Melody Control

A musical way to control a game

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Abstract

Every year the gaming market grows faster and gets more innovative, next to this process the input controllers stay very classic. The goal is to create a novel interface for any classic game. Beside the controlling the user also creates his own melody and an unique atmosphere while controlling. This work should explore if the use of an interface with musical feedback entertains more than an common controller such as a Joypad or Joystick.
In addition three variations with different interaction concepts will be developed and compared to each other to figure out which performs better in terms of performance, entertainment and exhaustion. The results show that the interface makes more fun but it is very difficult to recognize the music because of the high level of concentration.

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Related Work

Jan Silver released a project in 2012 that mapps common gaming operations to different objects for instance Play-Doh shapes. The Play-Doh shapes are connected to a MaKey MaKey Board by using wires with alligator clips . This promising work demonstrates that it could be very easy to create working prototype. Another game which is using the instrument metaphor for its controller is the Guitar Hero series of Activision. In the titles of this gameserial the user has to play with special controller which should look and feel like real music instruments like guitars and drums.

Idea and Motivation

The goal of this project was to create a novel interface which is generating sound by controlling a game. Therefore a real instrument should be expand to be able to act as a controller. This should lead to much more entertaining way to play a game and to an much more familiar acting with real instruments. To achieve that goal a very common music instrument should be transformed like the metallophone because this instrument is combining the preferences of being very flexible and very easy to use.

Scenario description

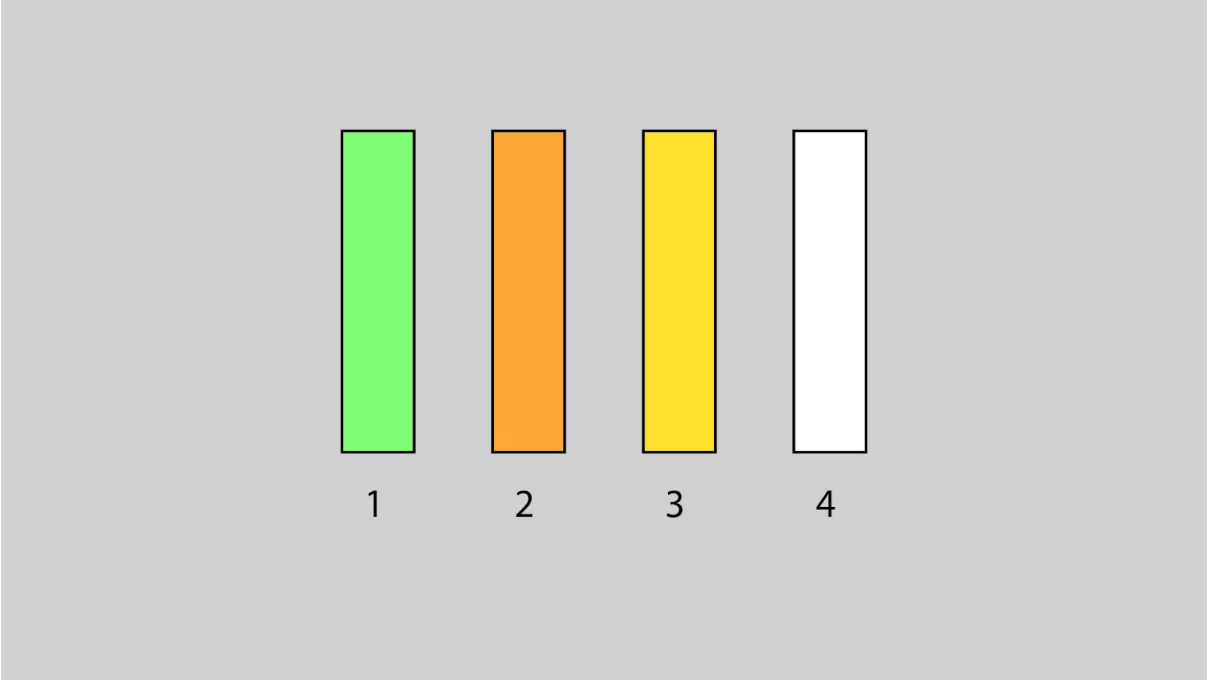
The user has to play a game which is automatically running (game is running and the user as to react). Over all there are three possible lanes with obstacles and the user has to dodge these obstacles to run to the goal as fast as possible. To dodge the users is able to jump, duck and to switch lanes to the right and left. Furthermore he is able to activate a shield. With each second the user is successful by dodging the speed is rising up to make the game more challenging. But if the user is hitting an obstacle, he stops and starts with the initial speed from the beginning of the game. With the shield the user is able to reduce this effect dramatically and avoids that the collision is counted.

