

# Tap Tap Boom: A multi-touch floor is great for creative collaborative music production

Jossekin Beilharz, Maximilian Schneider, Johan Uhle, David Wischner

Hasso-Plattner Institute  
Prof.-Dr.-Helmert-Str. 2-3  
14482 Potsdam, Germany

{jossekin.beilharz, maximilian.schneider, johan.uhle, david.wischer}@student.hpi.uni-potsdam.de

## ABSTRACT

*Tap Tap Boom* is a music production floor. It allows the user to create and edit music in an inspiring environment. Its size encourages collaborative working. The user can use the input modes *Step Sequencer*, *Groovebox* and *Pad* to record music. One can arrange music in clips on a multi-track timeline. In addition to feet input we offer the usage of objects like bottles or saltshakers to interact with the system. *Tap Tap Boom* elevates creativity by providing a new approach to music production.

## Author Keywords

music production, daw, multi-touch floor

## INTRODUCTION

You can split electronic music production into three sequential parts: In the beginning the musician composes. One generates and tests ideas. Inspiration and creativity play a key role at this stage. Afterwards the musician arranges the composition and does the final recordings. The music is complete. In the end the handcraft of mixing and mastering gives the final touch to the sound and makes it ready for release.

There is a wide variety of tools which aid the process of electronic music production. They focus on different parts like recording, arranging, mixing or mastering. Several typical representatives are depicted in the *Related Works* section.

*Tap Tap Boom* provides a mixture of the mentioned tools controllable by feet as an integrated system. Users can record new music clips with the three input modes and the virtual instruments. Afterwards one can arrange these clips in tracks on a timeline to form a song. By moving around on the floor users engage physically when creating music. Furthermore the size of the floor allows several users to work

simultaneously. Therefore *Tap Tap Boom* offers a new perspective to music production.

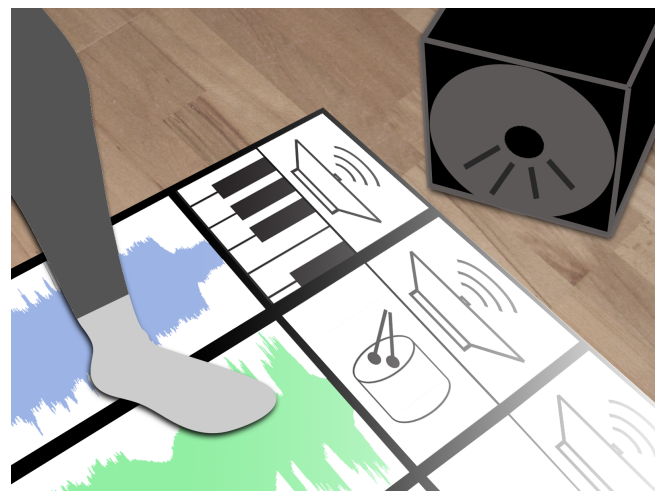


Figure 1. On a large floor screen users can record and edit music collaboratively using feet.

## WALKTHROUGH

### Device

*Tap Tap Boom* uses a rectangle-shaped multi-touch enabled screen as its main output and input device. This screen lies on the floor and has a size of at least six square meters. The user stands on its surface. The system should be able to track the user's feet and many objects accurately. To implement this, we propose a combination of frustrated total internal reflection and diffuse illumination. We think, this is the best combination for exact input tracking. The beamer will be placed under the floor together with infrared light sources and infrared cameras. It backlights the floor, which is a screen consisting of a translucent glass surface and LEDs on the side. It has to be solid enough to hold multiple persons and objects standing and moving on it.

The user controls the transport (play, pause, forward, rewind) with a remote control in the user's hand. It will be coupled with the system via bluetooth. Additionally some sort of audio monitoring system, that is well audible to the user, is essential.

## Usage

*Tap Tap Boom* consists of the three main areas main menu, timeline view and the music input section.

The system knows whether the user is using it the first time. If so it provides a quick tutorial in the beginning, which shows that one can trigger actions with a double tap and open the navigation menu with a counter clockwise swipe gesture. To assure, that the user has read these instructions, the tutorial only disappears after the user has performed the described actions.

## Producing Music

The main menu holds the functions *Load Project* and *New Project*, which are self explanatory and the function *Instant Record*, which redirects the user to the music input section.

