Music co-creation in public spaces via interactive coffee tables

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ABSTRACT
This paper explores the development of a digital orchestra as an enabler of co-creation in public space. Based on the needs of a municipality in Gothenburg, we address a physical and digital culture house through a musical project, which aims to connect the jamming culture of musical get-togethers and the Swedish coffee drinking ('fika'), by modern, augmented technology.

General Terms
Design, Human Factors

Keywords
Interaction Design, Multi-touch Surface, co-creation, culture

1. INTRODUCTION
1.1 Design case
The theme for the Interaction Design Project course 2012 was *'Interaction Design in Public Spaces'*, which collaborated with the Lundby Municipality of Gothenburg for the project *'Virtual Culture House Backaplan'*. According to the description of the course website *'The interpretation of the task is very open and can lead to projects in game design, ubiquitous computing, or interactive installations. The projects can focus on engaging, showing, sharing or playing, as long as they relate to the general challenges of the theme.'* [6].

We believe that any installation in a public space has the purpose to attract the attention of people passing by for a short while and, for example, show them information, entertain them or raise their awareness about a problem. It also has the potential for enabling participatory creation, social interaction and engaging in activities with strangers. A public installation can be anywhere - a bus stop, a shopping mall, and so on.

1.2 Kulturhus Backaplan
The Kulturhus Backaplan is still an ongoing project, with its general idea being a place where people can meet and engage in cultural activities. In the beginning we got a presentation from our clients, the municipal workers who are working on the project, and they stated their mission and vision. They have done user research to explore what the local people want in the future culture house. As can be seen in figure 1, this brought up many ideas and perspectives.

Since it is not completely defined yet where the culture house will be, the client wants to focus on a virtual culture house, where the creation of culture can take place. Given the requirements of the course and clients, we had to come up with what could fit into the virtual and the public space, and from this the idea for a music-making space was born.

1.3 Music for co-creation
Our purpose is to bring people together by co-creating music. This lets people affect the environment they are in by making and adjusting the music however they want. The choice for music is based on the fact that music transcends cultural barriers and language; everyone can understand and create music. Different parts of the world have different musical practices, instruments and even the way music is experienced varies. Nevertheless, it is easy to agree that music is a common cultural practice. A very strong metaphor of our project is the phenomenon of jamming on the streets. Based on our own international experience, this is not really happening in Scandinavia, however it is rather common in many other places of Europe, where streets are the platform of cultural activity. Perhaps one of the reasons why this does not happen that much in Scandinavia is the weather, especially outside of Summer season. By facilitating the possibility of a jam session indoors in the kulturhus we could translate that kind of culture into the Scandinavian one, and see the same phenomenon arise in places where this does not happen often. It could also be interesting to see the kind of new social behaviors that would emerge, since making music together enables people to interact with each other.

One of the main aims of this project was that even someone who does not have a musical background should be able to make something that sounds nice. Perhaps it could also educate people about different kinds of music culture, or motivate a young child to become interested in learning music.

2. KULTURHUS ORCHESTRA
2.1 Concept development
As explained, our target area was music in the public space, which directed our design process towards the technology involving musical instruments. Developing a system which facilitates music creation easily becomes a very technology-oriented mindset, which is closely related to the field of interaction design. However, although taking this technological approach for granted from the beginning, we aimed hard to focus on using the technology to give an added value and be a method instead of an aim.

This resulted in putting a strong focus on the creation of harmonic music, with trade-offs against virtuosity, but enabling a wide social group to participate effectively and constructively in the music creation. Jordà defines the efficiency of a musical instrument compared to its learning curve [1]. The setting of our project required

Figure 1: Tagcloud of people's expectations of the culture house

to have a short learning curve due to the short time a user will normally spend in a café. For that reason the interface had to be simple and natural to use.