Interface description

In general three layout variations should be compared to each other. They differ in terms of flexibility, complexity and coordination claim.

Way of proceeding

To define the interface layout the amount of tiles is limited to four. Two of the tiles a refering to higher notes and the other two a referring to lower notes. They can be identified by numbers. Furthermore the operations are splitted up into three groups: vertical movement (group), horizontal movement (group) and the shield action (single). This means that each group has a similar pattern of triggering a action.



The following action triggering are used:

- **Sequence:**
  A predefined combination of tiles. The exhaustion of this action is depending on the length of a combination which the user has to remember and hit in the right way. In addition the user has a predefined amount of seconds to hit the next tile otherwise the combination is reseted. This needs a high accuracy combined with a certain speed. In the following this action is descripted with a “-” e.g. (1-3-4).

- **Same-time**:
  Tiles which have to be hit at the same time. The difficulty of this action lies in the timing and coordination. In the following this action is descripted with a “+” e.g. (2+1).
  .
- **Double hit:**
  A note has to be hit twice. This is a special form of a sequence it is a very common action which is very intuitive and easy. In the following this action is descripted as a sequence.

- **Combination of actions:**
  To increase the complexity it is also possible to combine different actions. Like a Double hit with a sequenz in addition. In the following this action is descripted as a combination like (2+1- 2+5).

Furthermore there are two different ways to define a layout for each operation.

- **Strict**
  Only one specific combination to trigger a action is possible

- **Flexible**
  A rule is defined which is to follow to trigger a action.
  In the following the other options are descripted with a “|” e.g. (2-3 | 3-4 | 1-2).

Interface Variation 1

The first variation is a combination which uses the sequenz and same-time actions. To jump, duck and activating the shield the user has to do a same-time action. To switch lanes the user has to do a sequence action.

Interaction layout

Jump	Duck	Right	Left	Shield
3+4	1+2	2-3-1	2-3-4	1+4

Vertical movement:
In this Layout the vertical movement refers to the music the tiles are generating. The most highest notes have to be hit at the same time to jump and the two lowest notes to duck.

Horizontal movement:
In this Layout the horizontal movement refers also to the music but in an other way. It uses the base sequence of 2-3 and the afterwards the highest note to jump(4) and the lowest (1) to duck. The last note also refers to the desired direction.

Shield:
The shield will be activated by the same-time action of the lowest and highest note.

Complexity

	Sequence	Same-time	Double-hit	strict	flexible
Jump		X		X	
Duck		X		X	
Right	X			X	
Left	X			X	
Shield		X		X	

Interface Variation 2

The second variation is a combination which uses all actions. It follows rules for vertical and horizontal movement therefore it is very flexible. The shield is a combination of the double-hit and same-time action. It is more flexible but also more complicated furthermore the horizontal movement is concepted simpler then the vertical movement.

Interaction layout

Jump	Duck	Right	Left	Shield
1-1-3 | 2-2-4	4-4-2 | 3-3-1	1-2 | 2-3 | 3-4	4-3 | 3-2 | 2-1	1+4 - 1+4

Vertical movement:
In this Layout the vertical movement uses the metaphor of “over jumping” something and refers to the position of a hit. The base of each combination is a double-hit action afterwards the user has to over jump a note to the right to jump and to the left to duck.

Horizontal movement:
In this Layout the horizontal movement follows the rule of movement. If the user wants to go right he has to hit a tile and afterwards the right tile neighbor. If he wants to switch left it is the other way around.

Shield:
The shield will be activated by the same-time action of tiles with the highest distance and has to be hit twice (double-hit + same-time).

Complexity

	Sequence	Same-time	Double-hit	strict	flexible
Jump	X		X		X
Duck	X		X		X
Right	X				X
Left	X				X
Shield		X	X	X	

Interface Variation 3

The third variation is focusing on being simple to use. It to the natural movement and dirct position of the tiles.

Interaction layout

Jump	Duck	Right	Left	Shield
1+4	2+3	3+4	1+2	1-1 | 2-2 | 3-3 | 4-4

Vertical movement:
In this Layout the vertical movement uses the two tiles with the biggest distance to each other to jump and the one with the smallest distance to duck.

Horizontal movement:
In this Layout the horizontal movement uses the two tiles which are the most right ones to switch right and the most left ones to switch left .