To record music, the modes Groovebox, Pad and Step Sequencer (see subsection *Musical Input*) are available. The user can choose an input mode and start recording. After the user finished, *Tap Tap Boom* switches to the timeline view, where the recording is available as a clip on a track.

The project view provides the functionalities to arrange clips in tracks on a timeline. A clip is a piece of music played by one instrument, e.g. a drum loop or a piano chord. A track is a container for horizontally arranged clips. In *Tap Tap Boom* all clips in a track play the same instrument associated with the track. Multiple tracks can contain multiple clips. Each track only plays one clip at a time.

On the right side of each track is an icon displaying the currently assigned instrument and a speaker indicating the volume settings. A double tap on the instrument icon opens a drawer, which contains instruments. To reveal more instruments, the user can scroll through them by swiping. To select an instrument, the user can double tap on it. A double tap on the speaker symbol opens a slider to change the track's volume settings.

A double tap on a clip opens a marking menu and a double tap on a part of a track without a clip opens another one. Both marking menus provide basic arrangement features, to work with clips. The user can select options in a marking menu by a single tap.

The navigation menu opens after a counter clockwise swipe gesture. It provides horizontal scrolling of the clips by horizontal swiping and global zooming of the clips and tracks by vertical swiping.

In the left upper corner of the timeline you find a save and a close button. Save opens a save menu, where the user can enter a project name. The close button returns the user to the main menu after the "Are you sure? Do you want to save?" security answer has been given.

## Collaborative Work

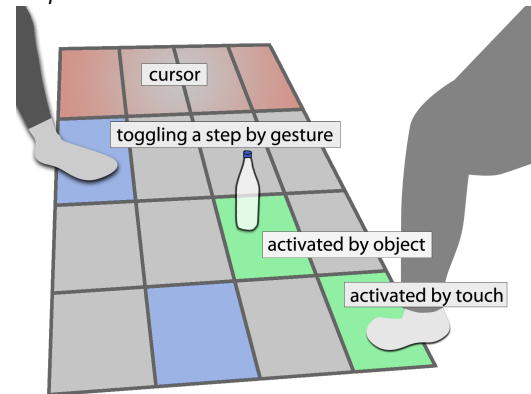
Music has a social component. Even though the need for having a band to perform music has decreased in electronic

music production, it is still more productive and more fun. That is why musicians often do not work alone but collaborate with others. To comfort this behaviour, *Tap Tap Boom* supports collaborative work of multiple persons at the same time on the same floor. The user interface is not having special collaboration modes or tools. Instead the normal user interface can be used by several persons at the same time. This behaviour is especially interesting, when using the Step Sequencer as described next.

## Musical Input

The user can input music with one of the following three modes. Each mode operates on a single clip from the timeline. The playback is looped on the clip.

### Step Sequencer



**Figure 2.** The Step Sequencer with an object activated step (bottle), a touched step (green) and toggled steps (blue). The cursor indicates the steps which are currently played.

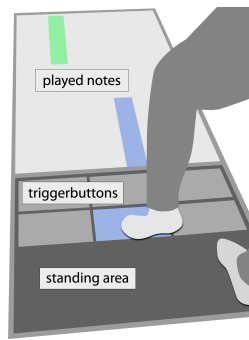
A Step Sequencer is a means of music input that works on a grid of same-length notes called steps. The user can activate these steps. An active step is triggered when the cursor of the looped playback reaches it. The user can work in real-time which results in a very vivid music composing experience. As shown in *Figure 2*, there are three ways to activate a step:

- Putting an object on a step
- Putting feet or hands on a step
- Performing a double-tap or circle-gesture on a step to toggle it permanently

Because it is possible to activate steps by touch, the floor allows intensive collaborative working. Several users can control different voices of an instrument at the same time. If the instrument is a drum set, these voices could be a snare, bass drum or hi-hat. If the instrument is tonal like a synthesizer, these voices could be different pitches.

### Groovebox

The Groovebox input has a grid of notes, that can be triggered by touch. It is a metaphor of traditional Grooveboxes like the Akai MPC [8]. Like the Step Sequencer, the Groovebox maps different voices or pitches to the different notes.



