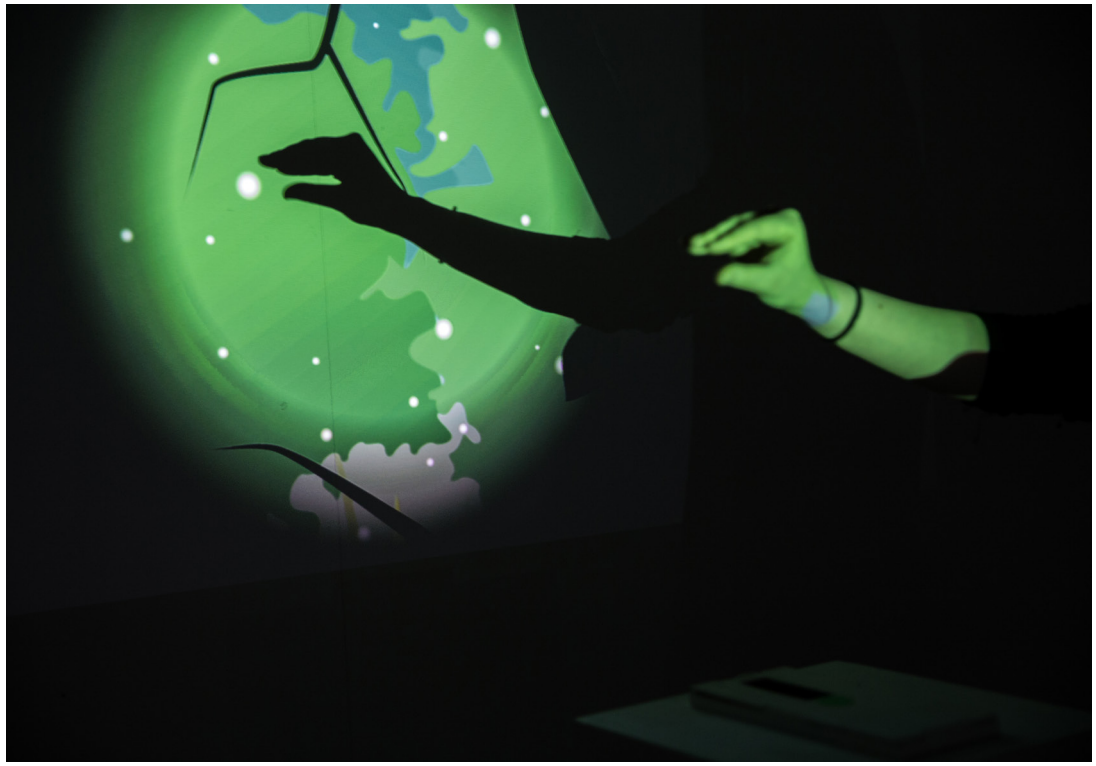
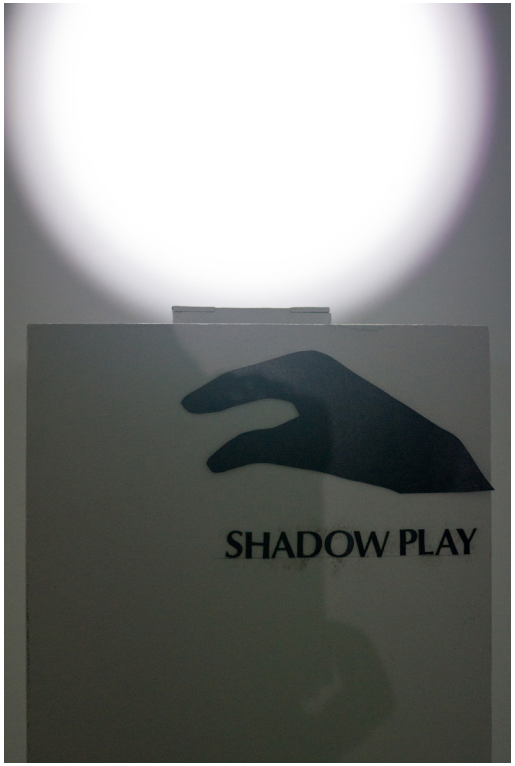
SPATIAL INTERACTION
“SHADOW PLAY”



Students: Katharina Durrer, Stephanie Dickerson, Manuel Leuthold
Mentors: Dr. Joëlle Bitton / Luke Franzke / Joël Gähwiler / Dr. Daniel Hug / Olav Lervik
Zurich University of the Arts, Interaction Design, FS 2018