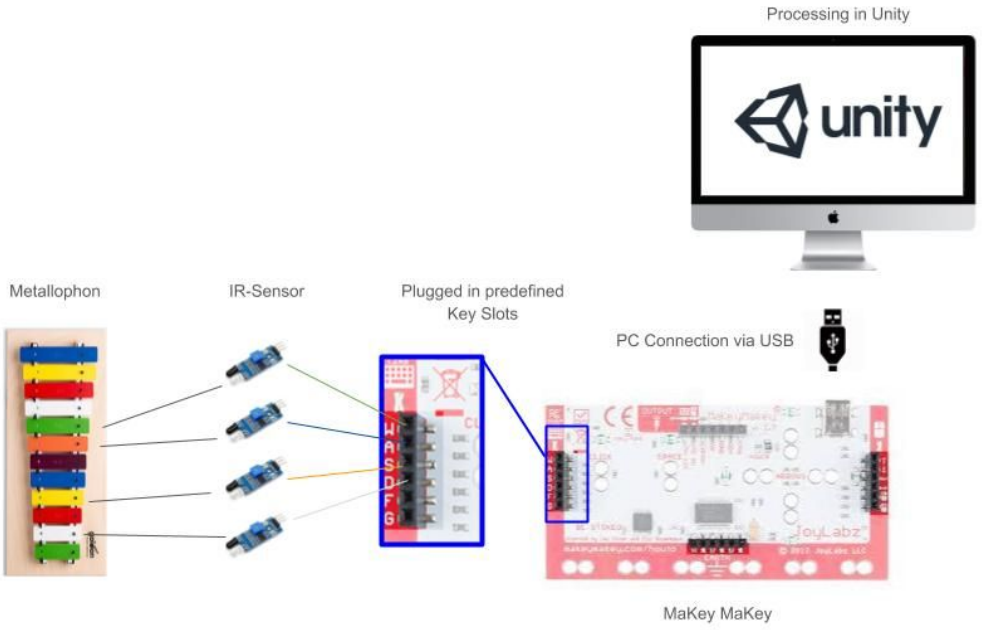
Shield:
The shield will be triggered by the double-hit action. It is very flexible.

Complexity

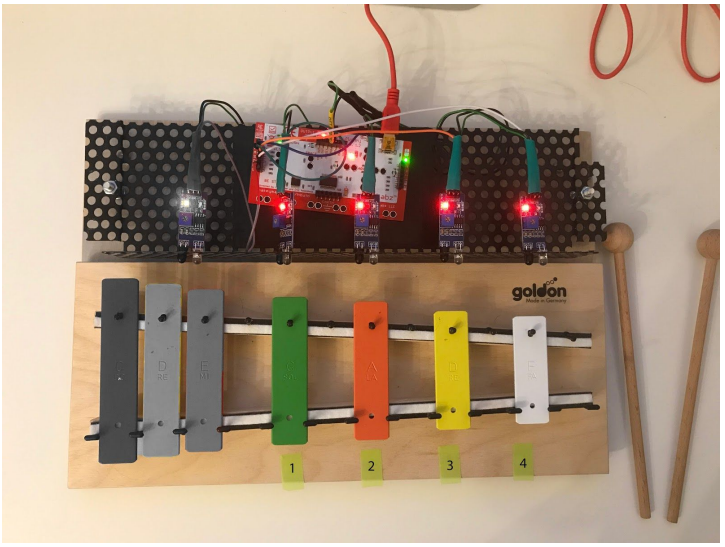
	Sequence	Same-time	Double-hit	strict	flexible
Jump		X		X	
Duck		X		X	
Right		X		X	
Left		X		X	
Shield			X		X

Technical setting

To build the prototype a MaKey Makey controller were triggered by the signal of four infrared sensor which measured if a obstacle went through a ray with a predefined measuring zone. The MaKey Makey was plugged to a iMac via USB and was recognized as a normal keyboard. Each pin of the MaKey MaKey has a predefined key which is triggered as soon as a circuit is closed.