Since our project aimed to enable the widest group of users (and the musically not well trained people), we opted for a realization by simply usable, easy to learn musical instruments. The concept of a step sequencer had been re-occurring in some ways in our design process, and it became the instrument model we followed as a controller. Having simple controllers gave us time and possibility to experiment more in the collaboration aspects of the project.

Our initial vision was to create a digital orchestra where dozens of people could play together. One of our biggest inspirations was the Universal Orchestra Experiment, which has a similar concept [2]. Although this vision was kept throughout the design process, we scaled it down to keep the technology robust for our early prototyping and final exhibition and leave the big scale vision realization as as a future opportunity. However, by scaling down the project, we still managed to keep the most important part of the design briefing: to enable co-creation, and especially by having the participation possible at the site.

2.2 Technology concept

To find an answer to our goals altogether (but keeping in mind the future opportunities) we decided to develop a modular system (see figure 2) by actually modeling how orchestras are assembled. We have a conductor, which is in fact a server to handle the connections and the music generation as well. Besides that we have the clients, which are an interactive coffee table, and three online interfaces, which follow the same principles as the coffee table.

When we outlined the idea for our project we had two key pillars that our ideas were formed around. First, we wanted to make co-creation of music possible, and second, we wanted the location of the users to matter. Soon after we concluded that three parts were necessary for this: an interface for the user, a music generating machine, and a 'brain' to tie them together.

This allowed us to divide the design process into three branches and work in parallel on these fronts.
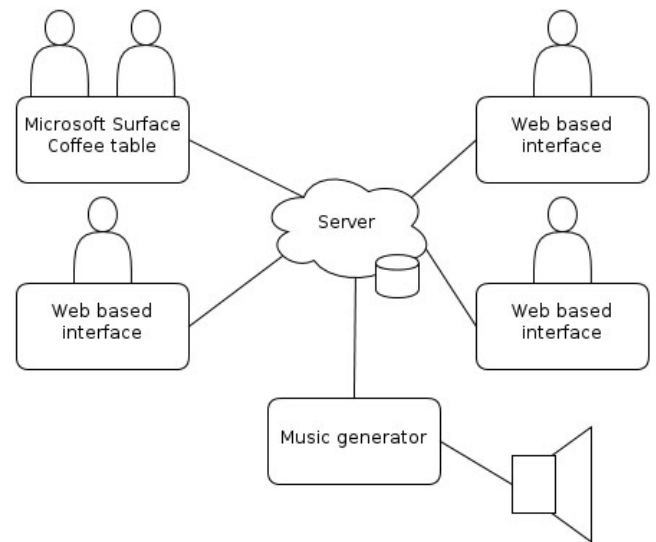

Figure 2: The modular setup of the project

2.3 Table

The table was one of the implemented user interfaces. In the early sketches of the table we thought of it as a round surface where time passed like an analogue watch - this because we thought about the music being played in a loop, and a circular shape was a more natural way to represent this. The surface would be divided so that there would be 8 beats, and five notes could be played each beat, depending on the distance to the center, like a shortened musical scale, as seen on figure 4. The choice of five notes is to only allow specific notes from a harmonic set, so that the produced music would always sound good.

We made a lo-fi prototype from cardboard in an octagonal shape to match an 8-beat surface (see figure 3). After several adjustments in height and size, we decided instead to opt for using a Microsoft Surface multi-touch table, because it gave us most of the features we were looking for, and it was much easier to work with its software. The drawback was that the surface does not match our initial circular design, so we had to re-think the look and feel so that it would fit in a rectangular layout instead. Several sketches and interaction ideas were thought out on how to have the notes/beats division on this situation (see figure 5). We also searched for possibly related projects that use the Microsoft Surface and brainstormed ways of interacting with it to see whether we could come up with a new kind of interaction. The examples we found seemed awkward or unnatural [3], which did not match our purpose of making the interface simple to use. In the end we concluded that the grid layout worked best in this situation rather than a closed loop shape (which would not fit very well in the screen area of the table) or other, more complex ways of interacting (which would probably detract people from using the table).

