an audience, whereas Lee & Freeman's *echobo* [6] invites the audience to play simplified mobile phone-based instruments that follow a chord progression determined by the artist and broadcast over a local network.

While solo performances, music ensembles, and participative concerts based on mobile technologies usually feature trained performers, mobile devices also conquered sound and multimedia installations in which technology supports the audience's autonomous interactions. Especially in this field, the ubiquity of mobile devices has shifted the focus of design from the users' interactions with technology to the mediation of interactions among users mediated by technology. In this sense, the installation *Schminky*, a networked sound game setup in a café, for example, "was specifically designed to promote social interaction" [9]. The creators of the installation PESI [3] intend to extend mobile music instrument with social interactions mediated by an additional technical setup based on optical tracking.

Our current research project[2] focuses on developing scenarios and mobile web applications for creating sound environments and music performances in various contexts including dedicated events to spontaneous gatherings. While the design of digital music applications is usually articulated with physical (*i.e.* acoustic) properties of devices and spaces, here, social behaviors take an important part in the design of scenarios and applications. In this context of emerging ubiquitous computing, this work-in-progress aims at presenting a first step towards understanding how human–computer interactions may influence — and blend with — social interactions in the field of sound and music.

Scenarios and Application Prototypes

To systematically investigate the interconnections between sonic and social affordances in a flexible setting we created the *Collective Sound Checks*. This series of workshops in collaboration with the *Studio 13/16* at the Centre Pompidou in Paris allows us to explore collective performance scenarios based on mobile web application

[1] http://rjdj.me/

[2] http://cosima.ircam.fr/

prototypes with teenagers. Each workshop lasts 4 hours during which the participants are free to join and to leave the activities at their will. The workshop space is large enough so that the participants equipped with their smartphones can experience the distribution of sound sources over larger distances and gather to multiple smaller groups when necessary (see figure 1). They are free to explore the web applications at their will and have access to all of them from the start. At some point, the workshop leaders might suggest particular rules for playing. A workshop is usually attended by 20 to 50 participants, who stay between 15 and 90 minutes. We held a first series of 3 workshops in May and June 2014 and another series of 4 workshops between October and December. The periods between the workshops allows us to iterate on the applications and refine the scenarios based on the participants' feedback.

Figure 1: A group of participants playing with the *soundscapes* at the Studio 13/16 at the *Centre Pompidou*.

We faced multiple challenges while designing these scenarios. First of all, the aesthetics and social affordances of the proposed applications had to match the age group of the participants. Secondly, given the open organization of the workshops, most of the applications had to instantly catch the attention of the teenagers and allow them to jump in freely. Finally, we wanted to allow the participants to engage with the applications for longer periods within the 4-hour workshops, exploring different possibilities, developing their performance skills, and collaboratively constructing sound environments or musical performances.

Setup and Technologies

The participants were provided with a small hand-held loudspeaker connected via a mini-jack audio cable to a mobile device (see figure 2).

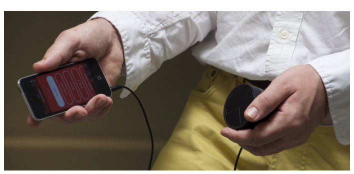

Figure 2: Mobile device connected to a loudspeaker provided to the participants of the Collective Sound Checks.

The hand-held loudspeakers amplify the sound sufficiently so that the sound experiences created by the applications is not too much disturbed by environmental noises and conversations between participants. Nevertheless, all scenarios work with the internal loudspeakers of the mobile devices.

The applications are based on upcoming HTML 5 web standards such as Javascript, Web Audio API, Device Motion, and Web Sockets. The motion sensing relies on the embedded sensors of the mobile devices (*i.e.* accelerometers and gyroscopes). This choice allows for rapid prototyping and for ease of deployment in the workshops, as well as for spontaneous demos and performances in any other context using a local HTTP server and WiFi network. Some of the prototype applications that do not require any synchronization or communication between the mobile devices have been published on the project's web site.[3]

Scenarios

The first web applications we explored in the *Collective Sound Checks* is a set of *soundscapes* turning mobile devices into sound-emitting devices that react to motion. While the participants can use these applications individually to explore different techniques and metaphors, we encourage them to create spontaneous performances and environments of distributed sound sources by walking around in the workshop space or by gathering together and exploring different movements and simple choreographies. Further applications are based on network infrastructures that synchronize the mobile devices or connect them to a common instrument.

Drone. This application reacts to the device rotation and responds with the amplitude and frequency modulation of a set of oscillators generating a bass drone. Strongly shaking the device generates the sound of

[3] http://cosima.ircam.fr/checks

electric discharges. This application started from the idea to collectively create a complex bass drone sound composed of a large number of sources. In the first prototypes, we noticed that a drone sound modulated by the movement dynamics of a device strongly evoked Star Wars *lightsabers*, especially in the context of a workshop for teenagers. We finally let this reference govern the sound and interaction design of the application, so that the initial affordance of the application has been extended by the possibility to simulate lightsaber fights between two or multiple participants.

Birds. This application provides a collection of bird sounds played by jiggling the device. Following the metaphor of twittering, multiple participants can improvise non-verbal conversations answering each other's calls. When participants are distributed over a larger space, it generates a forest-like atmosphere of spatialised bird calls answering each other.

