# Spatial Audio Engineering in a Virtual Reality Environment

## An Easy Entry for Beginners

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## Motivation

- upswing of virtual reality (VR) [1]
- unused potential for work applications
- audio engineering difficult for amateurs

## We present

- spatial audio engineering VR application
- focus on inexperienced users
- use of motion controllers
- easy to change location of sound sources

## Methods & Evaluation

- Oculus Rift [2] and Razer Hydra [3] game controllers (Figure 1)
- With headphones the user is able to determine the direction sounds are coming from.
- Sound sources are represented as cubes. (Figure 2)
- The user can record and play performances by using the virtual buttons in front of him.
- Hands can change from a grabbing gesture to a pointing gesture by pressing a button on top of the controller.

**Grabbing Gesture (Figure 3, left):**

- pressing the trigger while near a sound source grabs it
- changing the position of sound sources by direct manipulation [4]

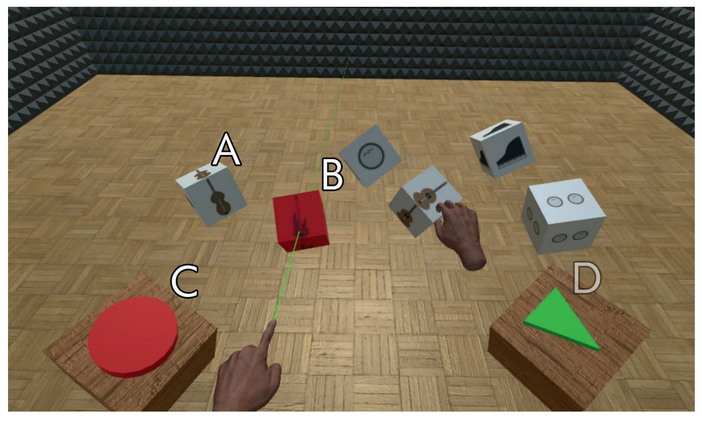
**Pointing Gesture (Figure 3, right):**

- While aiming at a sound source the user can start and stop sounds.

**Evaluation:**

- think-aloud test
- observation
- user-feedback

*Figure 1 (top): Application setup with Oculus Rift DK2 and Razer Hydra controllers*
*Figure 2 (right): The virtual environment – inactive sound (A), active sound (B), record button (C), play button (D)*




## Results

- no problems understanding the interaction with sound sources
- some problems understanding the relationship of real and virtual movement
- problems with aiming
- play- and stop-buttons not intuitive
- Testers did not move any objects during recording.
- Positive feedback was given on the overall spatial audio experience.

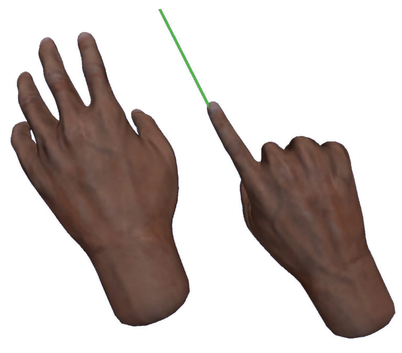


*Figure 3: Gestures of virtual hands.*
*Left: Grabbing pose, Right: Pointing pose*

## Discussion

Changing the position of sound sources was quickly understood because of our direct manipulation approach. The participants tested the positioning of sound sources in many different configurations. The users had problems aiming at sound sources and using the record function. Both require better visual feedback.

## References

[1] Statista GmbH. (2016): Forecast unit shipments of virtual reality head-mounted displays worldwide from 2015 to 2017. Retrieved June 02, 2016, from Statista.com: http://www.statista.com/statistics/509154
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[4] Shneiderman, B. (1983). Direct Manipulation: A step beyond programming languages. Human Factors in Interactiue Computer Systems.