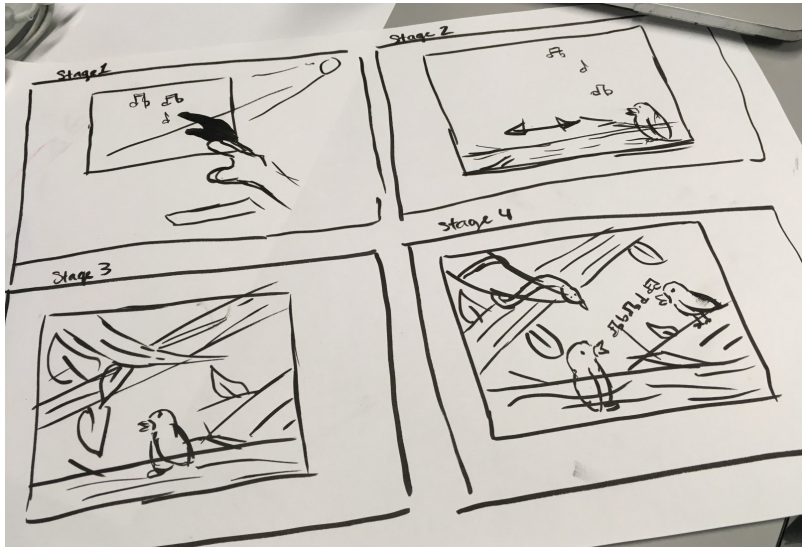
INTRODUCTION

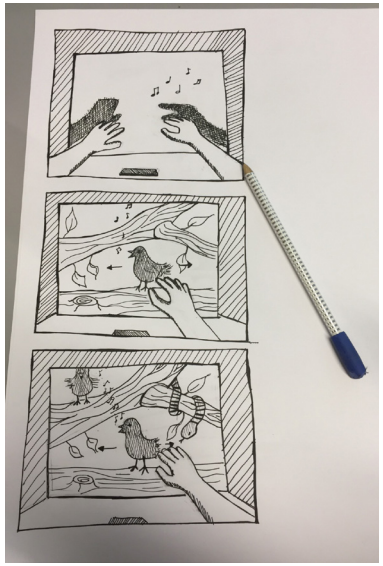
ZHdK collaborated with BirdLife-Naturzentrum Neeracheerried to create prototypes for a future spacial exhibition surrounding bird sounds. For the works, the main objective needed to be a concentration on how birds sounds should be effectively communicated to an audience. In addition, the user must gain some information. “Shadow Play,” by Stephanie Dickerson, Katharina Durrer, and Manuel Leuthold, focuses on distinguishing the unique songs of native birds. The work provides the audience with a projection of another world in which the user can be involved with by using their own hand’s shadow. By creating a simple hand shadow, and with the help of the device Leap, the user is able to control the singing of a bird and the movement of the background. A wide range of bird songs is introduced to the user, as they can listen to each in turn and remove and re-enter their hand in the work’s space to be presented with a new bird’s sounds. “Shadow Play” provides a playful and personal experience that an audience of all ages is able to enjoy.

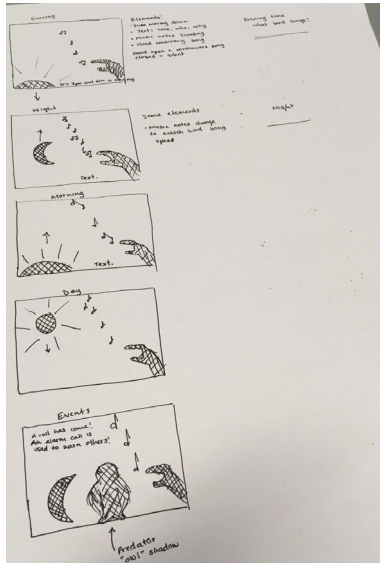


DEVELOPING THE CONCEPT

The concept began with an agreement between our group of wanting to do an interaction that involved a game of sorts. Fairly early on we played around with the idea of using our hands as a way of mimicking a bird's mouth, opening and closing for singing. We started off with a complicated idea of a game that involved a player using their hand's shadow for just bird singing at first, and then the screen slowly developing into a virtual world, where the hand would then control an animated bird. The original concept focused mainly on the player's bird interacting with other creatures, such as female birds for mating and sending off alarms for predators. After reviewing our concept again, we realized we focused a lot on visuals and not enough on sound, the main task. We redesigned our concept to involve just the player's hand shadow, the wall, and other shadow-looking animated animals to interact with. Again, we discussed, and concluded that there could involve more visuals. We finally decided on our final concept of the player using their hand's shadow over a virtual and interactive world. We stepped away from a level game toward a playful experience.





