A Social Crowd-Controlled Orchestra

Saiph Savage
Computer Science Department
UC Santa Barbara
saiph@cs.ucsb.edu

David Alvarez
Centro de Investigacion en Computacion
Instituo Politecnico Nacional
david@frozyog.com

Norma Elva Chavez
Computer Engineering
Universidad Nacional Autonoma de Mexico
norma@fi-b.unam.mx

Tobias Höllerer
Computer Science Department
UC Santa Barbara
holl@cs.ucsb.edu

Carlos Toxtli
Computer Engineering
Universidad Nacional Autonoma de Mexico
c-toxtli@comunidad.unam.mx

Salvador Medina
Computer Engineering
Universidad Nacional Autonoma de Mexico
smedinama@comunidad.itam.mx

CSCW'13 Companion, Feb. 23–27, 2013, San Antonio, TX, USA.
ACM 978-1-4503-1332-2/13/02.

Abstract

We present a novel social interactive system that brings music creation to the crowds. It allows anyone with a personal electronic device and regardless of their musical expertise to participate in the music an orchestra generates, while also encouraging social interactions among participants. Users can be either musicians or conductors. The latter drive the group's music production, while the others follow simple game-like instructions on their device for playing the conductor's selected songs. The primary mode of interaction for playing songs, consists of rotating one's electronic device in different ways. Our system also provides different social interaction cues that aim for novice and expert users to start conversations with each other and improve the group's performance as well as construct a community among participants. We report on a qualitative analysis, which suggests that users appreciate the system's versatility in providing service to a variety of devices and enjoy participating in the orchestra with their own personal device. Users judged the social interaction cues the system provided to be effective. We believe our findings aid the design of future social intelligent environments that seek to build communities with participants through music.

Figure 1: Screen-shot of the interactive interface the conductor sees. In the lower part of the interface the conductor obtains an overview of how musicians are clustered on stage and the musical instruments she has currently assigned to each group member, as well as a score of how well or how badly each person has done in following the conductor's instruction in the past. In the top left panel, the conductor has a list of songs he can choose for the group to play. In the top right panel, the conductor has a list of instruments he can choose to assign to the different musicians.

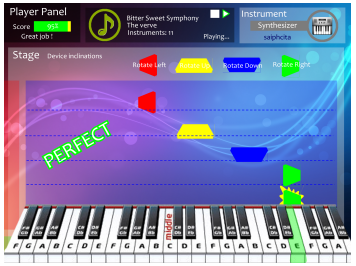

Figure 2: Screenshot of the interactive interface each musician sees on his/her own electronic device.

Author Keywords
Participatory Design, Music, Mobile, Experimentation, Performance

ACM Classification Keywords
H.5.5 [Information interfaces and presentation]: Sound and Music Computing Methodologies and Techniques

Introduction
Several studies have been conducted, analyzing what brings people to a concert hall to listen to an orchestra [8], and why individuals many times do not return [8] [5] [1]. A common theme found is that first-time concert-goers often had the sensation of "feeling inadequate and out of place". This indicates to us that inclusiveness and involvement of audiences is not necessarily a goal in traditional orchestra performances, and that there are opportunities for a different type of more audience-interactive performances.
We believe that by turning the orchestra into a more social and participatory event, in which the entire audience can take part in the music creation, and conversations between strangers are also sparked, participants will feel even more motivated to return to future orchestra concerts.

System Overview
Inspired by previous work that creates a more dynamic participatory experience within an orchestra [7] and systems that consider the social interactions and feedback of an audience for intelligent music catering [3] [2] [4], we sought to build a participatory system, that could potentially allow anyone attending the orchestra event to participate in the music making. We also incorporated social interaction cues, which can help integrate users to the performance even more.

To allow for heterogeneous participation, our entire system is built using HTML5. We built a server application using node.js that is in charge of creating the interconnection between the electronic devices of participants and a server. Communication between participants and the server is done through websockets. The musical performance is facilitated by webworkers, which are asynchronous HTML5 threads. We decided to develop interfaces for the web, as they give anyone who has access to the Internet, an opportunity of becoming part of the experience. Our system separates users into two types: conductors and musicians. In our scheme varying levels of participation are possible.
For designing the social interaction cues, our system builds on ideas from psychology, which consider that the best way to integrate new users to an event or organization is by having them interact directly with people that have been involved in the event for some time (experts) [6]. Therefore, prior to the concert, spectators are asked to complete a survey in which they state how many participatory orchestra concerts they have attended in the past. People that have been to 2 or more participatory orchestra events are considered experts. Once the concert is underway, the system tries to create groups of people that have an even number of experts and novice users. Having experts be intermingled with beginners, is our starting point for creating social interactions.
Once everyone is in their assigned group, individuals can make requests to the system to become conductors. The participant to make the first request, is selected as the first conductor and is drawn to the middle of the room. The conductor's task is to select a song that the orchestra will play, and assign musical instruments to each person. The conductor also has the power to assign greater volume to individuals that follow their instructions better, as well as lower the volume of persons that have a hard