In the final implementation the table detects fingers, coffee cups and most objects that are placed on top of it. We could have narrowed it to using only cups or other specific objects, but that would add another layer of complexity, both in our development as well as the user interaction. In the same way, we also refrained from adding extra functionalities other than activating musical notes. For example, the NodeBeat project [5] uses a multi-touch table and a mobile app to create music with very good interaction, but we felt that was

too complex. As we saw it, one should be able to look at the table and immediately start playing music without the need for special objects or further instructions. This allows people to explore the interface for themselves and also it would not interfere too much in the social act of drinking coffee together. For the same reasons we deliberately chose to not use special recognizable tags underneath the cups in order to not change the original environment more than needed.

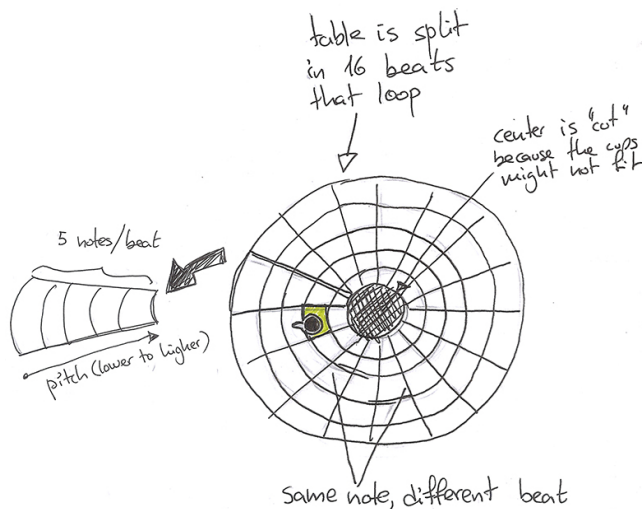**Figure 3: Early concept sketch of the table**

Figure 4: Sketch of the splitting a circular table into notes and 16 beats

In retrospect we can conclude that our project implementation was instinctively done using the evolutionary prototyping method [4], since it started with a lo-fi prototype for the table and resulted in a fairly good quality one.
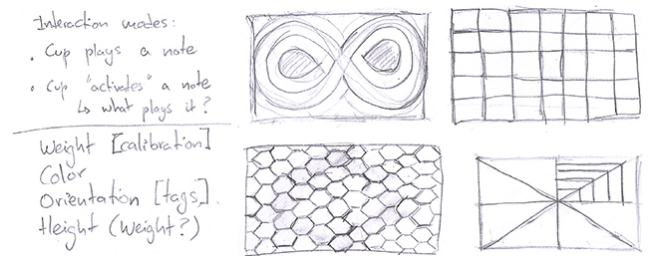

Figure 5: Some sketches for the table's interaction on a rectangular surface

2.4 Mobile app
The mobile interface was developed using web technology (HTML5, CSS and JavaScript). By utilizing web technology we saw several advantages compared to developing native applications. Firstly it did not limit us to one specific platform, since web applications run cross-platform. Moreover, it did not require the user to install any app on their smartphone, but they could just scan a QR-code and then open the application through the browser. This was an important design decision based on our principle to enable easy participation to the orchestra.

2.5 Server
The server was crucial to have robust and shared communication between all the involved technologies, and to facilitate the music generation towards the audio output for a sound system (instead of distributed instruments making separate sounds). To discuss the server in details, a practical approach is to distinguish the web part of the server and the music generation part of the server.

2.5.1 Webserver
The server stores the inputs in a SQL-database. This data is being updated by the table and web apps, and retrieved by the music generator through HTTP-requests. This allows for the data to be easily retrieved from any type of device, regardless of what operating system that device is running. This makes the system very scalable and also potentially allows the system to store different loops and settings throughout time, opening up an interesting area which could be further explored, how musical culture evolves through time.

