

---

# Tangled Beats: A Collaborative Tile-Based Music Production Device

**George Ball**

University of Bristol  
Bristol, UK  
gb15351@my.bristol.ac.uk

**Adam Stein**

University of Bristol  
Bristol, UK  
as15656@my.bristol.ac.uk

**Spencer Warren**

University of Bristol  
Bristol, UK  
sw15256@my.bristol.ac.uk

**Will Glasse**

University of Bristol  
Bristol, UK  
wg15313@my.bristol.ac.uk

**Sebi Stamen**

University of Bristol  
Bristol, UK  
ss15807@my.bristol.ac.uk

## ABSTRACT

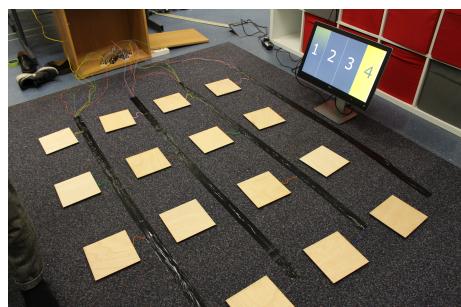
Tangled Beats is a unique tool for collaborative music production, targeted at newcomers to composition. Users contort their bodies in a similar way to the game *Twister*, activating tiles which are arranged in a grid format. Once pressed, each tile produces a unique, looped sound. Tiles can be held down in combination to create dynamic, complex sequences. Due to the spacing between tiles and the limited number of limbs of a single user, Tangled Beats is enhanced by multiple users as additional people can activate more pads, allowing for the creation of complex tracks. The device is a simplified production tool designed to give a taste of music production to amateurs in the hope that they will investigate more sophisticated tools to produce music in the future.

---

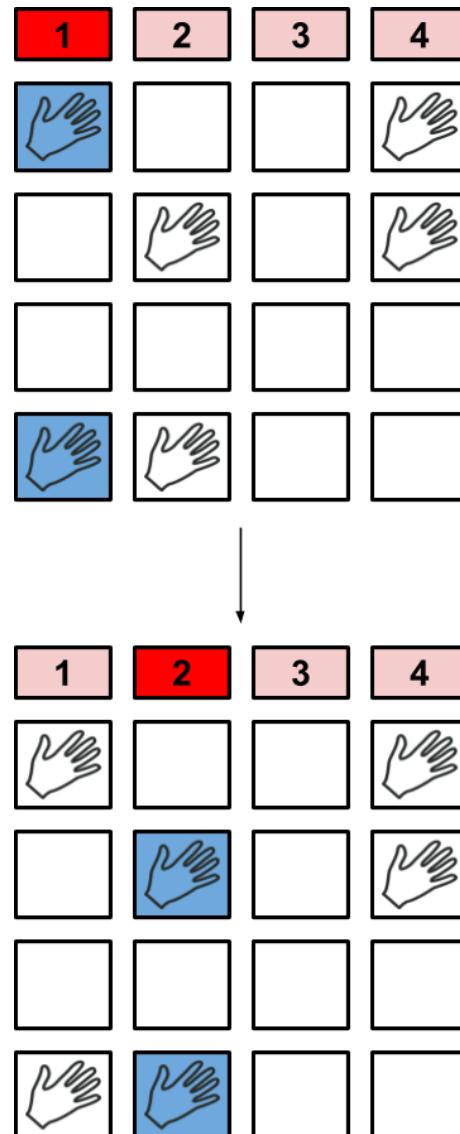
*CHI 2019, May 4-6 2019, Glasgow, UK*

© 2018 Association for Computing Machinery.

This is the author's version of the work. It is posted here for your personal use. Not for redistribution. The definitive Version of Record was published in *Proceedings of CHI 2019*, <https://doi.org/10.1145/nnnnnnn.nnnnnnn>.



**Sidebar 1: The final implementation of Tangled Beats set up for demonstration**



**Sidebar 2: Sequencer Mode displaying two consecutive beats**

#### ACM Reference Format:

George Ball, Adam Stein, Spencer Warren, Will Glasse, and Sebi Stamen. 2018. Tangled Beats: A Collaborative Tile-Based Music Production Device. In *Proceedings of CHI 2019*. ACM, New York, NY, USA, 6 pages. <https://doi.org/10.1145/nnnnnnnn.nnnnnnnn>

#### INTRODUCTION

When first venturing into music production, initial projects can be daunting. Industry standard music production tools such as *Ableton* or *Logic Pro X* can be extremely complicated for beginners due to the overwhelmingly large number of features. Furthermore, the barrier to entry is heightened by the cost of equipment and learning resources. Consequently, many people can be discouraged from progressing past the nascent stages of music production. Tangled Beats aims to give newcomers a simplified introduction at no cost.