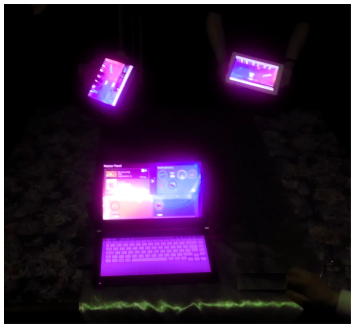

Figure 3: In this figure we see how users are taking part in the orchestra by using their personal electronic devices, which can range from tablets, laptops, smartphones, anything with an Internet connexion.

time following their directions, so they do not interfere with the group's music production. For this, the conductor is given an overview of how each individual musician is doing in the execution of their tasks. We provided this information, so that the conductor can become aware of possible beginners: people that might need assistance in becoming well integrated into the performance. The system provides social interaction cues for the conductor at the end of each song, promoting them to take a break and to have active conversations with these beginners. These discussions are encouraged to involve the whole cluster that these novice users are in, so that the experts in their group can also become aware and possibly help them become better.
Our system rewards groups that have no musicians that fall behind. The system encourages the conductor to publicly acknowledge groups that have excelled in the performance. Therefore, it is in everyone's best interest to help their group members succeed.
We believe that integrating these social interaction cues also helps influence the integration of users to the orchestra and their participation in future orchestra events. As users may feel obligated to return to the concert hall because they want to belong to a community. The more people are interacting, the more other users may want to participate. An overview of the interface that is presented to the conductor is shown in Figure 1 (Figure 4 presents a larger view of this interface.)

The interface of all other participants is slightly different from that of the conductor. It presents the user with the current song that he or she needs to play as well as the movements to be performed at different time frames. Each song in our system's play-list has been previously mapped to movements the user must perform on his/her own electronic device to efficiently play the song's musical notes. To determine how musical notes map to device movements, we worked closely with a music major that aided us in mapping seven songs. The main forms of interaction involve rotating one's device in various ways. The degree of rotation is detected through the accelerometer of the device, which is available to our HTML5 web interface. For user's whose electronic device does not hold an accelerometer, we allow for participation through a mouse or touchpad (the user has to glide his/her fingers in different directions.) An overview of the interface for audience members that are musicians is shown in Figure 2.
The purpose of this interface is to allow for all users, regardless of their musical expertise and electronic device, to be able to easily participate in the music making. We also seek to inform the user just how well he or she is doing in following the song melody. We believe this particular feedback is important, as the user's overall performance, affects the group's dynamics. Groups with people that follow the musical notes well are praised. When a group member falls behind, group conflicts can arise, as this individual is affecting the entire group's performance.
In essence, we turned music making into a sort of virtual game that celebrates when the user maintains the musical rhythm. But when problems within the group arise we promote discussion and conversation, seeking to enable the group to succeed in the future. An example of our system in use with various personal devices from the audience is shown in Figure 3.

USABILITY INSPECTION

In this section, we discuss the usability of our system using the cognitive walkthrough methodology. The usability inspection was done inside a university laboratory, which had been previosuly prepared to represent a "concert

hall". All furniture was removed from the space.

A. Users Twelve individuals were recruited for our study, where six of the participants had previously attended orchestra concerts and the other six had not. We asked all participants to bring a personal web-enabled electronic device. These twelve individuals were divided into four groups of three and placed in a corner of the concert hall each. We ensured that each group consisted of both novices and experts.

B. Tasks We had the groups play a series of five songs. The first song was conducted by one of the authors of the paper, with the intention of setting the norm of what the conductor's job was. After the first song was played, any group member could make a petition through his/her electronic device to be a conductor. The individual who was selected to be the conductor would leave momentarily his/her group, and come to the center of the room to direct the orchestra. This person would then select the music that was to be played, as well as state who would play what instruments. Between songs we conducted interviews: All participants were questioned about their experience in the crowd-controlled orchestra, as well as how they felt about the different roles they assumed (conductor, expert or beginner.)

C. Results and Analysis We list here a few of the interesting points encountered in the cognitive walkthrough:

All participants expressed that they enjoyed being able to use their own electronic device for participating in the crowd-controlled orchestra. One user specifically stated he liked how it was multi-platform, and "avoided all the extra installment hassles." Users also stated that they enjoyed playing together as a group. We noticed that after the second song, group members began high-fiving each other and rooting when the conductor stated that they had done better than the rest. A community was clearly beginning to be formed among group members.