**Figure 3.** Users can input notes by triggering buttons. Played notes are displayed moving away from the user.

The visual feedback of the notes is, similar to “Guitar Hero”, located above the input in a rectangle box with the x-axis representing the note and the y-axis representing the time. The notes are “flying” away from the user vertically, thus new notes appear on the bottom of the box and disappear on top.

### Pad

The user can play notes with the Pad input by touching a rectangular pad. The x-axis represents the pitch, while the y-axis represents the velocity or effect value for the note. It is also possible to trigger notes by placing objects on the Pad. The input is not quantised but continuous. The Pad displays a tonal scale, which enables the user to play in key. The Pad input is well suited for tonal instruments like synthesizers. The played notes are displayed in the same way as in the Groovebox mode.

## RELATED WORK

In music production a lot of paradigms do already exist. We transferred them to be used on a floor.

The timeline view and the use of clips are common paradigms used in audio and video production software. It can be found in DAWs<sup>1</sup> like Steinberg Cubase [1] or Ableton Live [2], in video editing software like Adobe Premiere [3] and multimedia runtime environments like Adobe Flash [4]. The iPhone has become a popular platform for multi-touch music software similar to *Tap Tap Boom*. Beat Maker is a “mobile music creation studio” [5] offering a similar feature set to ours with a timeline view and a multi-row Step Sequencer. BeBot [6] is a touch synthesizer similar to our pad input mode. Such an input can also be found in the Kaoss Products by Korg [7]. The Groovebox view is most-commonly known from the MPC series by Akai [8]. The company Jazzmunt is offering multitouch controller which may be programmed similar to a multitouch floor [9].

## DESIGN

During our contextual inquiry we found out, that the process of music production consists of composition, arrangement and finishing. After the task analysis we decided to focus on parts of the composition and arrangement process since these are the parts where inspiration and change of perspective

will have the biggest impact. In the following section we will present and explain our design decisions which led to such an inspiring system.

## Menus

### Instant Record

The musicians we talked to always emphasised how important it is, to have a quickstart function. Ideas just fade too fast, thus long configuration menus are impractical. The main menu of *Tap Tap Boom* features an “Instant Record” function. In our first designs, this took the user to an instrument selection menu with all instruments in a grid. Afterwards the user had to choose the preferred input mode. In user testing, we found out that the users were just overwhelmed by the instrument grid. Thus we changed the design with only the input mode selection appearing. The chosen input mode then starts with a default instrument. This is a drum set for the Step Sequencer, a sample set for the Groovebox and a synthesizer sound for the Pad. This decreases the expenditure of time significantly. Users can change the instrument via the “Choose Instrument” function.

### Choose Instrument

We use a drawer to choose instruments. The drawer is sliding in from the right side. It holds a lot of instruments, depicted with icons. Within the drawer instruments are scrollable by a swipe gesture on the instruments. To choose an instrument, our initial idea was, that the user steps with one foot on the instrument and with the other one on the area, the instrument should be applied to. During user testing on the floor no user was able to execute this action, not even after having an introduction before usage. Instead users just double tapped the instrument. In the end we included that into our design.

### Marking Menus

Our first marking menus could not be closed and worked with a kick-gesture to choose the desired option but our Paper Prototyping session showed, that each user just tapped onto the option. Since we did not want to add this into a tutorial, we decided to throw out the kick-gesture and to use taps instead. Furthermore we determined that a marking menu automatically closes itself, if no option is chosen within a short while (3 seconds).

### Save, Close and Navigation

In the timeline a save and a close button are present in the left upper corner. In the beginning we only implemented a save button and the project was automatically closed on save. During user testing on a Paper Prototype users complained about this behaviour. So we included separated save and close buttons. If the project is in an unsaved state, the user is asked if the project should be saved before closing.

The timeline view also has to feature a navigation function for moving and zooming. This is implemented as a marking menu. We investigated the possibility to have this marking menu always floating next to the user. During user testing on the floor with an overhead projector we discovered that this confuses and annoys users. In our final design, the navigation menu opens after a circle gesture.