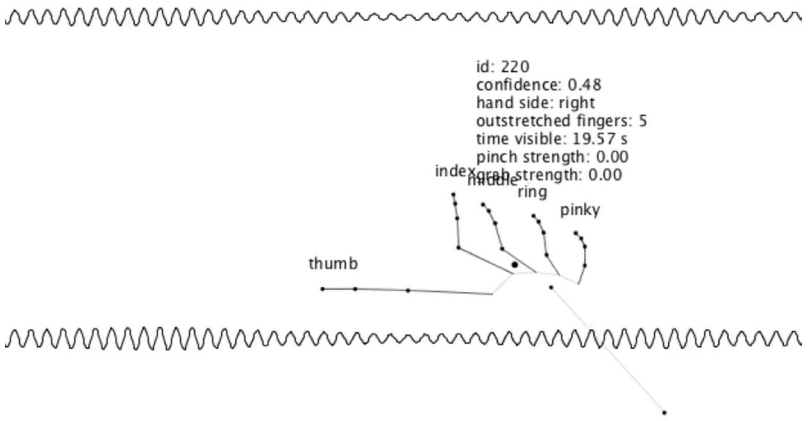


Right: *Sketches from different stages of the concept.*

TECHNICAL ASPECT

With the idea of an interaction that involves a hand-gesture to control sound, the main technical solution was not a difficult choice - the leap motion seemed perfect for this scenario.
Fairly early on we had a first code that we used to see if our main idea, controlling sound by hand gestures, worked. The processing library provided a code for the leap that already involved a float value called “pinch strength” that represents if the fingers are closed or open. Therefore we could use this value to control the sound, with the hand closed being no sound and the hand fully open being full volume. We tested it with an artificial sound and it worked surprisingly well.
The next steps were clear, implementing bird sounds into the existing code to see how controlling a birds voice feels like. We had to acknowledge that this didn’t work, as it felt more like controlling a music player with your fingers. Open/close for play/pause and the finger positions in between to control the volume. This led us to use a low pass filter instead of the volume control (more about this in the audio part of the documentation).

The last big step was to implement an audio file system to handle the different audio files of birds songs, as well as the ability to change the bird currently being played, by removing the hand out of the leap’s field of view. The latter could be done by using the “hand ID” value, a number that represents the current hand tracked by the leap. At the end we had a two dimensional Array that represents a number of different birds, each having a number of different audio files.
Besides the audio interaction, we also used the leap to add a visual feedback for the visitor. The vertical position of the hand controlled the vertical background visuals with a parallax effect, adding a sense of depth to the image and a stronger feeling of being in control of the whole installation.



Right: *Early program with the hand skeleton and measured values by the leap as well as waveforms of the audio.*

VISUAL ASPECT

Since we knew we wanted to focus on a player using their shadow for interaction, we decided that the visuals should also be more shadow-like. We developed a mood-board to visually represent what we wanted. The illustrations we preferred were solid, or slightly gradient in color, cartoon, and involving layers of visuals. From the mood-board, we moved onto our own imagery. With the overall aesthetic decided on, we experimented with what the visuals would be of exactly. Our final imagery is of a forest background, such as what a bird would live in. We used layers of illustrations in order to work with a parallax effect. We provided our audience with a background involving the ground level of a forest, branches of a tree, and the tops of trees, in order to provide variety. We used a range of colors and gradient effects to add interest. A spot-light imagery was used in order to focus a user's attention and create an environment closer to which one would make hand shadows in. The cartoon look we illustrated in was in line with our aim of a playful experience. Overall our visuals were shadow-like and layered, while still providing an interesting and fun atmosphere.