Studies have demonstrated the effectiveness of group interaction for learning tasks [1]. Moreover, collaboration and the sharing of ideas within the music industry has proved pivotal in producing notables feats of work (7 out of the 10 best selling music albums were written by bands as opposed to solo artists [2]). Industry tools for music production tend to focus on a sole user, typically using non-collaborative input devices such as a mouse and keyboard. Tangled beats aims to encourage collaboration by providing a simple, intuitive interface which is large enough to accommodate multiple users simultaneously. Tangled Beats has been designed to make the music production process both fun and engaging to encourage as many people as possible to participate.

#### WALKTHROUGH

Tangled Beats has two modes of interaction: Sequencer mode and Layer mode. Within Sequencer mode, each row represents one instrument and each column represents one beat of the bar. A graphic metronome shows the user which beat of the bar is active and a sound is produced for each active tile in that column as shown in Sidebar 2.

Tangled Beat's second mode is Layer mode, which removes the temporal aspect of the metronome. Each of the 16 tiles correspond to a different musical loop and activating a tile will generate the sound immediately.

Users can instantly change what is playing by moving their hands and feet to different tiles allowing them to produce complex sounds without any thought.

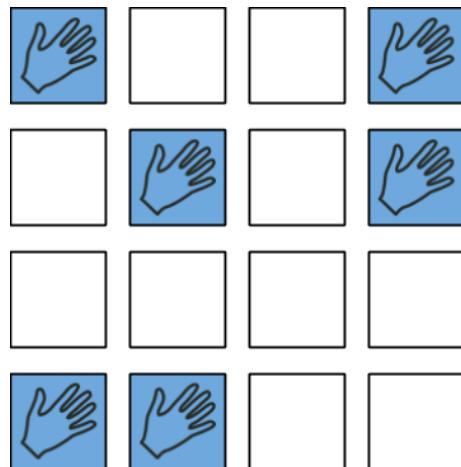
## RELATED WORK

Various designs for collaborative music frameworks have been introduced in order to make music production more accessible to the general public. Such devices need to be as intuitive as possible, with little need for prior usage instructions. It has been shown that complex pieces can still be created from simple, intuitive systems [3].

A prime example of a tangible music framework is *reacTable* [4], a tabletop interface on which multiple users place objects that translate into different sounds. *reacTable* uses a computer vision system called *ReactIVision* to track the location, orientation and type of each object placed on the table and play the corresponding sounds. In contrast, Tangled Beats uses pressure sensors underneath each tile in order to detect user input.

The functionality of *reacTable* is closely related to Tangled Beats, as both of them facilitate user collaboration and interaction to create music. While by comparison Tangled Beats offers a limited set of features, it is more intuitive for both the audience and the users. *reacTable* offers virtually endless possible combinations of sounds, at the cost of having a steep learning curve. With only 16 tiles in the grid, users can understand the functionality of Tangled Beats with no need of prior instructions.

Similar to *reacTable* in terms of functionality is the *Radear* [5]. *Radear* is a circular tangible interface which allows users to create music by placing wooden pucks on a transparent tabletop. This device is more similar to our system, since it abstracts many complicated features of the *reacTable* and provides a simpler and more beginner-friendly environment to create music. *Radear* uses optical reflectance sensors attached to a spinning arm underneath the table to react to different locations of the objects and produce music. While both Tangled Beats and the *Radear* aim to make music production easier, our strategy is to have users physically engage in the process.



**Sidebar 3: Layer mode displaying several active tiles**

## DESIGN

We designed Tangled Beats such that users can have fun individually but have their experienced enhanced through collaboration with others.

The design of the tile arrangement was inspired by the well known game of *Twister* in which players have to touch certain points on a square grid. Multiple users collaborate in order to trigger more sounds. Due to the similarity to *Twister*, most users would find the design familiar and intuitive to use right away. This way the learning curve of Tangled Beats is dramatically reduced.

In contrast to *Twister*, which is deliberately cumbersome for multiple users, Tangled Beats needs to make it easy to activate tiles across the board. Tangled Beats encourages collaboration and communication during the production process. With this in mind, a single user should not be able to reach all the tiles alone.