<sup>1</sup>Digital Audio Workstation

## Transport

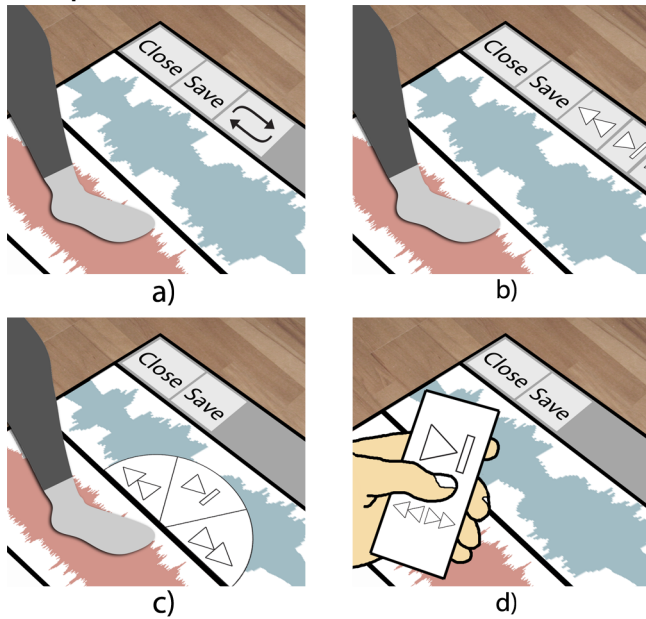


Figure 4. a) playback always looped without user control b) control on top c) control in marking menu d) control with remote

Transport offers pause, play, rewind and forward function to the user by a remote control. Our initial design did not offer any transport control. The system just looped the song/clip permanently. During prototyping we noticed, that it is stressful for the user not to be in control. We decided to place a static transport menu onto the left upper corner of the floor. Further testing revealed that these transport controls were too far away from the user for quick triggering. Our next idea was to implement a floating transport marking menu, but this failed in the same way as the floating navigation menu. The “open-anywhere” menu we created afterwards had the drawback of an additional gesture, which needed to be learned, and still took much time to use. Finally we decided to move the transport from the floor to a remote control in the hand of the user. This is the most direct way of control. In the tests users were very positive about this.

## Identifying Clips

Initially all clips looked the same. The user was unable to distinguish clips on the timeline, which especially posed problems with copy and paste. The system now marks clips by displaying the waveforms and automatically adding different colours to them.

## Sensing Input

The user is able to walk freely on the surface. This poses the problem that the system has to differentiate between a user walking on the floor and a user’s tapping for input. Our solution is to disable single taps as input. A user now activates functionalities by a double tap or a circle gesture.

During user testing on the floor and with a flash prototype users did not use the circle gesture and needed time to find out, that they have to double tap to interact with the system.

To fix this, we created a short tutorial, which automatically opens on the first startup. In this tutorial the user learns the double tap and the circle gesture. The user may only proceed after the actions have been performed at least once.

## CONCLUSION

We have transported the known paradigms of music production to a touch-enabled floor. Musicians will be able to interact with *Tap Tap Boom* by using existing knowledge and workflows. They will get a new perspective on music creation and this will boost their inspiration and creativity.

Especially the collaboration possibilities are exciting. In this paper, we have only sketched out the scenario in a studio with musicians as a target group. But why not implement a similar system for live concerts? Why not enable the musicians and the audience to interact through the floor? *Tap Tap Boom* could also be used for children, to offer an access to music production in a playful way.

Music production on multi-touch floors opens new possibilities, to interact with music, of which most still have to be leveraged.

## ACKNOWLEDGMENTS

We would like to thank Andreas and Johannes for taking part in the contextual inquiry and everyone who attended the class and gave us feedback in the user tests.

## REFERENCES

1. Cubase by Steinberg  
<http://www.steinberg.net/de/products/musicproduction.html>
2. Live by Ableton  
<http://www.ableton.com/>
3. Premiere by Adobe  
<http://www.adobe.com/products/premiere/>
4. Flash by Adobe  
<http://www.adobe.com/products/flash/>
5. Intua BeatMaker.  
<http://www.intua.net/products.html>
6. Bebot - Robot Synth by Normalware  
<http://www.normalware.com/>
7. Kaoss Products by Korg  
e.g. Kaoss Pad and Kaossilator  
<http://www.korg.com/Products.aspx?ct=4>
8. MPC Series by Akai Professional  
e.g. MPC 2000 and MPC 5000  
<http://www.akaipro.com/mpc>
9. Controll Surfaces by Jazzmutant  
e.g. Lemur  
<http://www.jazzmutant.com/>