2.5.2 Music generation
Regarding music generation, we had the vision to have a single output for audio, to avoid noise and cacophony, and to keep the control of generating harmonic music by the whole system, which is hardly ensured by autonomous instruments without musical mastery of them.

The music generation is realized in Pure Data, which is a real-time environment that supports audio processing, and it enabled us to sketch music processing much quicker than by hand-coding sound generation in Java or other languages.

The Pure Data code communicates with the web server, receiving what are the inputs on the separate clients, and based on these input sends out MIDI signals within the laptop, which are received by Ableton Live (a widespread music sequencer), where it turns the different MIDI signals into sampled instruments playing.

A restriction we put on the music generation is the use of spe-

cific musical scales. This limits the users in which sounds they can make, so that it results in harmonic and coherent music. In this way even musically untrained people are able to generate good sounding, enjoyable music.

Initially we considered to approach music generation in an algorithmic-savvy way, taking what is on the clients' input more abstractedly; such as generating drum patterns based on how the coffee cups are distributed around the table (orderly - solid pattern, scattered - swinging pattern). In the end we dismissed this approach for the current iteration, because this would have required more expertise and time for prototyping to develop the algorithms as basis. However, it is important to note, that the current system could be easily developed further in this direction.

Figure 6: User testing during the exhibition

3. DISCUSSION

We have created a new and easy way of creating music. It is easy, fun, and scaleable. We believe this has the potential to change how people interact in public spaces in a fundamental way. Generating interaction between tables and thereby groupings of people in public spaces, which is rather rare in Swedish culture.

The table was set up in Lindholmen Science Park during an exhibition of the Interaction Design course projects, and we got the opportunity to have people spontaneously try it out, which worked as a bit of user testing (see fig 6). This showed that there are a few areas that could benefit from another iteration or improvement. For example, comments were made in regard to the shape of the table, that it would make more sense for the table to be round, since it would be a more fitting shape to visualize the loop. Another user argued that the table should provide more advanced options for accomplished musicians to utilize their musical knowledge to create more advanced music, though that goes against our aim to have everyone to be able to play music with the table. In addition, one suggestion was to have a line sweeping over the table indicating the current beat to make it more clear for the user where it is.

One problem we encountered was when the music playing machine and the table got out of sync with each other, the visual feedback would be faulty. In general, finding out what instrument you are playing when several other tables are playing at the same time can be cumbersome. We often solved the problem by muting all but one table to make the interface more transparent. This would not be possible in an café, and would rather turn the orchestra into a solo performance. With better and more accurate visual feedback and a

monitor for each instrument, it would be easier to know which one is being played. There was also the question that too much noise in the café would disrupt the music, but, on the other hand, maybe it would change the behaviors of the customers in order to accommodate the music creation. It all depends on how exactly the table would be placed in the café's environment. Maybe it would be a centerpiece, and the people would be sitting around it. Regardless, we feel that it would be very interesting to place it in a real café for user testing in a real environment. Perhaps there are other spatial contexts that can be explored as well, like a family's living room, for example.

4. FUTURE WORK

During our development process, we did not really involve users to a big extent. This was due to the fact that we felt that we needed a working prototype before we could really involve potential users and gain much from their involvement. Furthermore, the prototype reached a working state rather close to our deadline and did not really leave much time for user testing. The first thing to do in any form of future work on the prototype would be to perform user tests to evaluate it.

There are a lot of possibilities to investigate in relation to how hand held devices can be used to enhance the experience of the coffee table. Furthermore, we have yet to fully investigate the potential of the space surrounding the table. Until this point, focus has been on the table itself and not really involving many other factors. However, its surrounding space can also play a big part in how the interaction takes place and also what behavior and interaction occurs in the café itself. Last - but definitely not least - is that to make the project feasible to implement in an actual café the tables need to be cheaper. The Microsoft Surface, while being great for quick prototyping, is not very suitable for this setup due to its high price.

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