Another interesting phenomenon we noticed was that the last two conductors ended to help the group they had belonged to, rather than seeking communal benefit. These conductors appeared to have given other groups more complicated pieces of a song to play, whereas to their own group, they gave very simple pieces, thus increasing the likelihood that their group would do best. This lead us to consider whether conductors should ever be group members. In the future we hope to investigate this point more. We have considered creating mechanisms, where individuals either take the role of conductors or the role of musicians. We are also considering creating communal benefits, in which the entire orchestra benefits from playing a song well, not just one particular group. Another comment we received when conducting the usability inspection, was that many users wanted to have a visualization of how their teammates were doing. They felt this could allow them to better help their group members.

Finally, we also received comments from users, that they had felt uncomfortable being labelled as experts, "just because they had attended a few orchestra events". In the future, we might directly ask users whether they consider themselves experts in "crowd-controlled orchestras" to avoid this problem. It is important to point out that all beginner users that had caused a bad performance and later received a private talk with the conductor and group members, expressed they truly enjoyed this interaction and felt it did aid them in improving their performance. In the future, we hope to integrate more social intergration cue points, where conversations between beginners and experts can begin.

Conclusion and Future Work

In this work, we presented a novel system for allowing the audience of an orchestra to become the orchestra. We also created several different social interaction cues that let orchestra members provide support for each other and better the music generated by their group. These social interaction cues led participants to form communities with each other. We found this created several interesting group dynamics that need to be further explored.
Specifically, we are interested in exploring what are the social groupings that allow users to have fun and best motivate users to repeat the experience. We wish to explore whether grouping people based on their degree of expertise is an adequate measure, or if it is better for users to create social interactions with users that are similar to each other (e.g. share the same musical tastes.)
A user study of our system is fourthcoming.
We would also like to explore remote collaboration within the orchestra, as the fact that our system is Internet based facilitates this type of interaction.
We believe our system offers a novel way for increasing user participation and social interactions between participants of an orchestra event.

Acknowledgements

This work was partially supported by CONACYT-UCMEXUS and NSF grant IIS-0747520.
Special thanks to PhD student Ismael Castillo of UNAM, who provided feedback for the musical interface, and to our users.

References

[1] American Orchestras.org, Audience Demographic Research Review, http://www.ccga.edu/AudienceDemographicReview.pdf, 2009

[2] J. S. Bauer, A. Jansen, and J. Cirimele. 2011. MoodMusic: a method for cooperative, generative music playlist creation. In Proceedings of the 24th annual ACM symposium adjunct on User interface software and technology (UIST '11 Adjunct). ACM, New York, NY, USA, 85-86. DOI=10.1145/2046396.2046435 http://doi.acm.org/10.1145/2046396.2046435

[3] NE Chavez, R Savage, DT Nava, S Savage, Enchantment Under the Sea: An Intelligent Enviroment for User Friendly Music Mixing Intelligent Environments (IE), 2012 8th International Conference on, 303-306

[4] Forbes, A. G. and Odai, K. Iterative Synaesthetic Composing with Multimedia Signals. Proceedings of the International Computer Music Conference (ICMC), Ljubljana, Slovenia, 2012.

[5] Gore E, Symphony Audience Development: Analysis of organizational culture in the performing arts, Arts and Administration Program and the Graduate School of the University of Oregon, Master Thesis 2009

[6] Isaacs, Ellen A.; Clark, Herbert H., References in conversation between experts and novices. Journal of Experimental Psychology: General, Vol 116(1), Mar 1987, 26-37. doi:

[7] C. Roberts and T. Hollerer Composition for Conductor and Audience: New Uses for Mobile Devices in the Concert Hall. In Proceedings of the 24th annual ACM symposium adjunct on User interface software and technology, UIST '11 Adjunct, pages 65, New York, NY, USA, 2011. ACM.

[8] Slywotzky A.,How Symphonies Grew Strong Audiences By Killing The Myth Of The Average Consumer, http://www.fastcompany.com 2012

Figure 4: Screen-shot of the interactive interface the conductor sees. In the lower part of the interface the conductor obtains an overview of how musicians are clustered on stage and the musical instruments she has currently assigned to each group member, as well as a score of how well or how badly each person has done in following the conductor's instruction in the past. In the top left panel, the conductor has a list of songs he can choose for the group to play. In the top right panel, the conductor has a list of instruments he can choose to assign to the different musicians.