To decide on the design of a tile we conducted a quantitative survey. We explained the concept of Tangled Beats by showing participants a short demo video. First, the survey asked users to choose between a circular tile, a square tile and a diamond tile. We chose a square tile as 75% of participants believed it was best.

Users were then presented three different sizes for a tile. Participants were shown three 4x4 grids of different dimension and the majority preferred the medium sized tiles.

## IMPLEMENTATION

Tangled beats is comprised of three components: the 16 tiles, the tile controller, and the software.

### Tiles

Each tile is formed of a wooden square, a force sensitive resistor (FSR) and foam suspension. The wooden laser ply square acts as the body of the tile with width and depth of 19cm and a height of 6mm. An FSR is fastened to the center of each wooden surface and is wrapped in foam to protect it. To provide equal weight distribution to the FSR, foam ‘feet’ support each corner of the surface. Each tile is powered passively and connects to the tile controller through simple wiring.

### Tile Controller

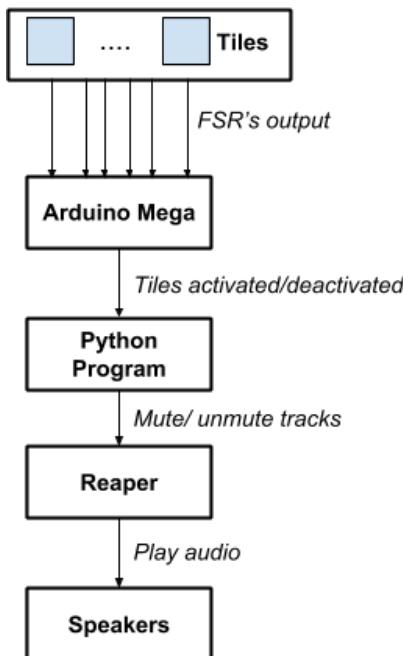
The central hardware for the Tile Controller is an Arduino Mega. Each tile is connected to the Arduino device through one of its analog pins and data is output to the controlling computer through its USB interface. The tile controller executes the force sensing code described in the next subsection.

### Software

There are three programs required to run Tangled Beats. The first is the force sensing program executed by the Arduino, the second retrieves the output from the Arduino and processes it into actions on the controlling computer and the third is *Reaper*, a digital audio workstation (DAW).

The force sensing program polls each FSR measuring their respective force values. If the force value is greater than a certain threshold and the tile is currently off, the tile is set to active and the tile’s identifying code is sent down the serial port. Once the tile is released, its identifying code is sent down the serial port. For each active tile, an LED on the Tile Controller lights up for debugging and input feedback.

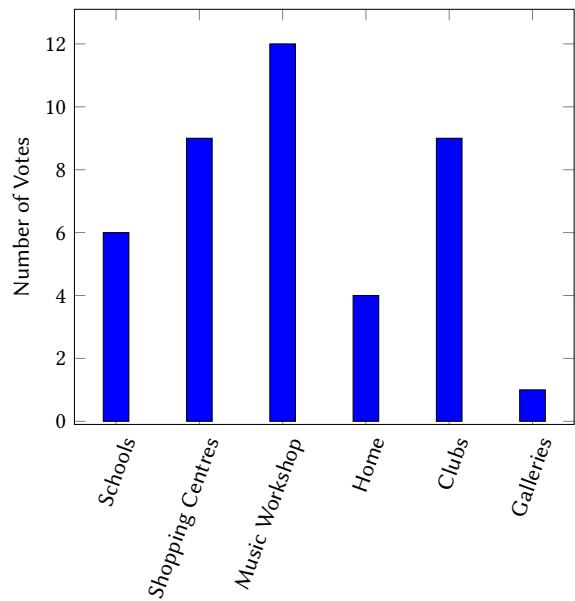
The controlling computer reads values from the serial port buffer and decodes them to utf-8 values. If a tile’s identifying code is present within the decoded values, a hotkey is triggered corresponding to that active tile. Each hot-key toggles the mute functionality for the tile’s track on *Reaper*. If the tile is active, the corresponding track is unmuted. Once the tile is released, the track is muted again.