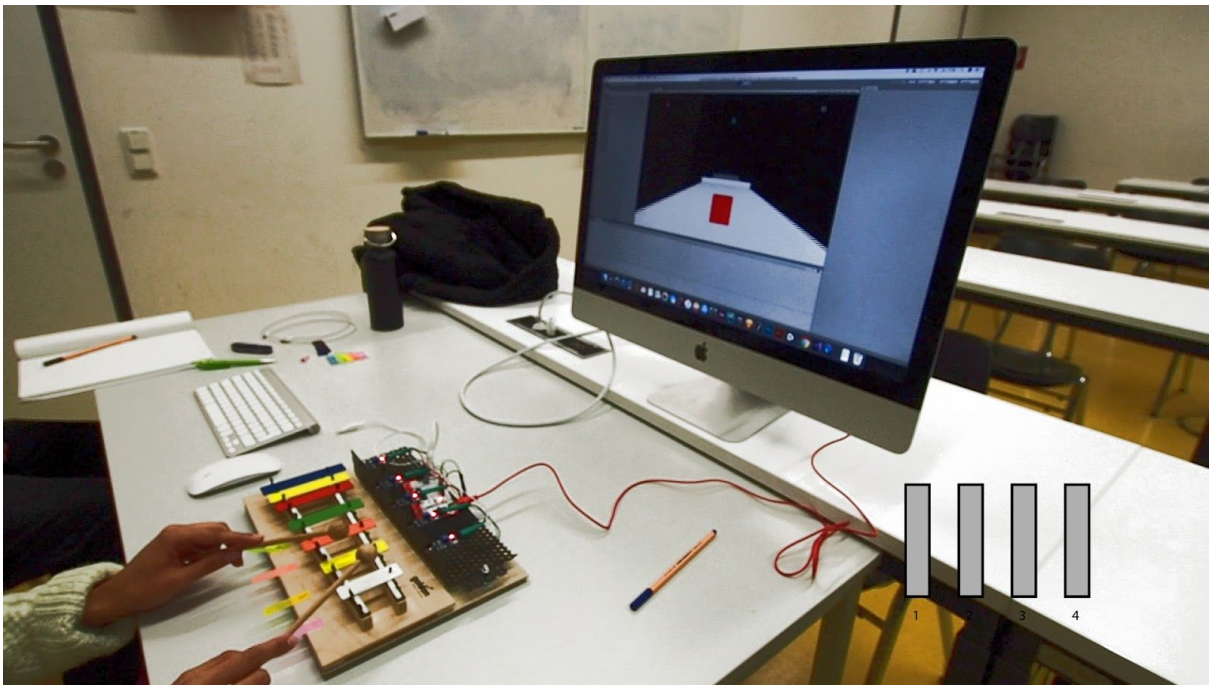


The game was developed in Unity and used the MaKey MaKey as a keyboard.



Test scenario

The task for each user was to run through an predefined course with every variation. To get familiar with interface it self and the serval layout the participants got an introduction and a learning session to train the action triggering. They were able to run through the course three to five times and afterwards three runs were measured. The best run was used for the results. To avoid a training effect in terms of the layout variations, the layout variations were tested in an random order for each participant.



After the measurement of the three layout variations the participants had two answer a survey to collect quality information.

Over all five participants tested the interface the average age of the persons 24.8. They had to test 3 times each variation. Therefore 45 (3x3x5) were measured but only the best of each trail were scientifically proceed so 15 (3x1x5) trails are represented in the results.

The runs were observed in terms of:

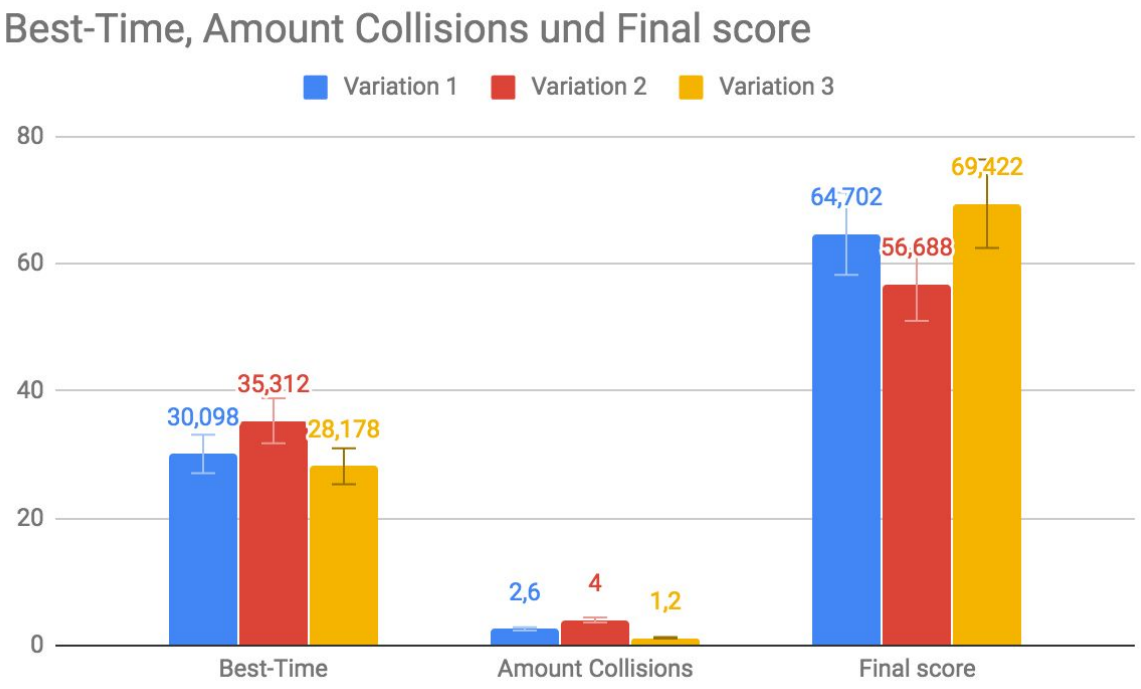
- best time
- collisions
- jump operation
- duck operation
- switching right operation
- switching left operation
- shield operation