Right: *Early stages of the background visuals.*

Above: *Visual representation of the background in the prototype.*
Left: *Full size of the final background with 5 layers.*

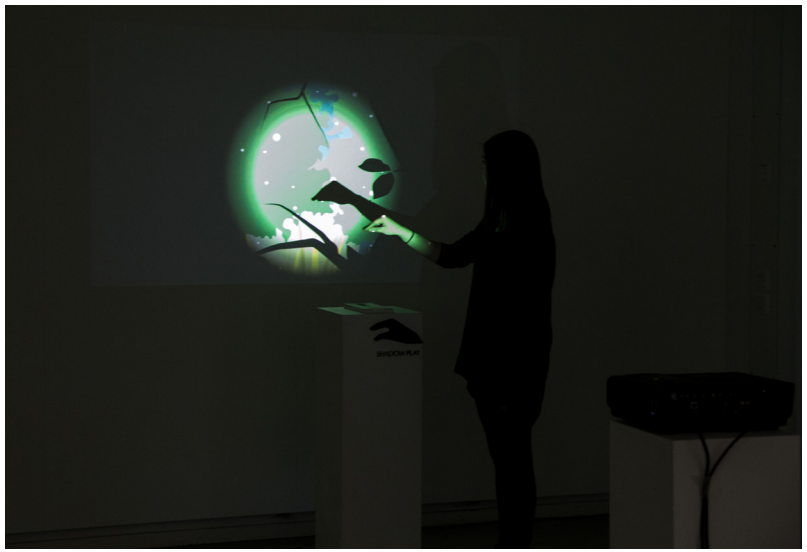
AUDIO ASPECT

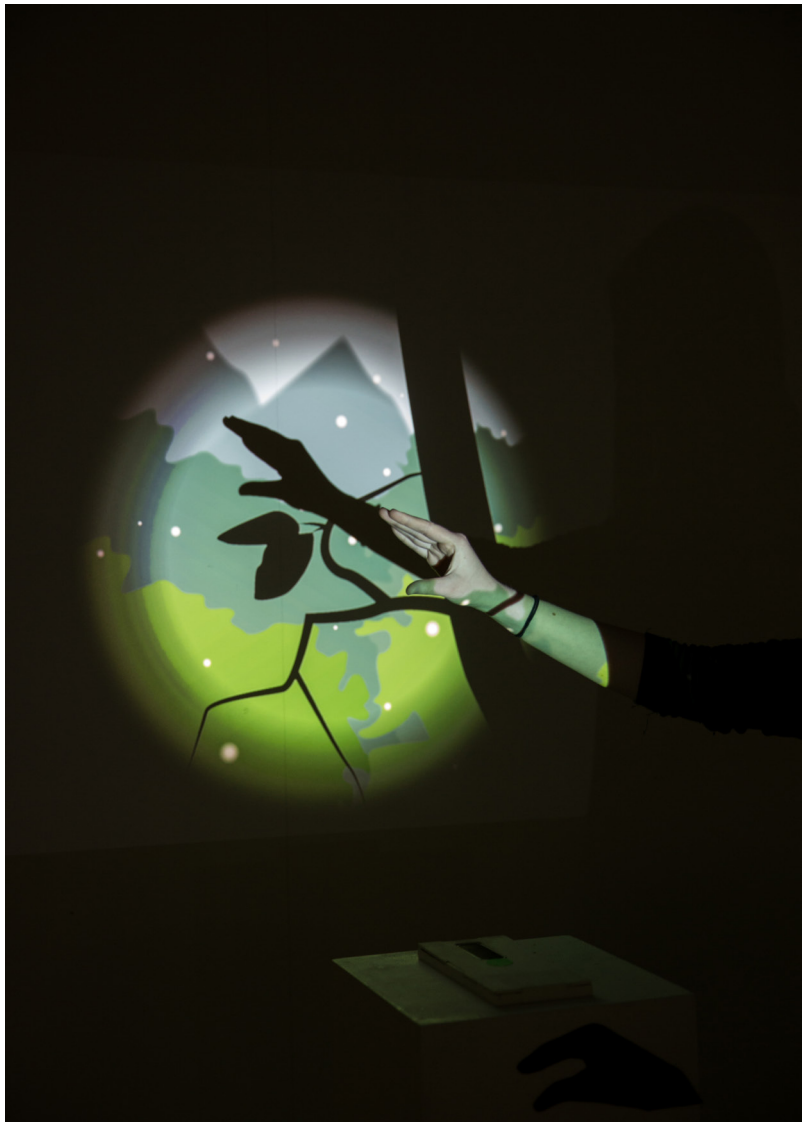
The sounds of the birds were of course an important part of our project, therefore we tried different variations of modifying the audio with the code and modifying the input sound files themselves.
As mentioned in the technical aspect, our first try was just controlling the volume of the sound file by the input values of the leap. As this didn't felt the way we wanted it to, we experimented with a low pass filter. First with MuLab and a Midi keyboard and later directly in processing with the leap motion. The result was that it felt much more natural, like your hand actually represented the bird's beak with the more open the beak, the clearer the sound. An almost closed hand resulted in a quiet and, in a way, filtered sound.