**Sidebar 4: The Flow of Tangled Beats’ Implementation**

User Study Responses (Scores from 1 to 5)		
Measure	Sequencer	Layer
Intuition	4.47	4.27
Enjoyment	4.67	4.60
Production Satisfaction	4.53	4.40
Encouraged to Pursue	3.93	3.80

**Sidebar 5: Table of User Study Responses**



**Sidebar 6: Suggested Contexts for Tangled Beats**

## STUDY

As mentioned in the walkthrough, we have two modes of interaction, each with their respective advantages. In order to identify the trade-offs between each mode, we conducted an informal user study. 15 participants were presented with a 4x4 prototype of Tangled Beats. Half of them tried Sequencer mode first, whilst the other half started with Layer mode. Having tried both modes we got participants to fill out a questionnaire to measure the intuitiveness, enjoyment, satisfaction and how much they were encouraged to take music production further (*sidebar 5*). We also asked a separate set of questions for suggestions of suitable contexts for the device. During the process we also gained qualitative feedback from participants on how we could improve Tangled Beats further.

## EVALUATION

Tangled Beats achieves the majority of its goals: it is simple to use and it encourages collaboration and communication. The study's results showed that participants found the device intuitive, enjoyed their experience, were satisfied with what they produced and were encouraged to take music production further. Sequencer mode performed better than Layer mode in every category in the context of where we did the study. Our evaluation will focus on the feedback obtained from Sequencer mode due to its success in the study.

Sequencer mode gained an average score of 4.47 out of 5 when participants were asked about how intuitive they found the device. However, 30% of participants agreed that the addition of LEDs would make user input clearer. In the next iteration, we could visualise which pads are producing sound through the use of projections or LED strips.

Tangled Beats was enjoyed by every participant in the study with 100% of people either agreeing or strongly agreeing that they had fun when partaking in Sequencer mode. Similarly, 93% agreed or strongly agreed that they were satisfied with the quality of the music they produced.

When participants were asked how much Sequencer mode encouraged them to take music production further, the average rating was 3.93. This is the primary objective of Tangled Beats, therefore receiving this result is very positive feedback. Participants stated that they would have preferred to have more control over the sound palette for more customisation of sounds.

We decided that it would also be useful to ask participants where they thought Tangled Beats would be best exhibited. As shown in (*sidebar 6*) the highest voted suggestions were all public spaces. These public contexts are very well suited to the Tangle Beats ethos, the idea of bringing people together to enhance creative production. The results from the user study confirms this hypothesis.

## CONCLUSION & FUTURE WORKS

In its current state, Tangled Beats achieves most of its goals: it is simple to use and it encourages collaboration and communication during music production.

A further improvement we are considering is to have the tiles light up when they are active. This way, Tangled Beats would not only play the tracks, but would also constantly display the sonic topologies to the users and the public. Having the tiles vibrate when pressed could also improve the user experience, especially for those with visual impairments.

Based on the user feedback, we consider having the option to record the audio whilst using the device. This would allow users to download their work and listen to their own piece of music. We also want to encompass more genres, whilst still preserving the intuitive design of Tangled Beats. This, paired with the recording feature, would create a more complete music production environment, making room for more creativity and flexibility for the users.

In summary, Tangled Beats is a novel platform aiding the teaching of simple music production concepts through collaboration and physical interaction. We envision the use of Tangled Beats in music workshops, schools and public spaces in order to provide a concise and exciting introduction to music production.

## CONTRIBUTION WEIGHTS

George Ball = 20%, Adam Stein = 20%, Spencer Warren = 20%, Will Classe = 20%, Sebi Stamen = 20%

## REFERENCES

- [1] Blumenfeld, Phyllis C., et al. *Learning with peers: From small group cooperation to collaborative communities*. Educational researcher 25.8 (1996): 37-39.
- [2] John Lynch, INDEPENDENT. *The 50 best-selling albums of all time*. August 2017. Retrieved December 2018 from <https://www.independent.co.uk/arts-entertainment/music/the-50-best-selling-albums-of-all-time-music-charts-singers-a7884191.html>
- [3] Gurevich, Michael, Paul Stapleton, and Adnan Marquez-Borbon. *Style and Constraint in Electronic Musical Instruments*. NIME. 2010.
- [4] Jordà, Sergi, et al. *The reacTable: exploring the synergy between live music performance and tabletop tangible interfaces..* Proceedings of the 1st international conference on Tangible and embedded interaction. ACM, 2007.
- [5] Arellano, Daniel Gábana, and Andrew McPherson. *Radear: A Tangible Spinning Music Sequencer*. NIME. 2014.