Also an score was generated which was calculated with an addition of 2.0 seconds to the time for each collision.

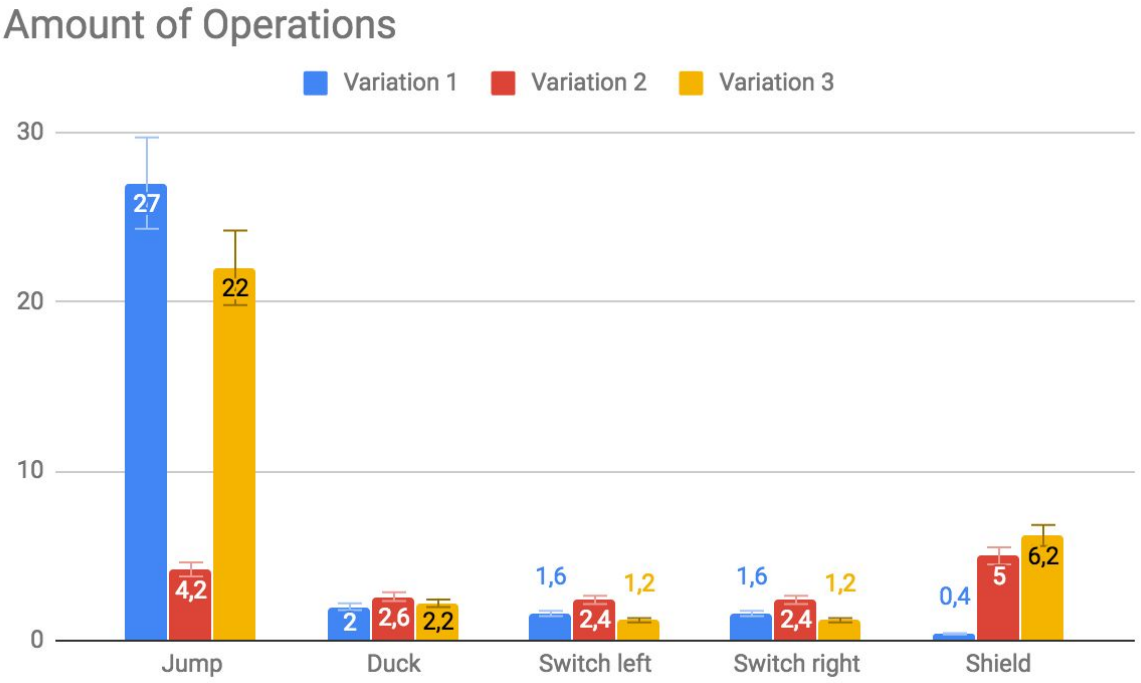
Calculation:
Score = 100 - time + amount of collison x 2.0 s

Results

The results proof that the simplest layout performs best in both time and amount of collisions. Furthermore it shows that the most flexible performs worst.



In terms of used operations the jump action was significantly preferred at the variation 1 and 3. Variation 2 shows that the shield operation was preferred and overall it was the most balanced variation in terms of operation usage. In general the results also showing that the use of each operation is depending on their complexity.



All participants recognized that the difference of the layouts where in terms of there complexity. In the survey 4 of 5 the participants mentioned that 3 Variation was the most easiest and enjoyable layout. And they and much fun playing with this interface.
But they also mentioned that often they were not able to focus on the music they generated because of the high concentration the interface needs to be played.

2 of 5 had also some trouble with the signal triggering so the activated an action by accident. Only one participant was able to focus on the music and he chose the Variation 1 as the one with the best melody.

Conclusion

Over all the project showed that it can be more entertaining to work with a music instrument as interface but it has to be very easy to use. Furthermore there are lot of possibilities to adjust the complexity for instants by using a much easier course.

One improvement could also be the recording of the generated sounds which will be played after the course is finished so they user can recap what they produced. Another way could be to design they course as that the user has to play a certain strict melody to achieve the course as a sort of training method.