Monks. This application allows players to create a choir of singing voices controlled with simple movements. The users can select a female or a male voice (an extract of a Meredith Monk recording or a Tibetan chant), where the roll angle of the mobile device modifies the pitch and timbre. With this application, participants generate meditative polyphonic sound textures filling up the space. This creates a quiet and reflective atmosphere in which they walk slowly, paying attention to each other.

Rainstick. Following the rainstick metaphor, in this application the player tilts the device from its horizontal position to produce the sound of different grains, liquids or masses pouring or rolling from one side to the other. The player can choose between different sounds such as *water*, *wood*, and *stone*. While the other *soundscapes* are based on direct mappings of motion capture parameters to sound synthesis parameters, this application introduces a physical model — of a mass particle sliding on a tilted surface — that mediates between the performers movements and the evolution of the sound. One way the teenagers use this application is to stand in a circle with the devices pointing to the floor, and to raise one after the other the device to make the sound move around the circle. Hereby, the participants learn to adjust their movements to the behavior of the physical model to make the sound move continuously around the circle.

We Will Rock You: Reloaded. This application invites multiple players to perform Queen's song *We Will Rock You* with a set of simple instruments and to create their own versions of the song.
The first shared goal for a group of participants is usually to recreate the song as they recall it. When the players get familiar with the instruments and with playing together, they usually start to draw away from the original song to create their own improvisations. Since the players have to stay in beat with each other they usually remain close together and keep eye contact like the members of a band. They often organize themselves by forming a strong rhythmic basis with the *drums* part ("stomp-stomp-clap"), while the others improvise with the *voice solo*, the *choirs* or the *guitar riff* parts.

Shaker. In this scenario, the participants are invited to record arbitrary percussive sounds (with their voice, or using props), which they can then perform by shaking their devices. All devices are automatically beat synchronized over the network so that multiple players can easily perform together.
At the *Collective Sound Checks*, the participants record their sounds using a microphone on a stand with a foot

pedal in the middle of the space, which creates further social interactions between the participants. When someone finishes a recording, all participants can load this recording on their device and play with it. That way, the participants can experiment with different sounds and create an ensemble by recording complementary materials.

The Matrix. In this scenario, the players are sitting on a grid (for instance, 3 rows by 4 columns, for a total of 12 people). Their mobile devices form a matrix of screens and loudspeakers that are used to spatialize sound and light. In the current version, *The Matrix* is performed by one player at a time. A representation of the matrix appears on the screen of a player who controls the movement of sound and light across the matrix of smartphones by moving his finger on the mobile screen. He remotely plays on other people's smartphones that emit sound and light modulated by the finger trajectory and speed. After a fixed time, another player takes over the performance. The rules the collective instrument imposes on the players opens a large field of experimentation. We could observe how performers picked up and developed particular playing techniques and sound–movement patterns from previous performers. While some participants could appreciate listening to the current performer playing, others complained about the long time they had to wait for their turn without playing.

Discussion and Conclusion

The Collective Sound Checks allowed us to explore different modes of interaction driven by mobile web applications in a flexible setup. The participants clearly enjoyed playing with the applications and some of them stayed up to 1.5 hours exploring different scenarios. They enthusiastically engaged in discussions on the scenarios and possible evolutions. Many of them asked for accessing the applications online to play outside the workshop.

The development of the applications has been governed by two interwoven perspectives: the motion-sound relationships in the interaction with the mobile devices, and the social interactions between the participants.
The role of digital technology in the scenarios is manifold. First of all, it provides motion–sound relationships that enable the user to individually explore different modes and metaphors of sonic interaction and expression. In each of the presented scenarios, the sound reacts differently to the device's movements. Secondly, the technology mediates the interaction between players in different ways. While in applications like the *soundscapes* and *We Will Rock You: Reloaded*, technology provides complementary elements that afford collective playing, in the case of *The Matrix*, it provides an infrastructure that connects the participants' devices to a common instrument. Each case ultimately induces a very different attention to the collective interaction.
Finally, in some of the scenarios, technology facilitates music playing. All of the applications have been designed to include participants independently of their musical skills. For instance, in the *Shaker* scenario, the application provides a common steady tempo to all players who consequently can focus on other aspects of their performance like varying rhythmic patterns and dynamics. This offers more room for improvisations and leads to interactions between the users that easily combine music performance with dancing.

The presented applications let us explore some initial ideas of how mobile web applications can support spontaneous collective performances. Future developments will seek to explore further spontaneous collaborative behaviors through adequate affordances of the proposed applications. While for now, the incentives and challenges implied by the proposed scenarios focus on sound production and music playing, following up on former projects [8], we would like to introduce extra-musical interactions, rules, and challenges. This could be seen as a gamification of music playing or simply as creating playful performances mixing musical and extra-musical challenges. While we will continue the workshops with teenagers, a generally exigent population of users, we seek to diversify the user groups and cultural contexts within future endeavors. Current ideas include artistic collaborations on participative concerts, as well as concerts without stage in which the audience members provide the infrastructure for diffusing audiovisual elements out of their pockets and are involved as players at the same time.

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