We also worked with different sound files. One try was using a looped file from one bird - a short chirp that we looped for 5 seconds. We didn't implement this in the final version as it didn't sound very natural but monotonous in a way. It also felt more natural and fun to produce one chirp or, for example, "kuckuck" when opening the hand.
The other file version was a short part of a whole birdsong. We used different variations and ranges of songs from one bird if possible, such as for the Nightingale.
In the end, our prototype had six different birds, which we choose by their living space matching our forest themed visuals, and by the good variety of songs and chirps they produced. Some had multiple short samples of their songs, and others like the Kuckuck, just one short noise.

FINAL PROTOTYPE

Our final prototype was an exhibition space in a dark spot of the gallery. It involved a white wall as a projection space, a podium with the leap motion hidden in a box, and the projector sitting on a podium farther back. Right beside the leap motion's podium, we placed cut-out footprints to show an ideal standing position for the visitor. A green spot next to the leap represented the ideal position of the visitor's hand for the vertical movement. Roughly two meters behind the leap motion's podium was the second podium where the projector was positioned. The projector did not only project the visuals, but also acted as the light source for the shadow play. This gave an interesting and sort of magical impression of a simple thing - the user's hand shadow on the wall with the projected visuals surrounding it, and the ability to move the background vertically, depending on the hand's position.
For the bird sounds, we used a small wireless front speaker, positioned on the ceiling, as you would normally hear bird songs from above you. A speaker in the back played the ambiance sound of a forest.

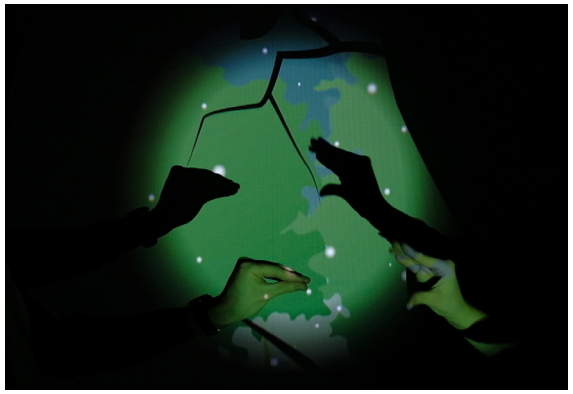




NEXT STEPS

As our work is still a prototype, we have plenty of ideas on how to improve and develop it in the future. We agreed on four clear points we would focus on, which were most important to us:

User instructive. As the leap has a narrow field of operation, we could add a visual feedback, such as a small green light projected on the visitor's hand, to signal if the position is in the sensor's field. Furthermore, a camera that tracks the hand's shadow, and not the hand itself, could help to improve the reliability, as it could possibly be more accurate and stable than the leap.
Adding bird names. A small but important detail would be adding the current bird's name next to the shadow to provide more information to the visitor.
Two visitors. The possibility to have more than one visitor at a time would also be something important to us in a next step. Each visitor would then be a different bird. This would make it easier to compare birds and be more fun, especially for families and kids.
Animation and interactive background. To provide more visual feedback for the user we would need a more interactive background and animation. For example, leaves on trees could fall when the bird is singing, or other birds could come attracted to the hand-shadow-bird's music. In a further step we would also like to implement the day/night cycle, an idea we had early on. This would make the installation more varied and would provide additional information to visitors, as only birds who actually sing during that time of the day would appear.



Top: *Adding Bird Names*
Middle: *Two Visitors*
Bottom: *Animation*

CONCLUSION

In five weeks we developed a concept and a prototype. Although the prototype is simple, we are satisfied that it accurately shows our ideas, and also demonstrates what is possible to go further with.
Throughout the process we had a lot of trouble with the Leap Motion. It had issues tracking the hand, and next time we would approach the concept differently by tracking the shadow directly instead. However, the Leap Motion remains a simple tool to quickly produce a prototype and to determine whether the idea works. Unfortunately, we didn't make enough use of the tests and our prototype was tested far too little by other people outside our group. User tests would provide value in a next project. Our group-work, worked really well as we could split our concepts in a efficient way.

We are satisfied with the resulting project, not least because we think it is successful in its ability to go further in many directions.